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Enabler or inhibitor? Educational technology in self and peer assessment

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This paper explores challenges and opportunities in self and peer assessment and its relationship with educational technologies that support the implementation of the assessment in Higher Educational contexts. While self and peer assessment offer a range of learning opportunities which may lead to enhanced learning outcomes, designing and implementing self and peer assessment comes with complexity and challenges. Through piloting two self and peer assessment tools, the limitations of current technology were identified. This suggested the need to deeply investigate challenges and enablers in self and peer assessment. An online survey captured perceived factors in addition to technology which contributed to the success. While student willingness to participate was the major inhibitor, technology and technology support were seen as vital to contributing to the success of self and peer assessment. Future work should consider educational technologies in context to contribute to the success of self and peer assessment endeavours.

Keywords: self and peer assessment, educational technology, Higher Education

Introduction

The literature has recognised both the opportunities and challenges that the design and implementation of self and peer assessment present (Liu & Carless, 2006; Murdoch, 2015). While various meanings of the term ‘assessment’ can be found in the literature (Boud & Falchikov, 2007), our use of the term includes both summative and formative connotations of assessment. This paper treats the term assessment as an umbrella term which encapsulates the broader notions of (self- and peer-) evaluation, review, marking and grading, for example. With this in mind and drawing on the definitions provided by previous literature (cf. Topping, 1998) the definitions of self and peer assessment are given below in the simplest possible terms for this study:

- Self assessment: students judge and make decisions about their own work against particular criteria.
- Peer assessment: students judge and make decisions about the work of their peers against particular criteria.

The benefits of self and peer assessment focus largely on a range of transferable skills (sometimes also known as graduate learning outcomes) that can be addressed and enhanced by both the design and implementation of self and peer assessment when done right – e.g. critical/reflective thinking, communication and teamwork skills (Yucel, Bird, Young, & Blanksby, 2014). Students first need to be able to grasp the assessment criteria and/or standards before they can assess their own work or that of others. They are then required to provide constructive feedback that leads to improving their/others’ intended future work. Students therefore develop these transferable skills in performing a particular self/peer assessment task. Further, self and peer assessment design can transform students into assessors themselves, who actively understand and perform the assessment, rather than being the assessed, the passive receivers of marks and feedback from academic staff (Brindley & Scoffield, 1998). This use of self and peer assessment directly relates to the model of sustainable assessment acclaimed by Boud and Soler (2015) making a shift “from a focus on disciplinary knowledge to what they can do in the world”. It also addresses the common criticism from employers about the limited number of ‘work ready graduates’ who lack such skills to be applied in real work situations (Boud & Tyree, 1980).

The complexity and associated challenges surrounding self and peer assessment have also been noted. The main focus in the literature seems to be on the credibility and accuracy of student grading (Brown, Andrade, & Chen, 2015; Hamer, Purchase, Luxton-Reilly, & Denny, 2015; Kulkarni et al., 2015). This is particularly of concern when the grades generated by students contribute to the overall summative grades in a unit or course. While students can be taught and trained to be credible assessors over a period of time (Boud, Lawson, & Thompson, 2013), there still seems to be considerable fear attached to giving the power of assessors to students. Liu and Carless (2006), for example, explored the resistance of academics towards peer assessment and highlighted that there are four major reasons for this resistance – reliability (of students to grade accurately), perceived expertise (of students to be able to assess the subject matter work), power relations (between staff and students and among students themselves), and time (that is available to conduct self and peer assessment). They go on to advocate for formative rather than summative peer assessment, arguing that peer feedback is the 'learning element' of peer assessment.

This paper builds on such existing literature and re-examines the opportunities and challenges of self and peer assessment described so far. It sheds light on how educational technologies in particular are identified as both enablers and inhibitors in facilitating this assessment approach. In this way, the paper aligns with Selwyn's urging for educational technology researchers to look beyond the 'state of the art' in educational technology towards the 'state of the actual' (Selwyn, 2010); in the context of this study, towards a focus on the everyday realities of technology-enabled self and peer assessment. The technology-enabled assessment literature in particular has an obsession with innovation, with Stödberg's recent structured review study finding the typical study in this area is a short-term, small-scale intervention study of the researcher's own practice (Stödberg, 2012). This paper also builds on an agenda set forward by Bennett, Dawson, Bearman, Molloy, and Boud (2016), who examined the complex relationship between educational technologies and assessment designs, and Tomas, Borg, and McNeil (2015) who argued for a research focus on the development and implementation of e-assessment. Much is possible in technology-supported self-and-peer assessment, but what actually happens in the fraught realities of everyday teaching and learning at a large Australian university?

Context

In 2015, Deakin University introduced the 'Assessment Tools Project' as part of the University teaching and learning strategic plan. The project intended to i) to raise more awareness and gather current practices and/or requirements around self and peer assessment across the University and ii) to investigate peer assessment elearning tools to enable these existing practices and to make recommendations on a University wide platform.

Engagement with academics and academic developers from across the university revealed that the types of self and peer assessments in place were varied in the form of contribution to student grades (i.e. summative vs formative), types of assessments (e.g. written, oral and teamwork assessments) and feedback (e.g. qualitative vs quantitative). A frequently mentioned inhibitor was that of technological challenges, i.e. that there was no online platform for self and peer assessment supported by the University. After investigating online self and peer assessment tools in the market (e.g. iPeer, WebPA, CATME, PRAZE, TEAMMATES, PeerWise, SAPCA), two tools were implemented on a pilot basis: PeerMark (as part of Turnitin) and SPARKPlus, which enabled different types of assessments. PeerMark is generally used for one-to-one review on written work submitted while SPARKPlus allows group/team work evaluation even without the submission of work by students. Over the two trimesters of the pilot phase (Trimester 3, 2015 and Trimester 1, 2016), over 20 units with approximately 2500 students used SPARKPlus while three units with about 300 students utilised PeerMark for formative assessment opportunities.

Though these tools are now supported by the university on a pilot basis, it is clear that no single tool meets all of the academics' requirements. While most academics acknowledged that self and peer assessment provided benefits for enhanced student learning experiences, leading to improved learning outcomes when done successfully, they also showed significant scepticism and talked about challenges to make their assessment successful. Given the importance of the 'state of the actual', further investigation of the challenges and enablers for self and peer assessment was required, focusing on the role of educational technology within a broader context.

Aims

This paper aims to:
1. further unpack the challenges and opportunities identified with self and peer assessment and;
2. understand the 'state of the actual' with respect to technology and self and peer assessment in a large Australian university.

Methods

A survey was developed with a total of 30 questions on the perceptions of, and experiences with, self and peer assessment, with the overall intent to understand what types of professional development opportunities (e.g. resources and workshops) were needed to build staff capacity in confidently designing and implementing self and peer assessment. To capture those who had not yet used either self or peer assessment, survey logic (which could send participants to certain pages depending on their previous answers) was used with differently worded variations of the questions. The resultant survey was entered into SurveyMonkey for data collection.

Data collection and analysis

All academics and academic developers at Deakin University were eligible to participate in the research project. In January & February 2016, an email was sent out to senior executive administrative officers in all Schools and Departments, requesting the survey link and participant information be distributed via appropriate means – i.e. inclusion in an email circular, or as a separate email to staff. A reminder email was sent in May 2016.

A total of 91 surveys were returned; 52 responses contained meaningful content while the remainder were blank or incomplete; 47 respondents responded to the two specific open-ended questions from the survey, which were relevant to this paper:

- What were (or would be) the challenges for implementation (of self and peer assessment)?
- What resources or support did you (or would you) require to implement self and peer assessment? For example, teaching support, talking to colleagues, literature, other universities' tool kits, etc.

Frameworks of content and thematic analysis (Vaismoradi, Turunen, & Bondas, 2013) with open-coding in nVivo were applied to analyse the texts/responses provided by 47 participants for the questions above.

Ethical approval

Ethical approval was gained via the Faculty of Health Research Ethics committee at Deakin University, reference number: HEAG-H 158_2015.

Results

Six inhibitor themes were identified, and are listed in order of frequency: i) willingness and capabilities of students, ii) technology, iii) teaching support and professional development, iv) willingness and capabilities of academics and colleagues, v) time, and vi) University policies. The themes, their frequencies (N) and indicative quotes are summarised in Table 1.

Table 1: Inhibitors of Self and Peer Assessment

Themes	Indicative quotes
Willingness and capabilities of students (N = 18)	Students don't like peer assessment. Enthusiasm from students. Students hate this type of assessment. We already have a great deal of difficulty getting them to do assessment of other types and participate appropriately without requiring something we know they do not like. Providing enough detail & support for the students to develop their group learning to allow for a good self & peer assessment. At first, the barrier of attitudes- many of our students are East Asian and are uncomfortable with self/peer assessment initially Convincing students it is a worthwhile thing to do - they see assessment as purely up to the academic staff.
Technology and technology support (N = 10)	Getting past LMS hurdles/controls Tools are largely inadequate [Deakin's LMS] Another system to learn, implement and evaluate. Technical set up. I used manual templates rather than automatic rubrics.

Teaching support and professional development (N = 10)	I had no assistance. I have never received induction on any collective activities of this nature or on self/peer assessment.
Willingness and Capabilities of academics and colleagues (N = 8)	Persuading colleagues at the initial introduction. Expertise and Cooperation The quality of staff and their ability to work with less than usual structure and power. My reluctance to provide an environment where students can bully other students. Confidence to describe the process (with benefits) to students and then working through their resistances.
Time (N = 5)	Time. Finding time to let students develop an understanding/appreciation of what self and peer feedback can offer learning. There is some staff resources, but they are stretched quite thinly in the Faculty for implementing and researching these types of initiatives. And I have barely enough time to write the assessment, let alone research them!
University policy (N = 5)	Having universal acceptance of the concept across the University. Standardisation of student/peer assessment.

In the case of enablers, similar themes were found (Table 2); however, the most frequent enablers were the need for, or use of, literature and other resources that enable academics to apply the assessment. Further, sharing their knowledge and experiences among their colleagues was also identified as a potential resource.

Table 2: Enablers for Self and Peer Assessment

Themes	**Indicative quotes**
Literature, tool kits, other resources (online, other institutions, samples) (N = 23)	Peer assessment websites. Literature, various published tools. Tool kits or 'how to' based on best-practice. Guidelines around practical and informative forms of feedback. Evidence of how this has been done effectively in other institutions. Sample rubrics, clear criteria for assessment.
Teaching support, including IT support (N = 12; 6 on IT support)	Proper support to implement greater teaching demands. Moderation support. Staff and student videos and technical how-to documents.
Working with colleagues (N = 12)	Talking to colleagues - mainly about the things that don't work. I was working with a colleague in this unit – we negotiated the task together. It was great. I have a colleague who has a lot of experience in this area and I would go to her.
Technology (N = 5)	IT support, Technology support. A reliable, easy-to-use interface above all. Faculty support team helped me set up [Deakin's LMS]. University evaluation tools would assist the process There is software around that claims to fulfill the task, but it requires a lot of setup and time.
Time (N = 2)	In our Faculty we are only allowed to spend 1 hour per student for all the assessment marking, and assessment must be designed to fit this requirement.
University policy (N = 3)	Clear policy about how these strategies fit with assessment policy.

Discussion and conclusion

What is the state of the actual with respect to technology and self and peer assessment at a large Australian university? Our analysis connects with two important themes in the literature, and provides further support for them.

Firstly, the implementation of self and peer assessment faces very human obstacles, most prominently, perceptions about the capabilities of staff and students. Very similar themes featured prominently in a previous study of peer assessment (Liu & Carless, 2006). That these themes would feature just as strongly, almost a decade later and in another country speaks to their enduring influence which may span cultures.

Secondly, although we sought to understand technological inhibitors and enablers of self and peer assessment, pure technical matters were not the most prominent feature of our data. Even when technology was mentioned, it was largely a matter of support, learning to use new tools, resourcing and time; this echoes findings by others (Bennett et al., 2016) of the need for support in designing assessment with technology. Our analysis further supports the need for researchers to move beyond a focus on the learning benefits of technology in assessment towards “building an understanding of development and implementation” (Tomas et al., 2015). High-quality self and peer assessment technologies and pedagogies have existed for more than a decade; actual practice is not inhibited by a lack of possibilities, but by the fraught realities of context and implementation. In this complexity, it is perhaps not surprising that the challenges or inhibitors that academics identify largely overlap with the required resources or enablers: inhibitors can become enablers once they are overcome.

Much to our delight (as researchers), many participants regarded research literature as an enabler of self and peer assessment. We suggest that future work on this topic, for this audience, might focus on practically addressing cultures, attitudes and perceptions around peer assessment, while at the same time supporting educators to identify and use technologies to achieve their desired designs of self and peer assessment.

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References

Bennett, S., Dawson, P., Bearman, M., Molloy, E., & Boud, D. (2016). How technology shapes assessment design: Findings from a study of university teachers. *British Journal of Educational Technology*.

Boud, D., & Falchikov, N. (2007). *Rethinking assessment in higher education : learning for the longer term*: London ; New York : Routledge, 2007.

Boud, D., Lawson, R., & Thompson, D. G. (2013). Does student engagement in self-assessment calibrate their judgement over time? *Assessment & Evaluation in Higher Education, 38*(8), 941-956.

Boud, D., & Soler, R. (2015). Sustainable assessment revisited. *Assessment & Evaluation in Higher Education*, 1-14.

Boud, D., & Tyree, A. (1980). Self and peer assessment in professional education: a preliminary study in law. *J. Soc't Pub. Tchrs. L. ns, 15*, 65.

Brindley, C., & Scoffield, S. (1998). Peer assessment in undergraduate programmes. *Teaching in Higher Education, 3*(1), 79-90.

Brown, G. T. L., Andrade, H. L., & Chen, F. (2015). Accuracy in student self-assessment: directions and cautions for research. *Assessment in Education: Principles, Policy & Practice, 22*(4), 444-457. doi:10.1080/0969594X.2014.996523

Hamer, J., Purchase, H., Luxton-Reilly, A., & Denny, P. (2015). A comparison of peer and tutor feedback. *Assessment & Evaluation in Higher Education, 40*(1), 151-164. doi:10.1080/02602938.2014.893418

Kulkarni, C., Wei, K. P., Le, H., Chia, D., Papadopoulos, K., Cheng, J., . . . Klemmer, S. R. (2015). Peer and self assessment in massive online classes *Design Thinking Research* (pp. 131-168): Springer.

Liu, N.-F., & Carless, D. (2006). Peer feedback: the learning element of peer assessment. *Teaching in Higher Education, 11*(3), 279-290.

Murdoch, J. (2015). Using self- and peer assessment at honours level: bridging the gap between law school and the workplace. *The Law Teacher, 49*(1), 73-91.

Selwyn, N. (2010). Looking beyond learning: notes towards the critical study of educational technology. *Journal of Computer assisted learning, 26*(1), 65-73. doi:10.1111/j.1365-2729.2009.00338.x

Stödberg, U. (2012). A research review of e-assessment. *Assessment & Evaluation in Higher Education, 37*(5), 591-604. doi:10.1080/02602938.2011.557496

Tomas, C., Borg, M., & McNeil, J. (2015). E-assessment: Institutional development strategies and the assessment life cycle. *British Journal of Educational Technology, 46*(3), 588-596. doi:10.1111/bjet.12153

Topping, K. (1998). Peer assessment between students in colleges and universities. *Review of educational research, 68*(3), 249-276.

Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & health sciences, 15*(3), 398-405.

Yucel, R., Bird, F. L., Young, J., & Blanksby, T. (2014). The road to self-assessment: exemplar marking before peer review develops first-year students' capacity to judge the quality of a scientific report. *Assessment & Evaluation in Higher Education, 39*(8), 971-986.

Please cite as: Adachi, C., Tai, J. & Dawson, P., (2016). Enabler or inhibitor? Educational technology in self and peer assessment. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp.11-16).

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The design process of university teachers: A descriptive model

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This poster presents a teacher design process model. The model is empirically derived from research that investigated the design work of Australia university teachers. The dataset comprised detailed interviews from 30 teachers from 16 Australian universities about how they undertook their design work when designing new units and/or redesigning existing units. The findings characterise the design process as a top-down, breadth-first approach, which is iterative, and is conducted prior, during and after a unit's implementation. The significance of this model is that it illustrates a process that has been under-researched and thus provides important insights into how university teachers could be better supported in their design work. Implications from this work are discussed and ideas for future research are presented.

Keywords: design process, teacher design practices, teacher design thinking, learning design

Introduction

Educational design is a fundamental aspect of a university educator's role. Yet, not much is known about the process university teachers undertake to design learning experiences for their students. Given that quality teaching is a strategic objective for most universities, it is important to better understand how teachers conduct their design work so that they can be appropriately supported (see Lockyer, Agostinho, & Bennett, 2016 for a detailed account of support initiatives). This poster presents the results of one component of a large-scale Australian-funded research study that investigated teacher design practices (see Bennett, Agostinho, & Lockyer, 2016a for a detailed explanation of the research project). The results show the process university teachers follow when they design new units/subjects and/or re-design existing units.

Method

Data collection comprised semi-structured interviews of 50-90 minutes in length with 30 university teachers from 16 of Australia's 39 universities. Participants were recruited through mailing lists of key Australian professional academics bodies and purposively sampled based on the following criteria: i. discipline, ii. years of higher education teaching experience, iii. student year level(s) taught, iv. years of online teaching experience, and v. no overlap in discipline from within same institution with less than four participants from a single institution. Participants were asked a range of questions about their teaching context, approaches to teaching, what influences their design practices and what supports they use. They were probed to recall details about their recent design experiences such as the design of a new unit and/or the redesign of an existing unit. An inductive analysis framework was devised to develop codes and summary tables were developed to compare participants' design process accounts and thus identify patterns (see Bennett, Agostinho, & Lockyer, 2016b for a detailed data collection and analysis explanation).

Results

Three key themes surfaced from the data:
- A teacher's starting point depended on the focus of the design problem
- Design involved considering a unit holistically (breadth-first approach) then working on the specifics
- Design was an iterative process that occurred before, during, and after a unit's implementation

The poster will visually present a design process model that depicts the above themes according to the following three design scenarios that emerged from our study (see Bennett et al, 2016b for a detailed account of results).

Scenario 1 - Designing a new unit: Teachers firstly consider the holistic conceptualisation of the unit, ie., the intended learning outcomes, the content to be included, and the student activities and assessment tasks. Learning outcomes or content is considered first depending on the design problem. Once this *unit framework* is established, the detail of the unit is then developed, such as elaborating the assessment tasks, scheduling assessment due dates, determining specific content topics and resources to include, and detailing specific student activities. During this process, teachers think about the specific aspects of the unit in relation to the unit framework, iteratively checking and adjusting to ensure that all the components align.

Scenario 2 - Redesigning a unit not previously taught: When teaching an existing unit not taught before, a teacher conducts a *familiarisation* process whereby he/she seeks to understand the unit framework and specific aspects of the unit. Adjustments to the unit framework and/or modifications to specific aspects of the unit may be made, whilst iteratively checking and adjusting to ensure the components of the unit align.

Scenario 3 - Redesigning a unit previously taught: When teaching an existing unit previously taught, the common starting point is to *modify* or *tweak* the existing unit by making small-scale changes that have been identified by the teacher and/or arise from student feedback. Changes to the unit framework may be made if a significant problem has been detected and/or the alignment is problematic.

Most of a teacher's design work occurs prior to the commencement of a teaching session. But as teaching proceeds, student learning behaviours may prompt the teacher to make adaptive changes to the design. A teacher may also leave some of the unit detail unfinished until after the semester has begun. Depending on the success of unit implementation, the teacher may reflect on the unit framework and specific details to identify future changes, feeding into another cycle of redesign. This usually occurs after the teaching session is complete, although teachers may make adaptive changes 'on-the-fly' during a session and may document their ideas for changes in anticipation of the subsequent cohort.

Discussion

The significance of our research is that it provides empirical insights into an existing practice that whilst may seem anecdotally familiar, has been under-researched. These findings are important because they offer insights into how teachers could be further supported in their design work as many support initiatives have been based on anecdotal assumptions of how teachers design (see Lockyer, et al, 2016 for a more in-depth discussion). Whilst it is premature to speculate on the kind of design support tools that would be beneficial, one feature emergent from our research is the provision of flexibility. That is, a design support tool should enable a teacher to create their unit framework and iteratively add detail to the design in a non-linear way, and document the design in some way to aid easy access/critique/review during and after a unit's implementation.

Another important finding from our research is that our participants' design processes show similarities to design work conducted in other disciplines. The design literature characterises the design thinking process as starting from "abstract specifications" (Razzouk & Shute, 2012, p. 336) where a designer then follows a non-linear "forward (breaking down) and backward (validating) reasoning strategy" (p. 337) to devise a solution. This is synonymous to the process depicted in Scenarios 1 and 2. Furthermore, Scenario 1 illustrates a top-down, breadth-first approach; an approach exhibited by expert design thinkers (Razzouk & Shute, 2012). Our participants, however, did not explicitly reference any design models in guiding their design process. Nor did they talk about their design work in 'design speak'. The significance of conceptualising the design process of university teachers within the broader field of 'design' give us scope to further examine how teachers identify, understand, and articulate their design problem and what problem-solving strategies they employ to craft a solution. This may give us further insights into how teachers can be better supported in their design work.

Conclusion

Whilst our findings make a substantial contribution to a thin evidence base about university teacher design, we have only scratched the surface in our investigation of teacher design practices. Much more needs to be explored. Ideas for future research include examining: design processes of expert and novice teachers to identify similarities and differences; if different types of designs result from different design processes; and investigating the relationship between the design process and the design outcome, and how that influences student learning.

References

Bennett, S., Agostinho, S. & Lockyer, L., (2016a). Investigating University Educators' Design Thinking and the Implications for Design Support Tools. *Journal of Interactive Media in Education*. 2016(1), p.9. DOI: http://doi.org/10.5334/jime.404

Bennett, S., Agostinho, S., & Lockyer, L. (2016b). The process of designing for learning: Understanding university teachers' design work. *Educational Technology Research and Development,*1-21. doi:10.1007/s11423-016-9469-y

Lockyer, L., Agostinho, S., & Bennett, S. (2016). Design for e-learning. In C. Haythornthwaite, R. Andrews, J. Fransman & E. M. Meyers (Eds.), *The SAGE Handbook of E-Learning Research* (2nd Edition) (pp. 336-353). London: SAGE Publications.

Razzouk, R., & Shute, V. (2012). What is design thinking and why is it important? *Review of Educational Research*, *82*(3), 330–348. doi:10.3102/0034654312457429.

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Attentional and cognitive processing of analytics visualisations: Can design features affect interpretations and decisions about learning and teaching?

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There has been an increasing demand for course-level learning analytics to inform design improvements and interventions. While there has been an increasing research and development focus on dashboards to facilitate this, less has been done to investigate the impact of design features on optimising the interpretation process when translating learning analytics into actionable interventions and design changes. In this paper, I assess the effect of two prominent design features on the attentional and cognitive processes when using learning analytics at the course level. Emergent thematic analysis revealed response patterns suggesting systematic effects of three design features (course-only data, course- versus school-level data, course-only data with learning events marked) on the interpretive patterns, proposed actions, and consequential thinking of participants in the study. Implications for future designs of course-level learning analytics dashboards, as well as academic development are discussed.

Keywords: Learning analytics, dashboard designs, visualisations, attention, data literacy.

Introduction

In the Higher Education sector, learning analytics has increasingly gained impact in addressing a range of educational challenges and issues, including student success and retention (e.g., de Freitas et al., 2014). Work in the area of student retention in general has adopted predictive algorithms in application of learning analytics, in conjunction with student demographic variables to predict the likelihood of attrition of students particularly in their first year of enrolment (e.g., Dietz-Uhler, & Hurn, 2013). More recently, there has been an increasing focus on the usability and validity of learning analytics used in the context of enhancing learning and teaching (Gašević, Dawson, & Siemens, 2015; Gašević, Dawson, Rogers, & Gasevic, 2016).

One of the ways in which learning analytics is incorporated into learning and teaching practice is by way of learning analytics dashboards. On the surface, the premise of incorporating learning analytics via dashboards into learning and teaching practice is seemingly simple – make student learning data available and accessible to educators to help them identify areas of improvement for student engagement and learning. This should then help educators make adjustments to their practice accordingly. These changes should subsequently improve educators' pedagogical practice and overall student learning and academic achievement. This theoretical approach is based on the premise that there is a linear, straightforward relationship between data and pedagogical practice decisions that will improve student learning and academic outcomes. In reality, this suggested pathway from making digital data log files available to effective pedagogical action is a simplification of the complexities of implementing such approaches in a university. I argue that there needs to be consideration of complex organisational, educational, and learning factors before the sector sees large-scale benefits of digital data-informed practice.

Various factors have been identified in the literature that impact on the success of institutional implementation of learning analytics, including: technical infrastructure, privacy and ethical policies and considerations, data expertise, research competencies, and culture change in institutional readiness to adoption and strategic leadership (e.g., Duval, 2011; Macfadyen & Dawson, 2012; Pardo & Siemens, 2014; Slade & Prinsloo, 2013). This paper will focus on the impact of specific design features of learning analytics visualisation on the interpretation of the data and will include a discussion of ideas directed at connecting to course-level action enhancements. Thus far, there has been substantial sector-wide progress made in this regard, with research and development focused on providing learning analytics dashboards to educators to equip them with additional tools to inform their learning and teaching practices such as course design and design of interventions to enhance student learning, or to enhance the learning experience. There have been a wide range of dashboards, varying in the nature and range of data presented, the design features, and purposes of use. Examples include those developed at Higher Education institutions. For example: Course signals (Arnold & Pistilli, 2012) - learning analytics dashboards to enable course instructors to provide real-time feedback to at-risk students, featuring a traffic light system for quick visual indication of whether the student needs help; and Loop Tool (Bakharia et al., 2016) - course-level learning analytics dashboard to enable instructors to improve their learning design, featuring event-marked course analytics. There are also others developed by educational vendors (e.g., Blackboard Analytics, Echo 360 analytics, D2L predictive learning).

While the impact of the pedagogical beliefs of educators on learning and teaching practice has been well-documented (Lumpe, Haney, & Czerniak, 2000; Trigwell, Prosser, & Waterhouse, 1997), the direct influence of pedagogical beliefs for the use, interpretation, and integration of data-informed practice is not as clear. Data in isolation neither allows for valid interpretation and judgement, nor provides an inherent sense of direction of action. According to Mandinach (2012), to best use data to inform learning and teaching practices educators need to apply pedagogical content knowledge (Shulman, 1986). Educators bring to the instructional environment knowledge about how the data can be used to impact pedagogical design practices, and subsequently can provide instruction to affect change in student learning and performance. This ability to translate and transform data to instructional action is called pedagogical data literacy or instructional decision making. In considering pedagogical data literacy for learning analytics, where the potential affordance is more varied than that within the Mandinach applied contexts (i.e., data-driven decision making in schools), I argue for the added critical importance of principles of scientific inquiry (connectivity, inferential, and convergence principles; see Stanovich & Stanovich, 2003 for in-depth discussions of these) and to consider specifically, the unique need for pedagogical content knowledge within the domain of educational technology given the digital data source that is learning analytics.

A manifestation of pedagogical data literacy is educators' capacity to interpret data within their context to inform pedagogical action. Without pedagogical data literacy (not just pedagogical content knowledge, or data literacy in isolation), the educator runs the risk of forming judgements and making decisions on the basis of cognitive biases. If educators' pedagogical data literacy is key in determining the long-term, sustainable practice of using learning analytics to inform learning and teaching practice, how do we design systems and support professional learning of educators to optimise the ethical and intelligent application of learning analytics to enhance course design and student success?

Critical to the use of data to make decisions about learning and teaching strategies is the fundamental role that these cognitive mechanisms play in the processing of the data (information) and the subsequent decisions made for actions. Two primary human information processing factors play an important role in judgement and decision making from data are: (1) attention, and (2) cognitive biases. Attention acts as a gateway for information processing, determining what gets further processing in the brain, and what is selectively ignored from further processing. Attentional resources can be more automatically captured or guided by bottom-up features, such as familiarity of stimuli or physical features of the visual stimuli (e.g., colours, edge, salience of information, motion). Depending on the combined attributes of the visual stimuli, attention biases selection of certain features over others by simultaneously enhancing the neural response to the selected attributes, and attenuating cortical activity to the relatively ignored attributes (Desimone & Duncan, 1995). Bottom-up attention is fast, and guides or primes attentional selection of stimuli for further processing. Attention can also be guided by top-down factors, such as beliefs, intentions, and knowledge (see Styles, 2006 for review). Volitional control, based on expectancy, prior knowledge, and goals guides attention in a top-down manner, and occurs later (Theeuwes, 2010) thus serving to adjust the bottom-up selected features to a limited extent (McMains & Kastner, 2011). Depending on the interaction between the automatic, bottom-up features and more strategic, controlled top-down factors, the attentional selection of prioritised features will guide and limit what gets further processing in the final percept and judgement of the information (Serences & Yantis, 2006). Together, these form the set of neural resources for further processing of the information one is presented with in the world. Kahneman (2003) conceptualises these two forms of attention as *System 1* (fast, automatic, bottom-up) and *System 2* (slow, deliberate, controlled, top-down). When interpreting and making decisions from data, these two systems can operate in parallel, though one process may dominate depending on various contextual factors.

In the case of learning analytics dashboard applications, these features impact on attentional priority through selective attention mechanisms. This subsequently impacts on the nature of interpretation, as well as decisions made for action on the basis of the data visualisations provided. Hence, it is of utmost importance to consider the design features in terms of understanding ways to optimise designs of these dashboards to promote and drive adaptive (not maladaptive) behaviours. In the sector, there are a few prevalent design features that dominate the market for course-level learning analytics dashboards. One is the comparison of a school or department average when providing analytics related to access and interaction activity (e.g., Blackboard Analytics). The other is only the standard course-related data, and more recently, the idea of aligning some learning events on the access and interactions visualisations (Bakharia et al., 2016). The question here is: what is the contribution of these specific design attributes in influencing attentional selection as well as subsequent interpretations and translation of data for action?

The second critical information processing factor is the likelihood of cognitive biases influencing judgement and decision making. According to Kahneman (2003), System 1 thinking includes non-physical feature-based automatic processes such as cognitive biases. Substantial evidence from cognitive psychology reveals that people employ cognitive shortcuts to simplify the processing data for interpretation and decision-making (Tversky & Kahneman, 1981). These sources of bias can be referred to as "heuristics", and are often proposed to be the fast, representative, substitution attributes that come more readily to mind (Kahneman & Frederick, 2002). Typically, these cognitive biases arise as a strategy to reduce cognitive load or effort by simplifying the processing of the information (Shah & Oppenheimer, 2008). This inherent sense of forming intuitive judgements from graphical displays contradicts the complex perceptual and cognitive processes needed to make informed and accurate judgements. This gives a false (intuitive) sense of efficiency in forming judgements quickly on the basis of graphs rather than raw or statistical data stems from reliance on and preference for heuristics or cognitive biases (Meyer, Taieb, & Flascher, 1997). While heuristics are time and cognitive load efficient, they may also lead to systematic and predictable errors (Tversky & Kahneman, 1974). Of these, a common bias that is often perpetuated in learning and teaching practice is that of the representativeness bias (Kahneman & Tversky, 1972) – that is, the tendency for the educator to rely on evaluating the probability that the data reflects features that may be similar to an easily accessible knowledge on the parent population (e.g., knowledge of stereotyped biases, recency in memory). These biased interpretive lens may therefore lead educators to selectively attend to certain types or aspects of data over others, which may then shape their conclusions, and consequently inform their instructional or learning design in less than optimal ways.

The question in the context of dashboard design and academic development here is: are there ways to mitigate this automatic process of cognitive biases towards more deliberate, objective interpretation, judgement, and decision making using learning analytics? Gigerenzer (1991) argues that in complex, less-than-certain contexts, these cognitive biases may be permeable to interventions. Indeed, van Bruggen, Smidts, and Wierenga (1998) demonstrated that well-designed, contextual, decision support systems in conjunction with data presented for decision making in a managerial marketing context resulted in a reduction in the reliance on cognitive biases in decision making. These effects however, are small and depend on the design of the tools in supporting the complex critical thinking processes involved in interpretation and translation of data in making decisions in practice. These suggest that while cognitive biases may be implicit and difficult to mitigate, they are not completely impermeable to change.

The current research:

1. Seeks to investigate the extent to which visualisation factors affect attentional focus and interpretation of learning analytics.
2. Seeks to better understand schemas and attributions educators make when interpreting learning analytics for enhancement of learning and teaching in a setting designed to be close to a naturalistic 'busy academic' scenario.

As this research is broader than the scope of the current paper, I will focus on the main aims and will only report relevant methods and results. The questions of interest to address these aims are whether the visualisation differences affect the interpretive lens which educators employ when processing these graphs in trying to enhance learning and teaching. Are there themes in the interpretation and application that are suggestive of systematic attentional focus and interpretative lens across the three conditions (*Control*: Course-level only; *Event-Marked*: Course-level data with learning events marked; *Comparative*: Course- versus School-average data)? The rationale for addressing these questions is to better understand the information processing of learning analytics data to inform evidence-based designs of future learning analytics dashboards. To test this, I propose an extension of the existing learning analytics cycles to include consequential thinking when placing the educator at the centre of making meaning and designing subsequent actions for learning and teaching (see Figure 1 for extended learning analytics cycle), and promoting metacognitive processing of learning analytics as educators.

Currently, multiple models or cycles for learning analytics exist in the literature, though they typically emphasise the collection of data, followed by some analysis (or interpretation), and followed by action (e.g., Clow, 2012, Chatti, Dyckhoff, Schroeder, & Thüs, 2012). I propose that this addition of consequential thinking before action bridges the gap between data interpretation and action, such that the actions are more likely to be informed by current learning research and deliberate design before implementation and iteration. This final step, consequential thinking, was included in the model to highlight the importance of deliberate consequential thinking and planning as part of the explicit, a priori and iterative learning analytics cycle for learning and teaching, scholarship of teaching and learning (SoTL), or reflective practice. This added step in the learning analytics cycle fits within a design-based research methodology when using learning analytics for learning and teaching or SoTL (Brown, 1992; Reimann, 2006), or that of double-loop learning in reflective practice (Argyris, 2002).

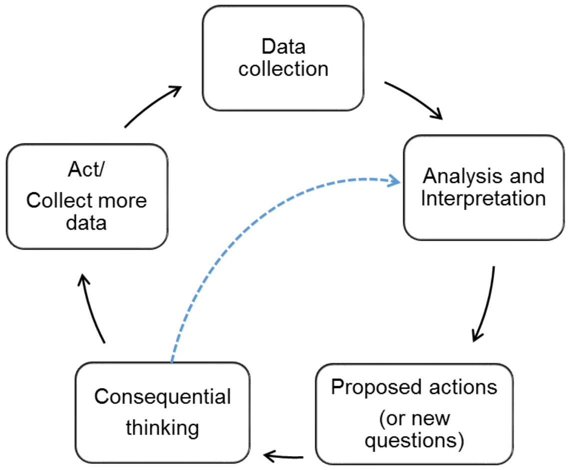

Figure 1. Learning analytics cycle for metacognitive educators. Consequential thinking is where interpretation is reviewed and refined through connectivity and inferential principles. Refinement and iteration continues *throughout* the cycle, with multiple double loops *during* each cycle (as indicated by dotted arrow).

Method

Participants

Participants were academics in a higher education institution from various disciplines, with varying teaching and data use experience. Participants were randomly allocated to one of two conditions: Overperforming course, and Underperforming Course. Relevant statistical tests were performed to test whether the two groups differed on several learning and teaching demographic factors: Academic disciplines, teaching modes, number of years of teaching, number of years of using data for learning and teaching, frequency for using data for learning and teaching, and engagement in learning and teaching practices. Chi-square tests of independence for categorical variables, and Mann-Whitney U tests run for continuous variables based on the small sample sizes per group (*p*s range = .235 - .805). These tests indicated that these groups were equivalent on all the relevant teaching and data-use experience, suggesting that the groups were comparable across the dependent variables of interest. Interestingly, the distribution of academics who self-selected to participate were biased towards the Sciences (n=11 out of 23).

Design

The study comprises a mixed experimental 2 (Between*: Over/ Under- performing course*) x 2 (Within: Scaffolding condition (*Unscaffolded*/ *Scaffolded*)) x 3 (Within: Visualisation conditions (*Control*/ *Comparison*/ *Event-marked*)) research design. In a 2-part online questionnaire, participants responded to a series of questions about their learning and teaching practices, and a set of questions proceeding 3 data scenarios (see Figure 2 for schematic of experimental design). Voluntary informed consent was obtained as per the ethical clearance (GU ref no: 2016/413) in accordance with the National Statement on Ethical Conduct in Human Research. The study was conducted as part of a larger in-person session about course-level learning analytics.

Data Scenarios

The data scenarios comprised three sets of graphs of learning analytics, contextualised within the self-report course characteristics (teaching mode, class level (undergraduate years (1- 4), or postgraduate coursework), and the typical number of students in the course) as determined by the participant. The rationale for this self-contextualisation is to ensure that the course context on which the respondent can draw upon in answering learning and teaching questions is equally familiar for all participants to their own courses, to enable interpretation and application of the data in a context that is relevant for oneself. A defined, pre-set scenario characteristic would vary the extent of familiarity of the individual respondents, hence biasing the academics whose contexts were more similar to the pre-set scenario than those with relatively minimal or less experience.

The three sets of graphs depict three different visualisations commonly used in learning analytics dashboards within the sector at present. They depict access (i.e., log-ins) and interaction activity (i.e., clicks) within the Learning Management System across three visualisation conditions: (1) Control (course level data only), (2) Comparison (own course-level data displayed with the School average data, where 'School' is the collective discipline, such as School of Public Health, where multiple degree/ programs may fall under one School), and (3) Event-marked (course level data only, with learning events marked on the graphs). The course data presented in both the Overperforming and Underperforming group was kept constant to ensure consistency and equity of interpretation potential across groups. The only difference in both groups is the School-level comparison data, where one group was presented with the School comparator line as higher than that of their course (Underperformer), or vice versa (Overperformer). Hence, the control and event-marked graphs were exactly the same for all participants. To minimise the order effects of going from or to an underperforming or overperforming course data, the order of the three graphs were counterbalanced across participants. Figure 3 illustrates an example of the visual graphical stimuli presented in one condition Overperforming group, Compare condition in the unscaffolded condition (background), and scaffolded condition (foreground).

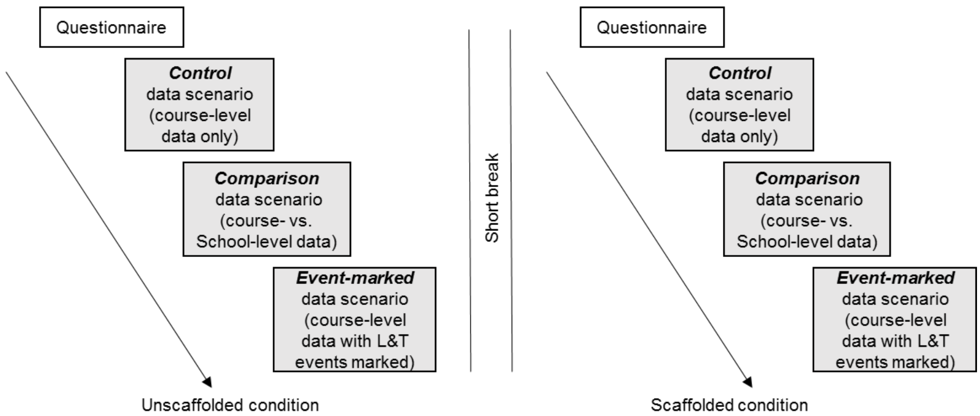

Figure 2. The schematic diagram of the flow of the study. All participants completed the unscaffolded condition first before the scaffolded condition. The order of the data visualisation scenario conditions (dark gray boxes) were counterbalanced across participants.

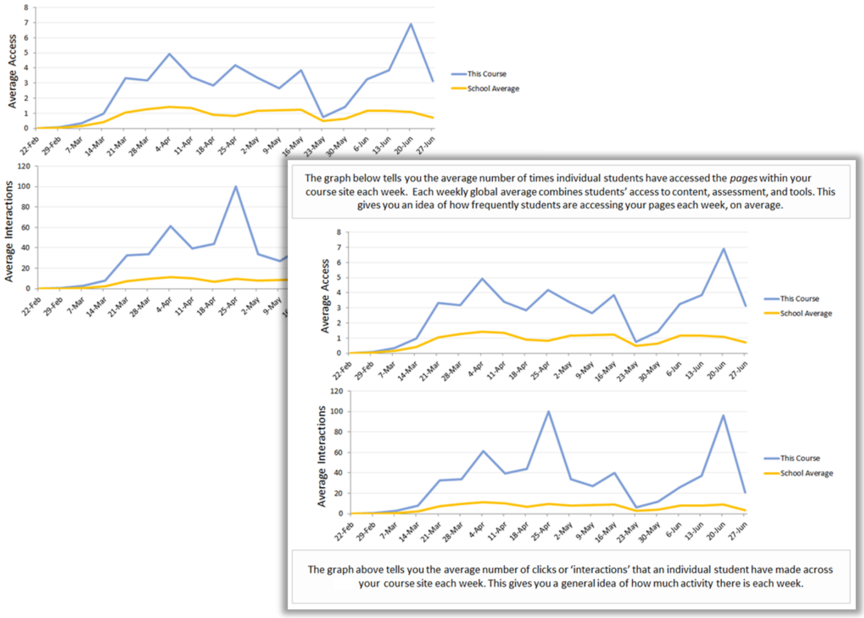

Figure 3. The visual graphical stimuli for the Overperforming group, Compare condition. Background graphs were shown in the unscaffolded condition, foreground depicts that shown in the scaffolded condition.

Procedure

Part 1 of the online questionnaire (Unscaffolded condition) contained several questions about the learning and teaching practices of the academics, a data literacy scale, and followed by the data scenarios. Participants were encouraged to keep their time on each page (one data scenario per page) to under five minutes so as to mimic the face-valid situation of assessing data during the semester. Participants were told to imagine the data they were about to see were from the course with the self-specified course. For each data scenario, participants were asked five open-ended questions designed to progressively tap into deeper levels of inquiry for interpretation, action, and justification for the action. For interpretation and action, participants were asked a general level question (designed to elicit System 1 thinking), followed by a deeper level question (designed to elicit System 2 thinking). Participants had a short break before proceeding to Part 2 (Scaffolded condition). Part 2 was a shorter version of Part 1, comprising the data literacy scale, as well as the set of three data scenarios. In Part 2 however, the visualisations were accompanied by scaffolding text which included a semantic explanation of how the measures were derived. In this paper, I will only be focusing on the qualitative responses to the data scenario questions.

Results

The present research sought to investigate the extent to which visualisation factors affect attentional focus and interpretation of learning analytics, and to better understand schemas and attributions academics make when interpreting learning analytics for enhancement of learning and teaching (L & T) in a setting designed to be close to a naturalistic 'busy academic' scenario. The question addressed here is whether the visualisation features differentially shape the interpretive lens with which academics adopt when processing these graphs. To this end, emergent thematic analysis (Massey, 2011) was conducted to assess whether patterns in the responses were systematically similar or different across the three visualisation conditions.

Table 1. Interpretation responses to the question "What overall impression of this course do you get by looking at the data?" coded into surface and deep levels of interpretations categories across visualisation conditions, with example statements of respective categories.

Visualisation condition	Number of Surface Interpretations	Number of Deep Interpretations	Example statement (Surface)	Example statement (Deep)
Control	5	17	"It varies over time."	"A spike on 25th April, low use and interaction on 23rd May and a spike on 20th June. I think in this course, if they are accessing the course then they are also interacting in some way, except that the 25th April"
Comparison	9	14	"My course is doing really well compared to the school average"	"Depending on what is usually offered at the school level, this course seems to do very well… There are specific design elements that encourage interaction on 25th April, but apart from that, the pattern of access generally follows the pattern of interactions."
Event-Marked	4	19	"Student's access increase around the final exam"	"The relationship between access and interaction is not clear. However, I note increased activity at the time of assessment, e.g. Quiz 1 and exam. With quiz 1 interactions increased as access decreased."

As an overview thematic assessment, the responses for the (System 1) interpretation question "What overall impressions of this course do you get by looking at the data?" was coded for categorisation into whether the response was a surface (i.e., general description of pattern observed) or deep (i.e., goes beyond simple description of overall pattern). As can be seen in Table 1, while the distributions of the number of surface and deep interpretations do not significantly differ, X^2 (2, N = 23) = 3.03, p = .22, inspection of the semantics content of the responses appear to vary in systematic ways.

Further inspection of the responses to the questions reveal dominant themes and schemas adopted when interpreting the graphs. Here, I will reveal the emergent thematic patterns according to the revised learning analytics cycle as per Figure 1: analysis – action – consequential thinking, for each visualisation condition.

Unscaffolded: Control condition

Analysis.

Predominately, participants' responses focused on identifying general patterns and trends of activity within the course across the semester. Deeper levels of interpretation include noting of inconsistent activity such as notable peaks and troughs across the weeks, followed by some hypothesizing about potential related learning events. For example, one respondent stated that "(students were) Slow in using the course information and peaks in interaction around the end of April and June. Access and interaction increase rapidly at the end of semester suggests that they are looking for information to prepare for the exam or assessment". When asked "*What notable aspects of the data do you think are important?*", some respondents delved deeper into the analysis aspect of the data (e.g., "Students are not engaged before Week 1, and engagement does not really start until about Week 6. Engagement also drops off markedly at the end of teaching weeks until the end of exam period."). As with the first level interpretation, deeper level interpretation also included hypothesizing about potential related learning and teaching events in the course. On the other hand, some respondents delved deeper into the further inquiry before hypothesizing – this involved asking more clarification questions about the data presented (e.g., "Most importantly, what do the words access and interactions mean. Peaks and troughs and their timing are important as well as actual numbers (on the vertical axis)."), or suggesting other sources of information that would improve their capacity to interpret the data appropriately (e.g., "I need to refer to the course schedule to align the chart with course events.").

Action.

When subsequently asked "*What actions might you take towards enhancing learning and teaching in this course?*" a cluster of responses were focused on increasing engagement earlier (e.g., "Increase engagement at the commencement of the course; create expectation/requirement of consistently accessing and interacting with course material e.g., regular assessments/tasks."). Others stated the need for more information before suggesting any actions (e.g., "Not enough data here or context or detail to make these calls.").

Consistent with the themes above, when asked to provide justification for the proposed action (question: "*Why do you think that might be a good thing to do?*"), three clear themes emerged in the responses. Some justifications were solely based on the data, and were *(1)atheoretical* (e.g., "You may be able to improve the learning in the course by engaging the student from the start and throughout the whole semester.", or "Will keep the access going even when students are busy"), some were (loosely*) (2)theoretically based* (e.g., "Keeping the students engaged across the semester will encourage deeper learning approaches.", or "Engage students in good levels of access and interaction form the beginning; decrease likelihood of final cramming etc"), and finally, some *(3) maintained the level of inquiry* or testing assumptions (e.g., "Given the assumption above, it might improve overall learning.").

Consequential thinking.
When asked "*What do you expect might occur as a result of the changes you are proposing?*", most respondents expected more consistent engagement (by way of access and interactions) throughout the semester as a function of the proposed actions, with students engaging with the course earlier than the apparent start of engagement at Week 3 on the graph (e.g., "Fewer peaks in the processes; more consistent engagement with learning throughout the course."). Others went further to speculate change beyond behaviours to that of student satisfaction and learning as an aspirational outcome (e.g., "increased student satisfaction; community of learning through greater interactions and connectedness", or "Improved student learning and understanding would be good but this may not happen.").

Unscaffolded: Event-marked condition

Analysis.
As with the control condition, the analysis involved interpretation based on student activity within the course, but with more hypothesizing on the basis of the learning and teaching events. This resulted in more consistent critical analysis of the data in relation to learning and teaching events within the course (e.g., "Poor engagement with initial lectures/course introduction; increased participation up to Quiz 1; drop off in engagement in May (lack of further quizzes); peak engagement at end final exams"). Here, more respondents made interpretations of the two graphs in conjunction rather than in isolation (e.g., "Access increases gradually over time until the final exam, excluding late May. Interaction is higher when linked to key assessment", or "The relationship between access and interaction is not clear. However, I note increased activity at the time of assessment, e.g. Quiz 1 and exam. With quiz 1 interactions increased as access decreased.").

A drawback of the deeper analysis question here was that some respondents made inferences about students' approaches to learning from mere LMS access and interactions (e.g., "Students involvement in this course, is based on assessment. Students are not sufficiently motivated in this course. They are simply doing what needs to be done in order to complete the course. They are adopting a surface approach to learning."). Students' cramming behaviour was also inferred without clarification of the source of measures as the basis for interpretation ("Both access and interaction are driven by assessment. Last minute cramming to study for the Quiz & Exam."), where the surge of activity may well have been attributable to completing the quiz within the LMS itself rather than the speculated (lack of) attempts to study. Contrary to this, others approached deeper interpretation of the data with more caution – some questioned the assumptions of the data prior to making inferences about students' learning behaviours (e.g., "Assuming that the graphs represent web hits on certain pages, student access the website more often near exams and quizzes. Perhaps an assignment was due at other peak points in the graph."); others stated their capacity and data limitations and caution in inferring learning from the learning analytics graphs (e.g., "I don't know how to account for the contradiction between interaction peak at assessment two and no corresponding peak for access...this seems odd to me - so anomalies between graphs are significant as well.", or "..This data is not rich enough to infer much").

Action.
As with the control condition, respondents suggested increasing engagement sooner, but with more specific learning and teaching strategies. A large proportion of respondents suggested to increase access by way of increasing the number of assessments throughout the semester, rather than having one big exam at the end following one quiz, and to perhaps make these assessments of smaller stakes (e.g., "Increase access and interaction at the very start; increase assessment/quiz activities so occur on a regular basis; decrease importance of final exam - more equitable assessment tasks). Others went further to suggest specific active learning strategies (e.g., "Try and make the classes more interactive, explaining to students why what they are learning is important, make connections with what they already know or will do"), or to initiate deeper inquiry processes to answer the questions that arose from the initial graphs before making inferences for actioning ("Identifying specifically what type of resources students were accessing and what they were doing with them.", or "Focus group with students where I present the data and ask questions around their study habits").

Compared with the control condition, justification themes for the proposed actions were similar, but again, more specific. As an example justification for spreading assessments across the semester based on the inference that students appeared to be driven by assessments, some respondents justified this proposal atheoretically (e.g., "Gives more data for interventions for students not completing the weekly assessment. Engages students in the course continually on a weekly basis."), or with some theoretical basis (e.g., "Encourage students to engage with the material and make connections with the material which means they are more likely to remember it and want to learn more."), or with further caution of interpreting of current data as insufficient to make inferences ("Better presentation of the data so that will give me a better understanding of the meaning and give me the possibility to make changes to the course/teaching activities if required.").

Consequential thinking.
As with the control condition, most respondents expected more consistent engagement throughout the semester as a function of their proposed action, though now with greater specificity in relation to assessments (e.g., "More uniform engagement by students", or "May study early for preparing for the exam and assessment.").

Unscaffolded: Comparison condition

Analysis.
The responses in this condition largely centered around the School comparison (21 out of 23 responses focused on this, one focused on the course, one was unsure as to how to interpret the graphs). Themes were similar across both the Over- and Under-performer conditions. Thus, the discussion of responses will not be differentiated by condition. Further to the examples given in Table 2, respondents who did interpret the data more deeply approached interpretation with more caution and inquisition, though maintaining the relative comparison to the School average (e.g., "If these courses have approximately the same number of students then obviously students are accessing this course less than the average compared to other courses in the school.", or "This course seems to have less access and interaction compared to the school average - but there might be a good pedagogical reason for this (course could be very different type of offering to rest of school)".)

Action.
Interestingly, the themes emerging from proposed actions were not consistently aligned with the interpretations. While some maintained the schema associated with the School comparison (e.g., "Encourage course convenor to discuss L&T approaches with other convenors - try and improve their courses!", or "Find out what other members of staff in the school are doing to try and increase levels of access and interactions to at least school levels."), some continued to propose actions irrespective of the School comparison, as that seen in the Control and Event-marked conditions (e.g., "Face to face interactions early on Setting expectations of behaviour early in semester needs to occur"). Others were hesitant to act on the basis of the graphs in question citing insufficient information to propose action or interpret accurately. When asked to provide justification for their proposed actions, consistency of engagement was framed in the context of a School, rather than within a course (e.g., "Brings a common pattern to the school and brings the course to school levels providing students with a more consistent approach").

Consequential thinking.
Consistent with the Control and Event-marked conditions, the dominant expectation was that the proposed actions would result in more consistent engagement across the semester. In addition, there were responses that highlighted expectations around a more coherent school ("Better response to course and a more coherent school based approach"), or made references to expected course and teaching evaluations when given relative School average data that places their course to be higher than the average ("My course gets better... and given the lack of interaction with other courses in the school, my SETs and SECs (*teaching and course evaluations*) will shine brightly.").

Scaffolded condition

To answer the additive question of whether scaffolding improved the information processing of the visualisations, we assessed the responses for any insight clarifications emerging in the responses post scaffolding. Responses appeared to be similar thematically and in depth to those in the Unscaffolded condition, but with fewer responses suggesting there is insufficient information to make meaningful interpretation or inferences.

Discussion

The present paper focused on investigating the extent to which visualisation factors affect attentional focus and interpretation of learning analytics. In particular, the aim was to better understand schemas and attributions academics make when interpreting learning analytics for enhancement of learning and teaching in a setting designed to be close to a naturalistic 'busy academic' scenario. In answering the first question of whether the visualisation differences affect the attentional and interpretive lens with which academics adopt when processing these graphs in trying to answer learning and teaching questions, we assessed the responses to the five open-ended questions of inquiry: two interpretation questions, two action questions, and one consequential thinking question, in line with a revised learning analytics data cycle loop (see Figure 1). The interpretation and action questions were designed to elicit System 1 (fast, automatic thinking), followed by System 2 (slow, deliberate thinking) cognitive processes to assess the functional role of cognitive biases in this context.

Emergent thematic analysis of the responses suggest that the design features tested in this study – control, comparative, and event-marked features – do shape the attentional focus and subsequent interpretation of the data. This was most prevalent in the comparative condition whereby most of the respondents' interpretations centred on the Course vs. School average relativity instead of inspecting and interpreting the pattern changes within their own course. This is unsurprising given the evidence of social comparison tendencies once the attentional lens is focused on the comparative features of the visualisation (Corcoran & Mussweiler, 2010). This suggests that the social comparative feature simultaneously enhanced deeper processing of comparative data, and obscured deeper processing of the data pattern changes within their own course.

Interestingly, when asked to propose actions on the basis of the interpretations in the Comparison condition, some respondents who interpreted in terms of School-referencing reverted back to general course-level actions. That is, respondents were equally likely to propose actions that were School-referenced as they were to propose actions without referencing the School (course-only proposed actions). This is despite having made School-average-referenced data interpretations. This inconsistency in the line of thought in interpretation through to action perhaps indicates a potential gap in the bridging of understanding the data to devising rational, evidence-based action, whereby the addition of more complex contextual factors (such as the additional comparison to School average data) made this more challenging.

Generally, more concrete hypothesizing about student learning occurred in both the Comparative and Event-Marked conditions compared to the Control condition, however focused interpretations and proposals for actions around student engagement and learning were more evident in the Event-Marked condition. Whilst interpretation in the control condition did focus on the course, this was also the condition where academics asked more questions or requested the need for more data before making inferential leaps or proposing actions. Taken together, the findings highlight the importance of aligning design of learning analytics dashboards with the intended educational purpose. Specifically, the factors that impact attentional selection of information for further processing is an important consideration for the future design of learning analytics dashboards, particularly when considering the intended purpose of these dashboards in enhancing learning and teaching whilst minimising errors in inferences from quick glances of dashboard data. Interpretations in the Comparison and Event-marked conditions were consistent with, and largely constrained within the features of these graphs: the comparison line of School average data obscured the course-level pattern variations and highlighted the School-Course comparisons, while the interpretations in the Event-marked condition (graph marked with largely assessment items) revolved around assessments.

The addition of 'deeper dive' (System 2; Kahneman, 2003) questions in this study was intended to elicit deeper inquiry processes in interpretation of learning analytics for devising actions to enhance learning and teaching practice, and in particular, in having greater consideration of the impact of these proposed actions. Here, we observed a consistent emergent theme of academics' expectations of student engagement across the semester shaping their proposed actions. Regardless of the visualisation conditions, academics largely expected students to maintain a consistent level of engagement with their course (at least in terms of online engagement in this context, irrespective to teaching mode). This finding is interesting, as it suggests an expectation that students should engage consistently across the weeks in the semester, regardless of semester breaks and conflicting demands that change over time. This adds the question of how do these educator expectations influence the interpretation and strategies that they may employ to enhance their course for learning. That is, how does this expectation drive their data-informed practice, and how does it influence the behaviours they would like to facilitate in the students (i.e., distinction between engagement as seen with the analytics presented here, and depth of learning). Given the consistency of this expectation, it is possible that this might be an expression of a heuristic shaped by normative institutional or educational discourse. While this contention cannot be determined from this study, this highlights the importance of deliberate consideration of the institutional and support-services framing and discourse-setting around institutional approaches to digitally-enhanced learning and learning analytics in general.

One of the recurring challenges for learning analytics is the conception and measurement of ‘learning’ in ‘learning analytics’. Given that the learning analytics presented in this study were general ‘access and interactions’ activities across the entire course, the fact that deeper considerations of learning beyond engagement was less evident in the responses in this study suggests that the level of interpretation was for the most part appropriate. Given the concerns in the sector for inappropriate or overinterpretation of learning analytics, the findings indicate some parsimony in this pattern of interpretation of data suggesting that this may not be a concern for the majority of educators in higher education.

However, a minority of respondents did infer learning approaches from this distal data. This highlights the need for more discussions in the sector about using learning analytics as a key measure in learning and teaching, in particular in inferring learning from learning analytics given its measurement properties, reliability, and validity. While learning analytics in this context can open up possibilities for near real-time interventions in learning and teaching design, the considerations of the translation of learning analytics into appropriate interventions remains a challenge that needs to be addressed. In particular is the challenge in inferring learning as a process rather than outcomes (Lodge & Lewis, 2012), as is the more prevalent practice in higher education.

Interestingly, the scaffolding manipulation resulted in minimal change in interpretation. It may be that while scaffolding is necessary to reduce uncertainty, the current manipulation of scaffolding with the semantic information of how the measures were derived is not sufficient to have the impact of improving interpretation of the visualised learning analytics graphs within a short period. That is, the short given duration (under five minutes) to answer the questions for each data scenario was insufficient for participants to encode, understand, and apply the semantic scaffolding (semantic information about what the graphs indicated/ measured) sufficient for the intended purpose. It might be that educators will require more comprehensive, coherent academic development that links the semantic information of the measures with the learning science and learning design to optimise their capacity to truly enhance their practice with data and evidence.

There are certain contextual factors that may impact on the generalisability of the findings of this study to that of other higher education institutions. First, given the numbers of participants in this study, it is worth noting the exploratory nature of this study. Second, it is important to note here that at the time of the study, the amount of institutional or prior exposure to learning analytics is relatively low. Future research could investigate the impact of the design features with academics who may have had more experience with learning analytics to assess the effect on more mature users.

There are a few implications for professional learning. Given that this study was conducted in a university that does not yet have an institutional learning analytics dashboard implemented, this speaks to the level of maturity in understanding use of learning analytics at a deeper level. Indeed, when asked for the types of data they use to enhance learning and teaching, only seven out of 23 participants indicated some experience with using analytics (i.e., Blackboard native performance reports, Yammer, Echo 360). The question remains as to whether this signals the requirement for deeper levels of scaffolding beyond the semantic information of the measures. Future professional learning initiatives and research could move beyond just semantic scaffolding (the "*What")*, but perhaps including inquiry triggering scaffolding using the connectivity principle (e.g., exploring common lines of questioning) and links to relevant literature (i.e., to help with meaning-making and considerations of theory and relevant variables to focus on when using learning analytics). Further, design and training development could consider the general themes that emerged in the justifications of actions in this study – actions proposed were either atheoretically developed, loosely linked to theory, or in some cases, resulted in deeper inquiry process, rather than prescriptive actions. By and large, the main message for educators in general is to perhaps slow down, and make deliberate the cognitive processes involved in interpretation of learning analytics to mitigate some of these automatic processes.

The main rationale for addressing these questions was to better understand the attentional and cognitive processing strategies activated when using learning analytics data for learning and teaching so as to inform more evidence-based designs of future learning analytics dashboards. The preliminary findings in this study suggest that the design features of learning analytics dashboards, such as marking learning events, or overlaying the School average data over the course data, do systematically shape the interpretive lens academics take when using learning analytics to inform learning and teaching. This finding highlights the importance of considering the attentional and cognitive factors when designing the tools, professional learning, and institutional strategies as part of the implementation of learning analytics. I suggest that none of the visualisation examples used here were better than others, but rather that it is important to consider the alignment of the intended purpose and design features of learning analytics dashboards and to be cognisant of the factors that *bias* towards, or as importantly, *obscure* attentional selection of certain features of the data. Further, while cognitive biases may be difficult to mitigate or change, it is worth considering and understanding these cognitive processes in using learning analytics for learning and teaching. While biases may be activated, it may be possible that they can be mitigated when deeper, deliberate consequential thinking processes are engaged in. This is particularly critical when learning analytics is used in conjunction with student demographic data (i.e., labelling bias, stereotypes, etc.; for example, see Ohan, Visser, Strain, & Allen, 2011).

The complexity of interpreting learning analytics for specific purposes in learning and teaching enhancements is clear. While course educators are best positioned to make sense of the data that arise out of their own course context, and apply it to design relevant, effective actions, careful design of the learning analytics dashboards aligned with purposes need to be considered to optimise this capacity. This work could help educators not only develop their teaching practice, but also leverage previously untapped sources of data and evidence in the scholarship of learning and teaching.

References

Argyris, C. (2002). Double-loop learning, teaching, and research. *Academy of Management Learning & Education, 1* (22), 206-218.

Arnold, K. E. & Pistilli, M. D.. (2012). Course Signals at Purdue: Using learning analytics to increase student success. *Proceedings of the Second International Conference on Learning Analytics and Knowledge, LAK 12* (pp. 267-270). New York, NY: ACM.

Bakharia, A., Corrin, L., de Barba, P., Kennedy, G., Mulder, R., Gasevic, D., et al. (2016). A conceptual framework linking learning design with learning analytics. *Proceedings of the Sixth International Conference on Learning Analytics and Knowledge, LAK 16.*

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of Learning Sciences, 2* (2), 141-178.

Chatti, M. A., Dyckhoff, A. L., Schroeder, U., & Thüs, H. (2012). A reference model for learning analytics. *InternationalJournal of Technology Enhanced Learning, 4* (5), 318-331.

Clow, D. (2012). The learning analytics cycle: Closing the loop effectively. *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge, LAK 12* (pp. 134-137). New York, NY: ACM.

Corcoran, K. & Mussweiler, T. (2010). The cognitive miser's perspective: Social comparison as a heuristic in self-judgements. *European Review of Social Psychology, 21* (1), 78-113.

de Freitas, S., Gibson, D., du Plessis, C., Halloran, P., Williams, E., Ambrose., M., et al. (2014). Foundations of dynamic learning analytics: Using university student data to increase retention. British Journal of Educational Technology, 46 (6), 1175-1188.

Desimone, R. & Duncan, J. (1995). Neural mechanisms of selective visual attention. *Annual Reviews of Neuroscience, 18,* 193-222.

Dietz-Uhler, B. & Hurn, J. E. (2013). Using learning analytics to predict (and improve) student success. *Journal of Interactive Online Learning, 12* (1), 17-26.

Duval, E. (2011). Attention please! Learning analytics for visualisation and recommendation. In *Proceedings of the 1st International Conference on Learning Analytics and Knowledge, LAK '11* (pp. 9-17). New York, NY: ACM.

Gašević, D., Dawson, S., Rogers, T., & Gasevic, D. (2016). Learning analytics should not promote one size fits all: The effects of instructional conditions in predicting learning success. *The Internet and Higher Education, 28,* 68-84.

Gašević, D., Dawson, S., Siemens, G. (2015). Let's not forget: Learning analytics are about learning, *Tech Trends*, *59* (1), 64-71.

Gigerenzer, G. (1991). How to make cognitive illusions disappear: Beyond "Heuristics and Biases". *European Review of Social Psychology, 2, 83-115.*

Kahneman, D. & Tversky, A. (1972). Subjective probability: A judgement of representativeness. *Cognitive Psychology, 3,* 430-454.

Kahneman, D., Frederick S. (2002). Representativeness revisited: attribute substitution in intuitive judgment. In T Gilovich, D Griffin, D Kahneman (Eds.), *Heuristics and Biases: The Psychology of Intuitive Judgment* (pp. 49-81). New York: Cambridge University Press.

Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. *The American Economic Review, 93* (5), 1449-1475.

Lodge, J. M. & Lewis, M. J. (2012). Pigeon pecks and mouse clicks: Putting the learning back into learning analytics. In M. Brown, M. Hartnett & T. Stewart (Eds.), Future challenges, sustainable futures. Proceedings ascilite Wellington 2012.

Lumpe, A. T., Haney, J. J., & Czerniak, C. M. (2000). Assessing teachers' beliefs about their science teaching context. *Journal of Research in Science Teaching, 37,* 275-292.

Macfadyen, L. & Dawson, S. P. (2012). Numbers are not enough: Why e-learning analytics failed to inform an institutional strategic plan. *Educational Technology & Society, 15* (3), 149-163.

Mandinach, E. B. (2012). A perfect time for data use: Using data-driven decision making to inform practice. *Educational Psychologist, 42* (2), 71-85.

Massey, O. T. (2011). A proposed model for the analysis and interpretation of focus groups in evaluation research. *Evaluation and Program Planning, 34,* 21-28.

McMains, S. & Kastner, S. (2011). Interactions of top-down and bottom-up mechanisms in human visual cortex, *The Journal of Neuroscience, 31* (2), 587-597.
Meyer, J., Taieb, M., & Flascher, I. (1997). Correlation Estimates as perceptual judgments. *Journal of Experimental Psychology: Applied, 3* (1), 3-20.
Ohan, J. L., Visser, T. A. W., Strain, M. C., & Allen, L. (2011). Teachers' and education students' perceptions of and reactions to children with and without the diagnostic label "ADHD". *Journal of School Psychology, 49* (1), 81-105.
Pardo, A. & Siemens, G., (2014). Ethical and privacy principles for learning analytics. *British Journal of Educational Technology, 45* (3), 438-450.
Reimann, P. (2016). Connecting learning analytics with learning research: the role of design-based research. *Learning: Research & Practice, 2* (2), 130-142.
Serences, J. T. & Yantis, S. (2006). Selective visual attention and perceptual coherence. *Trends in Cognitive Sciences, 10* (1), 38-45.
Shah, A. K. & Oppenheimer, D.M. (2008). Heuristics made easy: an effort-reduction framework. *Psychological Bulletin, 137* (2), 207-222.
Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15* (2), 4-14.
Slade, S. & Prinsloo, P. (2013). Learning analytics: Ethical issues and dilemmas. *American Behavioral Scientist, 57* (10), 1510-1529.
Stanovich, P. J., & Stanovich, K. E. (2003). *Using research and reason in education: How teachers can use scientifically based research to make curricular & instructional decisions.* Washington, DC: National Institute for Literacy.
Styles, E. A. (2006). *The psychology of attention.* Hove, UK: Psychology Press.
Theeuwes, J. (2010). Top-down and bottom-up control of visual selection. *Acta Psychologica, 135* (2), 77-99.
Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Education, 37* (1), 57-70.
Tversky, A., & Kahneman, D. (1974). Judgement under uncertainty: Heuristics and biases. *Science, 185,* 1124-1131.
Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science, 211,* 453-458.
van Bruggen, G. H., Smidts, A., & Wierenga, B. (1998). Improving decision making by means of a marketing decision support system. *Management Science, 44* (5), 645-658.

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Confidence drives exploration strategies in interactive simulations

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Maximising the benefits of digital learning environments requires understanding how students process what they are exposed to in these environments. Besides approaches based on examining information processing within the cognitive domain, the importance of including emotions has been recently addressed. This study aimed to explore emotional dynamics during discovery learning in an interactive simulation, with continuous measures of self-reported confidence and challenge. Interactions from participants were recorded and two groups were created according to the exploration strategy used: systematic or non-systematic. Visual exploration was also measured by eye tracking as well as knowledge at pre- and post-test. Results suggest that learners using a systematic exploration strategy ran significantly more simulation cycles than non-systematic learners. Moreover, the latter group reported to be significantly less challenged and more confident about understanding the material. These results emphasise the importance of student perceptions of their capabilities when learning in flexible, less structured digital environments.

Keywords: discovery learning; confidence; interactive interface; digital learning environments

Discovery learning, confusion, challenge, and confidence

Although somewhat controversial in terms of efficacy, discovery-based learning environments provide opportunities for understanding how students learn when exposed to relatively unstructured learning environments. Discovery-based or simulation-based environments provide students with the ability to choose their own way through the learning process to a large extent. In digital learning environments, this is achieved by offering students flexibility in the environment. This flexibility can take many forms. Some environments are relatively constrained but give students some freedom to make choices about their path through the environment. Other environments, particularly immersive simulations (e.g., Kennedy, Ioannou, Zhou, Bailey, & O'Leary, 2013), are more flexible, giving students many options for choosing how they progress through and interact with the technology and with the content.

Discovery-based learning environments have been criticised due to a lack of direct instruction (Kirschner, Sweller, & Clark, 2006). Hattie and Yates (2013) for example, argue that students are often ill prepared to use these environments and struggle to make sense of the material within. In less structured learning environments, students are required to take more responsibility for their learning than in well structured ones. This means that students need to rely more on their use of self-regulatory skills and motivation in such environments, which may or may not be sufficient to support them (Graesser, McNamara, & VanLehn, 2005; Wigfield, Hoa, & Klauda, 2008). The opposing view is that, in making decisions about their own progress through the material, students are able to construct new knowledge based on their prior knowledge and experiences. Thus, discovery-based environments align well with constructivist theories of learning (e.g., Bruner, 1961). In the case of conceptual change, these discovery-based environments appear to be particularly beneficial. De Jong and Van Joolingen (1998) conducted a review of research focussed on discovery-based learning environments and found that virtual conceptual simulations can be particularly effective in bringing about conceptual change. Therefore, when students need to learn complex material, a discovery-based environment appears to be beneficial in allowing students to engage with the material in a more personalised way by giving them flexibility in their approach and progress. However, the uncertainty about the effectiveness of these approaches suggests that caution must be used in their application.

One affordance that is often overlooked in relation to discovery-based digital learning environments is that they also provide opportunities to uncover the process of learning. Much of what is understood about learning in the higher education context is reliant on theory or on student performance in assessment. Learning and performance are not the same thing (Soderstrom & Bjork, 2015). Performance is related to the production of an artefact of some description; a snapshot of student achievement. Learning, on the other hand, is a developmental process that occurs over time. Flexible learning environments not only allow students flexibility to personalise how they go about their own learning but the choice of strategies they use also provide clues as to how they are progressing and regulating their learning. Analysing these choices and strategies then allows for intervention if it appears that students are veering into unproductive learning behaviours. In other words, flexible learning environments provide an opportunity to better understand how students approach ill-structured learning and then use this information to enhance the design of the environment through iterative cycles (see also Bakharia et al., 2016).

Where the affordances provided by the ability to monitor and track student progress may be of most benefit is in building on the fledgling research to date about student emotion and subjective experience as they acquire knowledge. Traditionally, the information processing aspects of student learning have received more attention than subjective states and emotion (Pekrun & Linnenbrink-Garcia, 2014). It is becoming increasing apparent that these subjective states heavily influence whether students can successfully navigate through discovery-based environments. For example, a growing body of research demonstrates that, while student confusion can be beneficial in helping students achieve conceptual change, if it is not effectively resolved, students can experience boredom and frustration, which can lead to them giving up (Arguel & Lane, 2015; D’Mello & Graesser, 2014; D’Mello, Lehman, Pekrun, & Graesser, 2014). The detection of emotions, such as confusion, in digital learning environments can hence be a critical factor to maintain learners in an optimal emotional state promoting the best learning performances (Arguel, Lockyer, Lipp, Lodge, & Kennedy, in press). Early detection of learner confusion could be performed on the basis of analysis of visual exploration strategies measured with an eye tracker (Pachman, Arguel, Lockyer, Kennedy, & Lodge, in press). Therefore, the focus of the study discussed in this paper is on the subjective aspects of learning in digital environments. Our aim was to align these subjective states with the strategies used to navigate through the environment and the visual exploration of the learning material. In doing so, it was expected that a further link could be made between student learning strategies and the cognitive and affective states that drive these strategies.

One challenge that is particularly difficult in the development of better understanding about student experiences as they learn in discovery-based environments is the vast individual differences between students. Not only do students have differing levels of prior knowledge, they will adopt different strategies when learning. For example Dalgarno, Kennedy, and Bennett (2014) report that learners’ exploration activity can be categorised into at least two types of strategies. In a comparison between scientific material presented in a tutorial style module and an interactive style module, Dalgarno et al. found that students tended to adopt either a systematic or non-systematic approach in the interactive version. The difference in this case is that systematic approaches tended to be more methodical, changing a limited number of variables in each simulation run compared to non-systematic approaches that involved a more haphazard strategy. The students adopting the systematic approach achieved greater learning gains than did either the tutorial condition or the students who adopted a non-systematic approach. In this instance, the individual differences in strategy selection had a significant effect on student learning. The strategies students adopt as they learn in these environments will be driven by their experiences and potentially other factors such as personality factors, motivation and interest in the material (Ames & Archer, 1988). In a follow up study, Lodge and Kennedy (2015) found that confidence was an important factor related to the strategies students adopt when exploring discovery-based environments. More confident students appear to have a tendency to overestimate their understanding and tend to be less systematic and methodical in their strategies. This aligns with work on overconfidence, in particular the Dunning Kruger effect (Kruger & Dunning, 1999) or the observation that the most unskilled are often unaware that they are in fact unskilled and tend to overestimate their skills or knowledge.

Understanding how the subjective experiences of students such as their confidence level relate to the other factors that influence how they use discovery-based environments is therefore an important issue for research in educational technology. Furthermore, being able to personalise and adapt the environment on the basis of the strategies students adopt will require determining how they are experiencing the learning environment and how this aligns with observable interaction with the task. Learning analytics and the learning sciences have begun to provide some clues about how different strategies used in discovery-based environments can be productive or non-productive. Our aim on this study was to take a further step towards connecting the student subjective experience of the task in terms of their level of confidence and perceived challenge and the observable interactions as they complete the task. Exploring the relationship between these factors is important if more sophisticated, adaptive systems are to be built that can respond to the student experience of the task. We did so in this study by assessing students self reported levels of confidence and perceived difficulty (i.e. how challenging) they felt the task was. This data was then compared and contrasted with two forms of observable behaviour that both give an indication of the strategy that students adopt. The first is the audit trail of activity in the task (as per Dalgarno et al., 2014 and Lodge & Kennedy, 2015). The second was gaze tracking, as has been used extensively to determine how students process material in digital learning environments (Van Gog, 2007). The use of an eye tracker for measuring gaze trajectories was the novelty of our study compared with the previous studies using the same learning material (Dalgarno et al., 2014 and Lodge & Kennedy, 2015).

Experimental study

Material and method

Participants

Thirty-three participants were recruited from the Macquarie University campus. For technical reasons, the recording of eye tracking data failed for 4 participants. Consequently, these participants were removed from analyses and the sample size used in the study was finally of 29 participants. The study was advertised on the university internal career website and all participants were compensated of A$15 for their participation. The age of participants varied from 18 to 29 years (M = 21.79, SD = 2.85) and the sample included 22 female participants and 7 males.

Materials

The learning material used in the study was initially developed for a study on discovery learning with computer-based simulations (Dalgarno et al., 2014) and has been subsequently used in another study (Lodge & Kennedy, 2015). The learning task was about understanding the influence of several factors on the level of the blood alcohol concentration and its evolution over time. The learning material consisted of an interactive interface displayed in a screen and composed of two panels (see Figure 1). On the left panel, seven parameters were manipulable, such as the body weight, the number of consumed standard drinks or the time when started to drink. On the right panel, a graph depicted the evolution of the blood alcohol concentration over a 24-hour period. Once participants were ready to observe the result of the manipulation of one or several parameter values, they clicked on a “Run Simulation” button and an updated curve was shown in the next screen. Running each simulation created different graphs and allowed participants to visualise the effect of the variables on the blood alcohol concentration, and also, to confirm or disprove some of their previous ideas triggered by the pre-test.

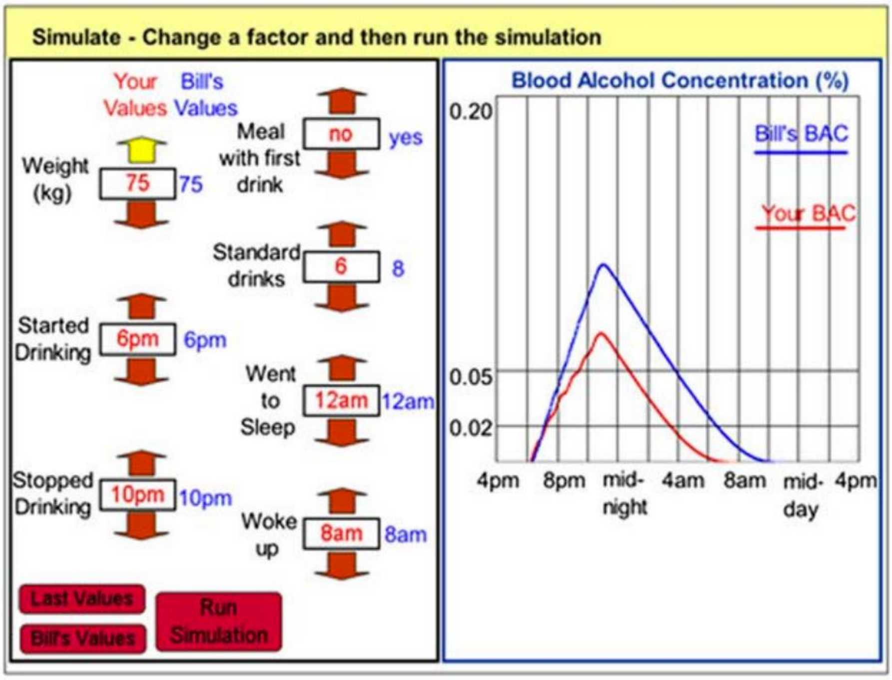

Figure 1: Screenshot of the simulation interface

Visual exploration of the material was recorded with an eye tracker Tobii T120 capturing participant’s gaze at a frequency rate of 60 Hz. This eye tracker system is based on a non-invasive technology using infrared remote cameras and did not require the immobilisation of participants’ head or the wearing of a head-mounted device. Interaction data (e.g., mouse pointer locations and click events) were also recorded and serve as an indicator for the classification of participants into the systematic and non-systematic groups.

Procedure
Before starting the learning task, all participants completed a paper-based pre-test questionnaire in order to assess their initial knowledge on the blood alcohol concentration mechanisms. Then, an experimenter calibrated the eye tracker for each participant before they started to navigate autonomously through a series of pages displayed on the eye tracker built-in screen (17" TFT, 1280x1024 pixels). At the bottom of each page, an actionable button “next” was available to access the next page. The eight first pages provided participants with the instructions, an introduction paragraph to the topic, and a practice activity. The following pages were the simulation runs. After each page, participants were asked to rate on paper-based scales their level of confidence about the material and how challenging they found the material to be. These were simple visual analogue scales from 0 – 10 with anchor points ranging from not at all to very much so (as per Lodge & Kennedy, 2015). Participants had the possibility to perform as many simulation runs as they wanted until they thought they had understood the material sufficiently. Finally, a post-test questionnaire was given to participants to assess their level of knowledge and to collect some demographics. Some questions were used to evaluate general motivation and study habits were given to participants. These questions were adapted from previous research and notably from the Motivated Strategies for Learning Questionnaire (MSLQ) (Elliot & McGregor, 2001; Hulleman, 2007; Pintrich & De Groot, 1990). This combination of items has been previously used in digital learning environments with undergraduate students and reported acceptable reliability (de Barba, Kennedy, & Ainley, 2016). Constructs measured included value beliefs, individual interest, goal orientation, self-efficacy, control beliefs, metacognition, elaboration, organisation, effort regulation, peer learning, help-seeking behaviour, and study environment and time management.

Results

Interaction patterns with the simulation
The data gathered from the simulation indicated differences in the way that participants were interacting with it. Some participants manipulated only one parameter at each cycle of simulation, whereas others preferred to change values of several variables before to run each cycle of the simulation. This variability of behaviours is interpreted as being the touchstone of the different strategies participants employed. Consequently, we have classified participants either as systematic or as non-systematic explorers, in a similar way as in Dalgarno et al. (2014). Systematic participants were defined as exploring the simulation by changing the value of only one parameter between each simulation run, on four or more occasions. This threshold was chosen according to Dalgarno et al.’s study, in which it was stated that the value of four could be considered as the minimum number of systematic iterations needed to learn key concepts of this learning material. In contrast, all other participants are classified as non-systematic explorers. According to this classification scheme, the sample of the study is composed of 20 systematic and 9 non-systematic explorers.

Number of simulation runs
During the learning task, participants were able to stop the discovery activity with the simulator at any time, which is as soon as they thought to have sufficiently understood the learning material. The total number of simulation runs before stopping varied from 5 to 26 runs (M = 11.6, SD = 5.72). There was an observable difference in the number of simulation runs performed between the groups. As illustrated in Figure 2, the participants from the non-systematic group ran on average a smaller number of simulation cycles (M = 6.11, SD = 0.6) than participants from the systematic group (M = 14.1, SD = 5.23). A Mann-Whitney test showed that this difference was statistically significant (U = 9, p = .0001), producing an effect size of r = 0.9 (Wendt, 1972).

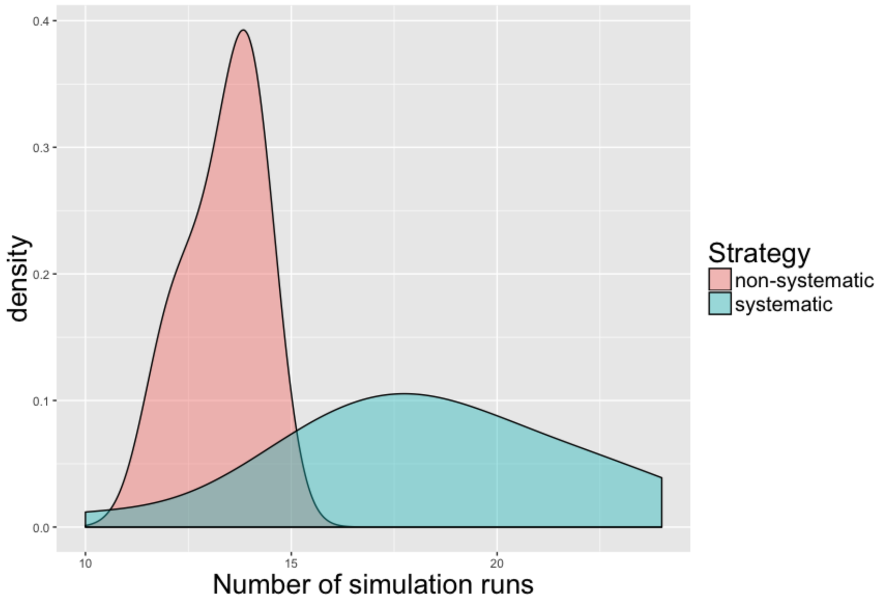

Figure 2: Estimated density of the number of simulation runs, according to the exploration strategy

Time spent on each simulation run

As well as for the number of simulation runs, participants were free to spend as much time they wanted in working on each of the runs. Despite the participants belonging to the systematic group performed more numerous simulation cycles, the time they spent on each cycle (M = 59300 ms, SD = 36600) was not significantly different from the time spent by the participants of the non-systematic group (M = 62100 ms, SD = 32800), U = 4511, p = .4. The distribution of the amount of time spent per simulation run according to the exploration strategy is presented in Figure 3.

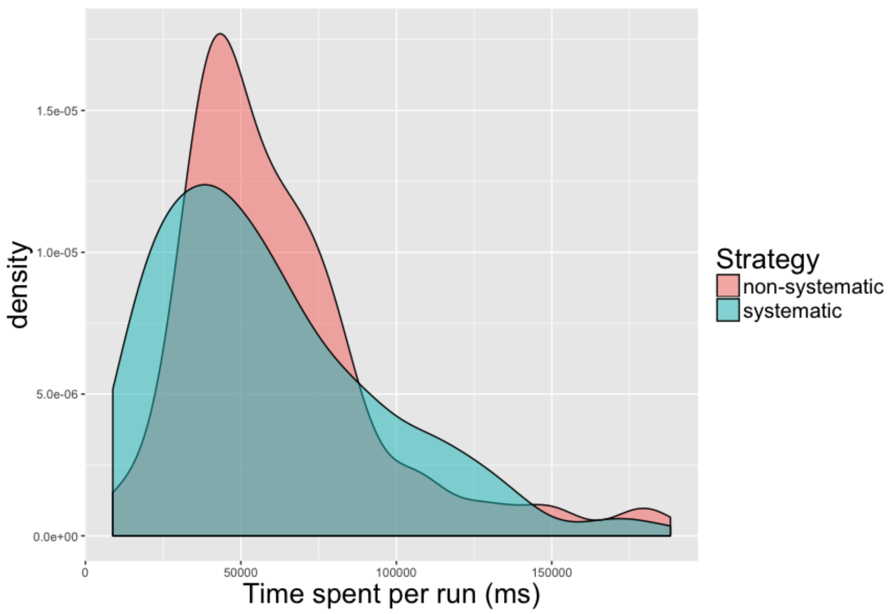

Figure 3: Estimated density of time spent in each simulation run, according to the exploration strategy

Visual exploration of the learning environment

During the entire learning task with the simulator, an eye tracker recorded the gaze trajectories and fixations from participants. However, analyses of data did not reveal any differences between the systematic and the non-systematic groups for visual exploration patterns. Figure 4 shows a representation of the simulator interface with additional layers depicting in different colours the areas of interest used for analysis and an example of heat map representation of additive gaze fixations on several locations of the screen. Red coloured areas represent zones of the screen with a higher number of fixations and denote locations attracting high levels of visual attention or a cognitive processing.

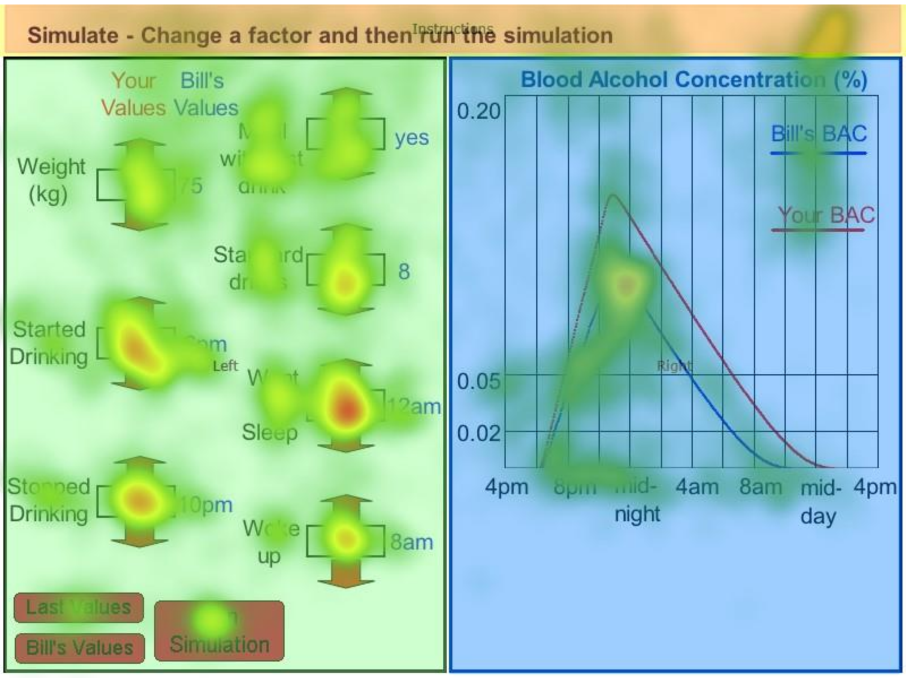

Figure 4: Visualisation of the simulation interface with heat map representation of gaze fixations

Responses to the questionnaires

General motivation and study habits questionnaire

No significant differences were observed between the groups of participants for any of the dimensions of the general motivation and study habits questionnaire. An explanation of the absence of differences here might be found in the nature of the items. Indeed, most of the questions asked of participants were quite general, addressing their course level learning experience rather than the task level learning experience that participants were subjected to in the study. Because the sample was composed of homogeneous participants, all being undergraduate university students, it is not surprising that only non-significant differences are observed regarding the responses given to generic questions about motivation and study habits.

Learning performances

According to the knowledge scores produced at pre- and post-test, all participants performed better after the completion of the simulation, Wilks' $\lambda = .57$; $F(1,27) = 20.48$, $p < .001$. But, there was no significant difference between the learning performance gains of systematic and non-systematic groups, Wilks' $\lambda = .99$; $F(1,27) < 1$. Consequently, we are not able to observe any significant differences of learning performances according to the exploration strategies used by participants.

Questionnaires about the session

Measures of emotions did not reveal significant differences between the systematic and the non-systematic groups either, except for the rating of Frustration. Participants from the systematic group agreed significantly more with the statement "I found this activity frustrating" ($M = 2.30$, $SD = 1.49$) than participants from the non-systematic group did ($M = 1.33$, $SD = 1.00$), t (22.5) = 2.05, $p = .05$ (adjusted test for not equal variances).

Self-reported scores of Challenge and Confidence

After having completed each run on the simulator, participants were asked to report on paper-based scales (from 0 to 10) as for how confident they were feeling regarding the understanding of the material (Confidence score) and how challenging they thought the material was (Challenge score). A previous study based on the same learning material found that the ratings of these scales were negatively correlated with each other (Lodge & Kennedy, 2015). A similar pattern has been also observed in our study (see Figure 5).

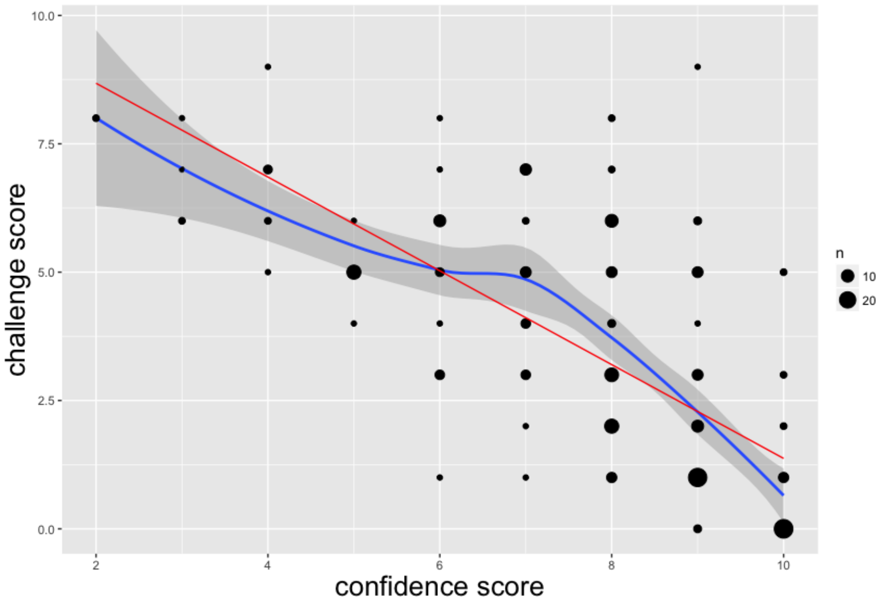

Figure 5: Relationship between Challenge scores and Confidence scores (for all participants and all simulation runs)

The observation of the relationship between scores for Confidence and for Challenge shows a significant negative correlation, $r(235) = -0.68$, $p < .001$. This result provides evidence that these two dimensions are perceived as having an opposite meaning from the participant point of view.

Because participants were able to stop the learning task as soon as they believed having sufficiently learned from the simulation, only the first 5 runs of simulation were common for all the participants. For this reason, to examine differences of rating between the groups, only the first 5 runs were considered, as shown in Figure 6.

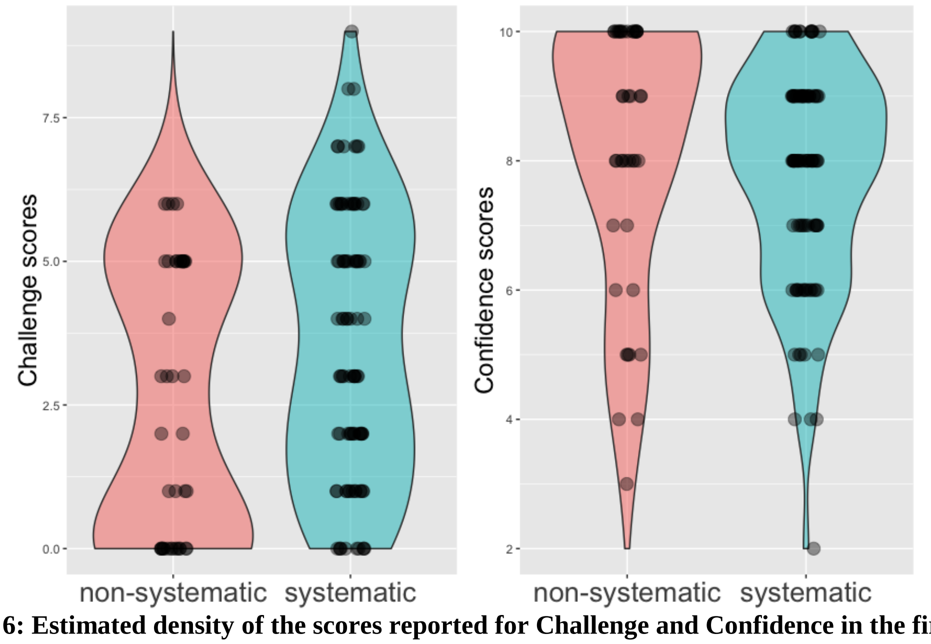

Figure 6: Estimated density of the scores reported for Challenge and Confidence in the first five simulation runs, according to the exploration strategy

The analysis of results permitted to observe a significant difference of ratings between the groups. Indeed, a Mann-Whitney test indicated that learners who had adopted a systematic strategy for exploring the simulation reported significantly higher Challenge scores ($M = 3.54$, $SD = 2.34$) than non-systematic participants ($M = 2.57$, $SD = 2.37$), $U = 1489$, $p = .02$, although the effect size can be qualified as small ($r = 0.24$). In the same way, systematic learners also reported lower Confidence scores ($M = 7.73$, $SD = 1.68$) than non-systematic learners ($M = 8.17$, $SD = 2.05$), $U = 2368$, $p = .05$ with a small effect size ($r = 0.19$).

Discussion

In our study, the strategies that participants used for interacting with the simulation had not produced any observable effects on learning performances or on visual exploration patterns. However, the participants who chose to explore the simulation in a systematic way, by manipulating a limited number of parameters before they ran the simulation, required a significantly larger number of simulation cycles than participants who used the non-systematic strategy. This result is understandable because seven parameters were included in the simulation interface and the systematic participants were determined in this study by their tendency to manipulate only one parameter at each cycle of simulation. Consequently, in order to explore the majority of these parameters, systematic participants may have required a larger number of runs than non-systematic participants, who were testing the effects of several parameters simultaneously. Alternatively, learners who are higher in confidence adopt a non-systematic approach, which suggests that they could be overestimating their level of understanding and conduct less simulation runs due to overconfidence.

Surprisingly, despite of a larger number of parameters manipulated, the time spent on average in each simulation cycle was not statistically different according to the strategy used. It was expected that learners from the non-systematic group spent more time in each cycle since they were modifying several parameters, but also needed to understand the outcome of the simulation in relation to the effects of the manipulated variables. This situation was expected to be more difficult than understanding of the effect of a single variable on the blood alcohol concentration curves; hence it should have taken more time for processing the information. However, despite the supposedly greater difficulty of learning the material with a non-systematic strategy for exploring the simulation, no difference in terms of learning performance was observed in the study between the groups. Again, this suggests that participants in the non-systematic group may have been overconfident and were therefore only processing the task at a surface level rather than more slowly and methodologically as those in the systematic group did. Either way, this study failed to replicate the results of the initial study using the same learning material, which had provided evidence of the benefits in terms of learning performances of using a systematic exploration strategy (Dalgarno et al., 2014). However, our study provides an additional result with the observation of some relations between the exploration strategy and the learners' confidence or overconfidence.

Future directions

This study provides insightful results regarding the links existing between levels of confidence, feeling of challenge, and the type of self-exploration strategy used during a learning task consisting of the interaction with a simulation. Future research will be useful to determine the existence of a directional effect between these factors. As with any research, the present study presents some limitations, such as the small sample size and unbalanced group sizes, which is justified due to its exploratory design.

To know if the choice of a strategy depends on how confident a learner feels regarding a task, or alternatively if the use of a specific strategy influences the way learners rate their feelings, a randomised controlled methodology would be needed. It is also possible that the individual differences of personality of participants may be a determining factor. For example, cautious learners might present a general tendency to use a systematic approach in exploring the simulation and also rate somewhat low their level of confidence, whereas more adventuresome learners would be quite overconfident, adopting a non-systematic exploration strategy. The latter case might also be related to an *illusion of understanding* experienced by some learners with a low prior-knowledge of the domain (Pachman, Arguel, & Lockyer, 2015). A frequent occurrence of an illusion of understanding in multimedia learning environments makes this explanation quite plausible (Paik & Schraw, 2013). Nevertheless, this would not completely explain the underlying mechanisms that can lead to benefits in learning performances. It is likely that more than one factor has an impact on the learning gains of the participants.

In Dalgarno et al.'s study (2014), participants had the possibility to explore the simulation in a systematic or a non-systematic manner, but they also had the opportunity to continue working on the learning task as long as they needed before feeling sufficiently confident about the topic learned. For this reason, it is possible that participants who were particularly confident believed to have sufficiently understood the material earlier than less confident participants, and did consequently run a smaller number of simulation cycles. If, like in our study, the amounts of time spent on each simulation cycle were similar for all the participants, it is also plausible that the total exposure time to the learning material would be different among learners. Since the most confident participants would have adopted a non-systematic approach, spending less overall time learning the material, they eventually produced lower learning gains than the less confident participants, which would have invested more time on the learning task. Nevertheless, neither the number of simulation cycles used nor the time spent on each of them was controlled for the exploration learning condition in the Dalgarno et al.'s study, hence the explanation provided here remains purely speculative. It however illustrates the complexity of drawing an algorithm of learning performances when inputs such as differentials between learners' behaviours, self-judgements of learning and feelings are involved.

To conclude, the approach consisting of including learners' individualities on their experience of feelings such as confidence and challenge, is a promising approach to improve the design of discovery-based digital learning environments. According to the results observed in our study, it is likely that the level of confidence and the self-discovery strategies are indeed linked. These strategies were operationalized in our study by a logical distinction we made between systematic and non-systematic learners. This distinction was certainly not the only one we could have chosen to differentiate different types of self-discovery strategies. Each learning situation, for which a specific instructional content is delivered in an environment, possesses its own specificities that educators may need to consider for improving learning outcomes. The present study provides a useful clue by pointing toward the direction of a relationship between emotions and self-discovery strategies captured by individual interaction patterns with the digital learning environment. Of course, knowledge about this effect is emergent and it needs to be developed with more studies and also from the experience of educators in their practice of teaching.

Acknowledgments

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References

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology*, *80*(3), 260.

Arguel, A., & Lane, R. (2015). Fostering deep understanding in geography by inducing and managing confusion: an online learning approach. In *Globally connected, digitally enabled. Proceedings ascilite 2015* (pp. 22–26). Perth.

Arguel, A., Lockyer, L., Lipp, O., Lodge, J. M., & Kennedy, G. (in press). Inside Out: Detecting Learners' Confusion to Improve Interactive Digital Learning Environments. *Journal of Educational Computing Research*.

Bakharia, A., Corrin, L., de Barba, P., Kennedy, G., Gašević, D., Mulder, R., … Lockyer, L. (2016). A conceptual framework linking learning design with learning analytics. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 329–338). ACM.

Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*, *31*, 21–32.

Dalgarno, B., Kennedy, G., & Bennett, S. (2014). The impact of students' exploration strategies on discovery learning using computer-based simulations. *Educational Media International*, *51*(4), 310–329.

De Barba, P. G., Kennedy, G. E., & Ainley, M. D. (2016). The role of students' motivation and participation in predicting performance in a MOOC. *Journal of Computer Assisted Learning*, *32*(3), 218–231.

De Jong, T., & Van Joolingen, W. R. (1998). Scientific discovery learning with computer simulations of conceptual domains. *Review of Educational Research*, *68*(2), 179–201.

D'Mello, S., & Graesser, A. (2014). Confusion and its dynamics during device comprehension with breakdown scenarios. *Acta Psychologica*, *151*, 106–116. http://doi.org/10.1016/J.Actpsy.2014.06.005

D'Mello, S., Lehman, B., Pekrun, R., & Graesser, A. (2014). Confusion can be beneficial for learning. *Learning and Instruction*, *29*, 153–170. http://doi.org/10.1016/j.learninstruc.2012.05.003

Elliot, A. J., & McGregor, H. A. (2001). A 2x2 achievement goal framework. *Journal of Personality and Social Psychology*, *80*(3), 501.

Graesser, A. C., McNamara, D. S., & VanLehn, K. (2005). Scaffolding deep comprehension strategies through Point&Query, AutoTutor, and iSTART. *Educational Psychologist*, *40*(4), 225–234.

Hattie, J., & Yates, G. C. (2013). *Visible learning and the science of how we learn*. New York: Routledge.

Hulleman, C. S. (2007). *The Role of Utility Value in the Development of Interest and Achievement.* (Unpublised doctoral dissertation). University of Wisconsin, Madison, WI.

Kennedy, G., Ioannou, I., Zhou, Y., Bailey, J., & O'Leary, S. (2013). Mining interactions in immersive learning environments for real-time student feedback. *Australasian Journal of Educational Technology*, *29*(2), 172–183.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching. *Educational Psychologist*, *41*(2), 75–86.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: how difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, *77*(6), 1121.

Lodge, J. M., & Kennedy, G. (2015). Prior knowledge, confidence and understanding in interactive tutorials and simulations. In *Globally connected, digitally enabled. Proceedings ascilite 2015* (pp. 190–201). Perth.
Pachman, M., Arguel, A., & Lockyer, L. (2015). Learners' confusion: faulty prior knowledge or a metacognitive monitoring error? In *Globally connected, digitally enabled. Proceedings ascilite 2015* (pp. 522–526). Perth.
Pachman, M., Arguel, A., Lockyer, L., Kennedy, G., & Lodge, J. M. (in press). Eye tracking and early detection of confusion in digital learning environments: proof of concept. *Australasian Journal of Educational Technology*.
Paik, E. S., & Schraw, G. (2013). Learning with animation and illusions of understanding. *Journal of Educational Psychology*, *105*(2), 278.
Pekrun, R., & Linnenbrink-Garcia, L. (2014). *International handbook of emotions in education*. New York: Routledge.
Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33.
Soderstrom, N. C., & Bjork, R. A. (2015). Learning versus performance an integrative review. *Perspectives on Psychological Science*, *10*(2), 176–199.
Van Gog, T. (2007). Data collection and Analysis. In *Handbook of Research on Educational Communications and Technology 3e* (pp. 763–806). New York: Lawrence Erlbaum.
Wendt, H. W. (1972). Dealing with a common problem in social science: A simplified rank-biserial coefficient of correlation based on the statistic. *European Journal of Social Psychology*. Retrieved from http://psycnet.apa.org/psycinfo/1973-26060-001
Wigfield, A., Hoa, L. W., & Klauda, S. L. (2008). The role of achievement values in the regulation of achievement behaviors. *Motivation and Self-Regulated Learning: Theory, Research, and Applications*, 169–195.

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Using a Video-Based Critique Process to Support Studio Pedagogies in Distance Education – A Tool and Pilot Study

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Studio courses have become a key way in which professional skills, especially those involving collaboration and design, are taught in many fields, including computer science. Studios typically involve students working on a design problem, periodically presenting their work for critique, and critiquing the work of other students or groups. They support productive inquiry, as well as teamwork, communication, and reflection. However, although studios have become an important mode of instruction for on-campus students, they have not typically been offered for online or distance education students. In this paper we describe a studio critique process that is designed to work asynchronously, using short videos, and a tool that we have built to support it. We also describe qualitative observations from a pilot study, in which video-based critiques were used at a university whose students predominantly study online rather than on-campus.

Keywords: Online education, studio pedagogies, video-based assessment.

Studio Pedagogies

The design studio has grown to become a key teaching methodology in several fields (Levy, 1980; Schön, 1987; Kuhn, 2001; Long, 2012; Bull *et al.*, 2013). Though design studios have existed as a teaching mechanism for many centuries, most modern studio pedagogies stem from a historic understanding of practices in architecture education. In a typical architecture design studio, students are given realistic multi-faceted design problems, and a learning space that is shared with other students working on other design problems. Work in the studio is seen as cumulative, with frequent critiques during the course of a project through “pin ups”, where work is pinned to the wall for the class collectively to critique, and desk critiques between the instructor and participants. By the 1980s, the design studio dominated architecture education (Dutton, 1987). Levy (1980) observed that the curriculum is centred around synthesis, through the studio as the environment in which all aspects of architectural skills can be learned and practiced together, and that the design goal motivates students to learn the material they need to know in order to complete the design. Schön (1983, 1987) described the studio as a means for developing reflective practitioners, who through a cycle of observing and refining practice, can address the “messy, confusing” problems that are of greatest human concern. He particularly linked the studio pedagogies to Dewey’s theories of productive inquiry (1938). Studio pedagogies are also supported by theories of experiential learning (Kolb, 1984), and more recently, researchers have sought to refine the theories behind reflection (van Manen, 1995; Bleakley, 1999; Leitch & Day, 2000).

Computer science has been an enthusiastic adopter of studio pedagogies. Computing was quick to recognise the importance of collaborative design and reflective practice to the discipline (Brooks, 1987). There is widespread recognition that computing is a design discipline, as well as a science and engineering practice. Before deciding how to build it, software professionals must first decide what to build. For many software projects, this is known to be what Rittel termed a "wicked problem" (Rittel & Webber, 1973) – a question that is inherently ambiguous, cannot be solved analytically, and can only be understood by proposing solutions. This is a similar concept to Dewey's "problematic situations" (1938) that Schön drew on when analysing architecture studios. From the 1990s, computer science sought to adopt studio teaching (Tomayko, 1996; Docherty et al, 2001; Kuhn, 2001; Hazzan, 2002). As on-campus studio courses in computing proliferated, academics adapted the pedagogies to fit the needs of the field, and there are now many variations (Hundhausen et al, 2008; Hendrix et al, 2010; Carter & Hundhausen, 2011; Nurkkala & Brandle, 2011; Billingsley & Steel, 2013; Bull & Whittle, 2014; Reardon & Tangney, 2015). Australia has been at the forefront of this, and studio courses and collaboration are now embedded in many Australian universities' on-campus computing and design degrees.

The Need for Asynchronous Critiques

Studio collaboration is, however, difficult to achieve for distance education classes. At our university, most of our computer science students are studying by distance, and many would not be able to attend a synchronous virtual class at the same time as their peers. On-campus courses with large cohorts have also reported difficulty scheduling enough time in the class for every group to present its work for critique (Matthews, 2013). There is therefore a need for asynchronous techniques that can enable remote students to fully participate in studio teaching. Particularly, we need asynchronous techniques to support the studio critique process that binds the class together.

Until now, there have been limited attempts to support asynchronous critiques in studio courses. These include two approaches that ask for text critiques of in-person or video presentations (Billingsley & Steel, 2014; Matthews, 2013). Though both were designed with online teaching in mind, they were implemented in on-campus courses only. The situation of a student in a large on-campus cohort, who meets many students but cannot engage with all students, is significantly different to that of a distance education student, who does not physically meet any other student in the course. With online learners, the MOOC provider NovoEd (Ronaghi *et al*, 2015) uses asynchronous critique-style feedback in some courses, but again only using text critiques, and outside of formal higher education. Saghafi *et al* (2012) experimented using text methods such as Wikis and Facebook comments for critiques in a virtual studio, but found that some students felt isolated using this method.

Asynchronous Critiques via Video

We are exploring the merits of students critiquing each other's work asynchronously via video, to enhance studio collaboration amongst distance education learners. This will allow students to present critiques more richly, for instance, including demonstrations of an issue, presenting sketches of an alternate solution, or enabling deixis by pointing at aspects of the design under critique.

Our project is not simply undertaken out of research interest, but also out of functional necessity. Our university has a computer science degree, where part of our professional accreditation depends on the teaching of collaborative, design, teamwork, and communication skills. We have chosen to do this through the incorporation of design studio units within the degree, and as the majority of our students are online rather than on-campus, we have a particular need to establish studio pedagogies that work online.

However, as studio pedagogies are not specific to computer science, having been inspired by architecture education, we are also interested in exploring the student experience of using asynchronous video for critiques outside the computer science studio units.

A Tool for Managing Video-Based Critiques: Assessory

We have developed an open source tool, Assessory[1], for managing a three-stage critique process:

1. Students (or groups) record and upload a video presentation of their design work. This is normally fewer than seven minutes in length, and may involve talking through design sketches.
2. Each student in the class is randomly allocated a number of videos to critique (normally three). For each video, they record a short critique video in reply, usually of less than three minutes in length.
3. The students (or groups) who recorded the original video presentations are then invited to watch the critiques of their work, and rate the critiques against a short form (normally, whether they were constructive, helpful, specific, and actionable)

This process is adapted from an earlier critique process for on-campus courses, that used in-person presentations and text-based critiques (Billingsley & Steel, 2014). Each step of the critique process is set up as a separate configurable task, so that other courses can use altered or shortened versions of the process.

In the initial version, as we test the concept, the video files themselves are uploaded to YouTube. This delegates the format conversion to a well-established existing service, and most students' devices (for example their mobile phones) already contain functionality for sharing a video to YouTube. In future versions, we will expand this to support different video upload services, including university-hosted ones. As shown in Figure 1, the student then pastes the video link into our tool, Assessory, which manages which students are allocated to critique or respond to which videos. As YouTube videos can be set to be "unlisted" (viewable only by users who have the link), Assessory can show the video to the students allocated to critique it, without the video being discoverable by the general public.

In stage 2, the videos selected for critique are the currently least-critiqued videos that have been received. This is an adaptation we had to make to the on-campus process. On campus, students would critique a selection of live presentations in a scheduled class. As students needed to know which presentations they particularly needed to pay attention for, the presentations to critique were pre-allocated by an algorithm in advance of the class. For the online process however, videos are submitted by students at unknown times, and there is no guarantee that all the videos will have been uploaded before the due date. The videos to critique therefore have to be allocated dynamically, so that an on-time critic is not delayed by a late presenter. By using a "least critiqued" rather than random algorithm, late uploaders can expect to receive some critiques although the pool of available critics will be smaller as some will already have completed their allocation.

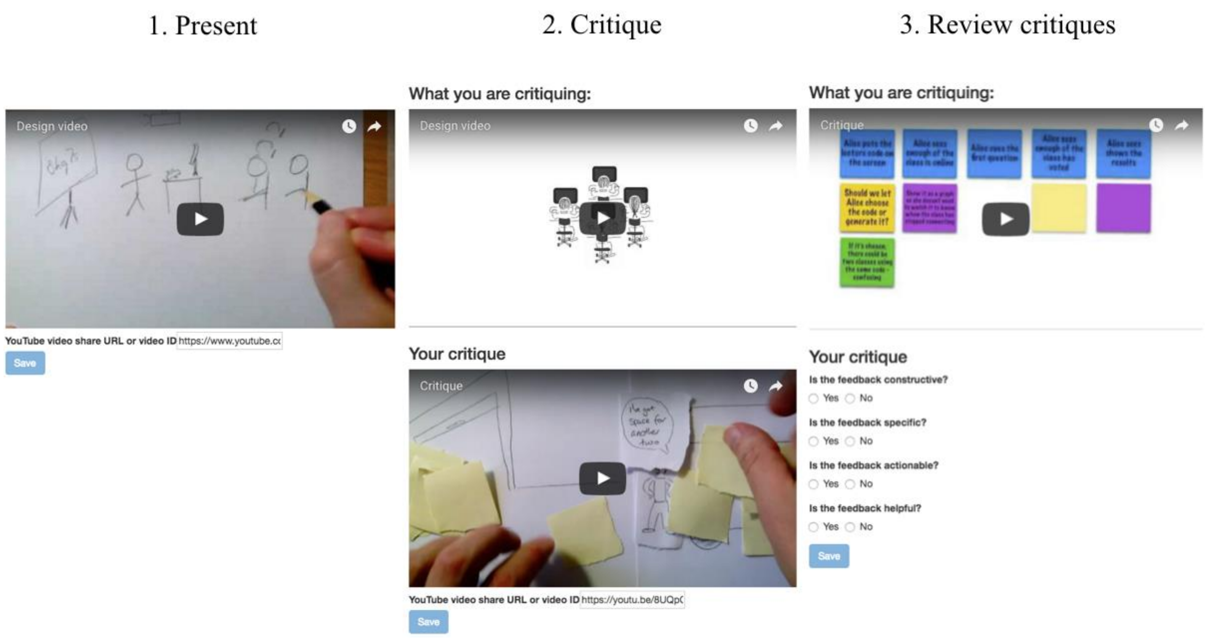

Figure 1: Assessory supports a three-stage critique process. First, students present their work via video. Then they produce videos critiquing the work of others. Then they review critiques of their work. For privacy reasons, the videos in the above illustration have been replaced.

[1] Project homepage http://assessory.org with source-code available from https://github.com/assessory/assessory.

A Small Pilot Study

In a pilot study in early 2016, we ran critique tasks in one unit in computer science and two units in education, taught by members of the research team. The task in each unit was designed by the unit coordinator, rather than deploying a standard task. We regarded this adaptation process as an important part of the pilot. In practice, teachers can be expected to tailor pedagogies to their classes, so we wanted to be able to reflect on the changes that different members of the team would make for their own classes. The results of our study are qualitative, and with only three teaching units, each with relatively small cohorts, we do not claim our results to be representative of broader education. Rather, they give us insights into the issues that can arise depending on the context of the class, and the variation in how students go about producing their videos and critiques.

Table 1: Pilot Study Unit summary

Unit	Topic	Presentations	Critiques	Other
A	Interaction design	14 videos	39 videos	11 demo videos
B	Learning theory	Lecturer-provided videos	15 videos, 4 audio	
C	Mathematics pedagogy	12 videos	25 text	

In Unit A, taught by the tool's author, the three-stage critique process was used, with students uploading the videos to YouTube and pasting the link into Assessory to manage the critique process as described above. This was an interaction design unit, in which eighteen students worked individually to develop smartphone apps. The three-stage critique process was used to ask students to critique each other's design work mid-way through the term, with an additional video demonstration of the student's finished product included at the end of term.

Each of the education units used an altered version of the process. Neither education coordinator wanted to use YouTube for submissions, instead preferring students to upload either to the university's Learning Management System (LMS), or to a special upload form if the video was larger than the LMS would accept. Videos were then manually reformatted and moved as necessary by the research team, rather than using our open source tool. In unit B, the coordinator preferred students not to see each other's work, and so tasked students with recording critiques for initial videos he provided (only using step 2 of the process). In Unit C, students did critique each other's work, and steps 1 and 2 were used.

Video strategies

When we proposed using video for critiques, one of our initial motivations was to enable deixis – being able to point at something on paper and say "this". In practice, especially in Unit A, we have found that there is a very large variety to the strategies students use to present not just their designs but also their critiques. Among the design videos, there were animations, recorded digital presentations, recorded on-paper presentations (using coloured notes instead of slides), screen-recordings panning through documents, and recordings of talking though paper design sketches and mock ups. In the critique videos, one student put images of design sketches onto a phone so they could swipe through them (recorded from another phone); another student screen-recorded the playback of the design video so they could scrub through the video and give a running commentary at key moments; yet another student sketched a key interface from the design video and used tangible items (coloured disks) to represent controls so they could illustrate an alternative design they wanted to suggest.

In unit B, some students expressed concern about physically appearing in a video. 4 students chose to upload audio critiques instead of video, and one initially uploaded text. These concerns were less prominent in unit C (though some confusion around the assignment instructions led to the critique stage being submitted as text) and did not occur at all in unit A. None of the units required students to physically appear in the video, but for Units A and C, the task design already made it more natural to place the work being described on-camera, rather than the student's face.

A secondary aspect is that we had speculated that the need to produce video could itself be a deterrent against students outsourcing their work, as the student's voice would need to be present. This appears not to be the case. While we did not find any evidence of outsourcing in the study, there were presentation videos that filmed a design artefact and superimposed text, rather than including a voice that would identify the student.

Technical aspects

Though it was not raised as a concern by students, a particular issue about how to handle late uploads became apparent in the three-stage process in Unit A. When students were late uploading to stage 1, it was possible to mitigate this by using a “least-critiqued” selection algorithm for stage 2. However, the same is not true for late uploads to stage 2. Each critique is addressed to a particular student, who we would like to review that critique. For online students, who do not review their critiques in a scheduled class, we therefore need to introduce a notification mechanism so that students can be informed when a new critique has arrived.

While we had wondered whether some students would object to being asked to upload their videos to YouTube, in practice none did. This was generally the smoothest process. One end-of-term demo video was accidentally set to *private* instead of *unlisted*, making it temporarily unviewable from within Assessory, but this did not interrupt a critique process. In units B and C, using a file upload process, there were significant issues with the size of the videos. As we did not know what device students would use to create the videos, we could not provide a specific compression and upload app. There were many cases of uploads taking long enough that students thought they had failed, and one where a student was unsure how to transfer the file from their phone to their laptop, let alone compress or upload it.

However, while using YouTube for upload provides the most convenience for students, in order to preserve student submissions after the due date, it becomes necessary to download the student videos. This is possible, and can be automated, but at the time of writing is not normally supported by YouTube’s terms of service.

Conclusion

Critique processes can play a significant role in supporting reflective practice. They engage students not only in the skills required to produce their designs but also in the professional communication skills needed to articulate their designs. They give students the opportunity to learn from each other’s problems and solutions as well as their own – observing each other’s work as it is produced rather than just when it is delivered. We find that asynchronous video is a flexible and useful means for supporting this. Students apply a wide variety of techniques in the critique of each other’s work as well as the presentation of their own work.

There remains some additional work to do to improve the technical ecosystem, in order to make it a smooth experience for online students. Particularly, to ensure the system connects to widely available video upload mechanisms, including institutionally hosted ones, and provide notification mechanisms for when critiques arrive. In this manner, critique processes are more akin to a structured video messaging task than a video assignment submission task.

In future work, we also intend to investigate the student experience in greater detail, through interviews with students and analysis of the content of student design, critique, and demo videos. For example, we would like to discover how strong the connection is between the feedback students ask for in their design videos, the feedback they are given in their critique videos, and whether it is taken account of in their eventual demo videos. Since our initial pilot, we have gathered a further 26 design, 25 demo, and 125 critique videos using Assessory within teaching units in the ongoing term, with further units planned for 2017.

References

Billingsley, W., & Steel, J. (2013). A comparison of two iterations of a software studio course based on continuous integration. In *Proceedings of the 18th ACM conference on Innovation and technology in computer science education* (pp. 213-218). ACM.

Billingsley, W., & Steel, J. R. (2014). Towards a supercollaborative software engineering MOOC. In *Companion Proceedings of the 36th International Conference on Software Engineering* (pp. 283-286). ACM.

Bleakley, A. (1999). From reflective practice to holistic reflexivity. *Studies in Higher Education*, *24*(3), 315-330

Brooks, F. P. (1987). No silver bullet – essence and accident in software engineering. *IEEE Computer*, 20(4), 10-19

Bull, C. N., Whittle, J., & Cruickshank, L. (2013). Studios in software engineering education: towards an evaluable model. In *Proceedings of the 2013 International Conference on Software Engineering* (pp. 1063-1072). IEEE Press.

Carter, A. S., & Hundhausen, C. D. (2011). A review of studio-based learning in computer science. *Journal of Computing Sciences in Colleges*, *27*(1), 105-111

Dewey, J. (1938). *Experience and education*. New York: Simon and Schuster.

Docherty, M., Sutton, P., Brereton, M., & Kaplan, S. (2001). An innovative design and studio-based CS degree. *ACM SIGCSE Bulletin*, *33*(1), 233-237

Dutton, T. A. (1987). Design and studio pedagogy. *Journal of Architectural Education*, *41*(1), 16-25.

Hendrix, D., Myneni, L., Narayanan, H., & Ross, M. (2010). Implementing studio-based learning in CS2. In *Proceedings of the 41st ACM technical symposium on Computer science education* (pp. 505-509). ACM

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. New Jersey: Prentice-Hall.

Kuhn, S. (2001). Learning from the architecture studio: Implications for project-based pedagogy. *International Journal of Engineering Education*, 17(4/5), 349-352

Leitch, R. & Day, C. (2000) Action research and reflective practice: towards a holistic view, *Educational Action Research*, 8:1, 179-193

Levy, A. (1980). Total studio. *Journal of Architectural Education*, 34(2), 29-32.

Long, J. G. (2012). State of the studio – revisiting the potential of studio pedagogy in US-based planning programs. *Journal of Planning Education and Research*, 32(4), 431-448.

Matthews, B. (2013). *Evaluating vicarious critiques as a tool for open online studio-based design education*. Unpublished grant application, University of Queensland

Nurkkala, T., & Brandle, S. (2011). Software studio: teaching professional software engineering. In: *Proceedings of the 42nd ACM technical symposium on Computer science education*, 153-158

Reardon, S., & Tangney, B. (2015). Smartphones, studio-based learning, and scaffolding – helping novices learn to program. *ACM Transactions on Computing Education*, 14(4), Article 23

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155-169.

Ronaghi, F., Saberi, A., & Trumbore, A (2015). NovoEd – a social learning environment. In: Kim, P. (ed.), *Massive Open Online Courses – The MOOC Revolution*, New York, Routledge, 96-105

Saghafi, M. R., Franz, J., & Crowther, P. (2012). A holistic blended design studio model: a basis for exploring and expanding learning opportunities. In *Society for Information Technology and Teacher Education International Conference (SITE 2012)*, Austin, Texas: EdITLib

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action* (Vol. 5126). Basic books.

Schön, D. A. (1987). *Educating the reflective practitioner*. San Francisco: Jossey-Bass.

van Manen, M. (1995). On the epistemology of reflective practice, *Teachers and Teaching – theory and practice*, 1(1), 33-50

Tomayko, J. E. (1996). Carnegie Mellon's software development studio: a five year retrospective. In *Software Engineering Education, 1996. Proceedings., Ninth Conference on* (pp. 119-129). IEEE

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Preliminary exploration of student use of Blackboard Collaborate in fully online courses

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This paper explores *how* students use Blackboard Collaborate (i.e., Collaborate) in fully online courses. It is the initial collection of data for a two-phase study exploring the 'how' and 'why' of integrating technology into fully online courses from the context of Collaborate. The findings report that despite anecdotal evidence suggesting a decline in student use of Collaborate, surveys results and usage exported from Collaborate via the learning management system (LMS) validate its continued inclusion in the design of fully online courses. Student benefits included interaction/connectedness, support for course content and assessment and the tool itself. Whilst areas in need of improvement were bound to technical issues and structure including purpose of the Collaborate session. Irrespective, the results favour the inclusion of Collaborate as a learning support tool in fully online courses.

Keywords: Blackboard Collaborate, online technology, online learning, student engagement.

Introduction

Higher education institutions (HEIs) are increasingly embracing online modes of instruction. Recent reports suggest that student retention is highly correlated with innovative and engaging online activities and course design (Leeds et al., 2013). An additional complexity in the online teaching environment is the diversity of the online student population resulting in variation in motivation, engagement and learning capabilities. For example, some students are returning to university after an extended break from learning whereas others have greater university recency. As a result, some students may lack the necessary educational skills that are often mandated by education practitioners in HEIs and likewise be unfamiliar with many areas associated with online learning, such as use of technology (e.g., blackboard, online communication etc.). These factors are likely to influence an online student's educational experience and their subsequent ability to engage in all learning resources. Most importantly, challenges such as these should drive the teaching pedagogy and instructional style of online courses to ensure the incorporation of new, emerging and engaging e-learning technologies catering for a diversity of students, their prior experiences and their learning needs. Technology is increasingly being used to increase student participation, engagement in classes and student outcomes. In fact, the use of technology to deliver education is gaining increasing attention in the literature, as more wholly online courses are being delivered (e.g., Bower, Kenney, Dalgarno, Lee & Kennedy, 2014). However, this move to online education highlights some challenges that educators need to consider, including student engagement, motivation and ultimately satisfaction within the online learning environment.

Therefore, the purpose of this paper was to report on *how* students use Blackboard Collaborate (i.e., Collaborate); an online virtual classroom tool in fully online courses to overall ascertain its applicability for 'use' for online students. This study surveyed students enrolled in the Bachelor of Business Open Universities (OUA) program offered through Griffith University. All students in this program undertake it in a fully online mode of instruction and, as such, students were surveyed online.

Literature Review

Initially, literature pertaining to student engagement, motivation and satisfaction will be briefly explored. Following this, a comparative discussion of asynchronous and synchronous communication including the use of Blackboard Collaborate will be discussed.

Student engagement is a key concern for educators as it has been positively associated with motivation and educational outcomes (Northey, Bucic, Chylinski & Govind, 2015). Stott (2016) highlights the role of poor student engagement in online courses, and cites the higher drop-out rates of online courses as an indicator of this 'engagement challenge' (Martin, Spolander, Ali & Maas, 2011). Similarly, Kim and Bonk (2006) argue that students withdraw from online courses citing a desire for a '…richer and more engaging online experience'. While it is highly sought after, Kahu (2013) acknowledges that this is often elusive due to the many situational and motivational factors which affect it. In particular, a meta-analysis by Lee and Choi (2011) found that environmental factors which posed a barrier to student engagement were availability of financial and social support from family and friends. In addition, work has been found to be a significant barrier for students engaging more in their online studies (Davis, Hodgson & Macaualy, 2012). In support, Stott (2016) found that lack of experience with online learning and other work commitments contributed to poor student engagement.

Another concern for educators is students' motivation to engage in the learning experience. Motivated and self-regulated learners are more likely to be successful in online learning environments, which are categorised by autonomous offerings (Azevedo, 2005; Dabbagh & Kitsantas, 2004). Students come to online courses with different levels of online experience and exhibit different levels of motivation and self-regulation while learning online. Therefore, it may be necessary to adjust the amount of structure, support, and scaffolding provided during online instruction. Artino and Stephens (2009) recommend developing self-efficacy among students in online settings as a way to increase such motivation.

Further, student satisfaction as a penultimate measure has been shown to be significantly different with online courses, when compared to traditional face to face delivered courses. Adam and Nel (2009) investigated the antecedents and consequences of blended learning and found that students' satisfaction with wholly online courses was lower than that of face to face and blended courses. Palmer and Holt (2009) found that provision of online support impacted student satisfaction with the online learning experience, whether directly or indirectly related to the actual course itself i.e., general support offered to students enrolled in an online program versus an independent course. Additionally, social presence as a positive indicator has been identified as improving student satisfaction with online learning and performance outcomes (Yamada, 2009).

Not uncommon, students enrolled in distance education have tended to be supported by asynchronised communication, learning activities and resources (e.g., pre-recorded lectures content, discussion boards, digitised readings, pre-set activities etc.) (Bower et al., 2014). Although, asynchronous communication has been found to support student educational outcomes by encouraging critical thinking and deep learning (e.g., Bonk & King, 1998), debate surrounding delayed feedback has commonly been identified as a limitation. Therefore, asynchronous learning methods may not be suitable to meet all students' needs and outcomes. Synchronous discussion, communication and interaction has been shown to facilitate student learning (e.g., Svensson & Forssell Eriksson, 2014) by enabling students to develop working relationships in a 'real time' setting and overcomes the issues often pronounced by asynchronous learning i.e., providing an avenue for immediate feedback (Hines & Pearl, 2004). As such, instructors should consider these issues when making pedagogical decisions on student experience (Artino & Stephens, 2009).

One pedagogical strategy to improve student engagement, motivation and ultimately satisfaction is to introduce more methods for student-staff interaction into a wholly online course. One way to facilitate this interaction and imitate a traditional classroom setting is through the use of synchronous communication tools in virtual classrooms. Blackboard Collaborate is a tool to allow live interaction between instructors and students. Each learning experience on this learning platform allows three way interactivity (between multiple students and the instructor) and is not homogenous. An immediate and positive outcome of integrating Collaborate sessions into a course is that students are given the opportunity to converse, engage and interact synchronously with their instructor and peers. The resulting student experience enables the instructor and students to engage in a similar learning platform to that experienced by face to face students and be part of a virtual learning community. This student centered learning ecosystem thereby creates extra opportunities for students to engage with the course, their instructor and peers.

Recent anecdotal evidence shows that attendance rates at Collaborate sessions have been in decline (i.e., over the previous year) in courses offered through the Bachelor of Business via Open Universities Australia (OUA) at Griffith University. Nonetheless this is juxtapositioned by the consistent student evaluations which show that students particularly enjoy the live Collaborate sessions offered through the online program. Although Blackboard Collaborate has been previously explored within the literature, commonly it has been done so from the perspective of what tools are more effective for online 'real time' collaboration (e.g., Wiki's, Blackboard Collaborate, social media, blogs etc.) (e.g., Bower, Kennedy, Dalgarno, Lee, Kennedy & de Barba, 2012; Hamid, Waycott, Kurnia & Chang, 2015), a comparative examination of the simultaneous integration of synchronous and asynchronous learning tools in a course (e.g., Yamagata, 2014) or use of Blackboard Collaborate through the instructors experience (e.g., Xiaoxia & E-Ling, 2012). This study attempts to provide a holistic and practical understanding of the student experience using Collaborate as a support tool for online learning across an undergraduate fully online business program. Therefore, broadly, the purpose of this study is to examine student *use* regarding their experience with Blackboard Collaborate sessions. Of particular interest to the researchers is;

- how often do students access the 'live' sessions of Collaborate,
- how do students prefer to access and participate in collaborate sessions,
- factors preventing students from attending/participating in the sessions,
- beneficial outcomes and improvements required of the collaborate sessions and;
- what was their experience with blackboard collaborate sessions.

Overall the findings will enable a greater understanding of how students use this type of resource and its perceived value for student learning.

Research Design and Sample

As stated, the aim of this study was to gauge an understanding of student *use* of Blackboard Collaborate. This study was based on the development and administration of an online survey. Online surveys are particularly useful when participants reside in geographically dispersed regions which is reflective of the Bachelor of Business OUA program, are less expensive and typically generate higher response rates (Malhotra, Hall, Shaw & Oppenheim, 2008). Specifically, students were asked to report on their (1) frequency of attendance and reasoning for non-attendance, 2) access, (3) frequency of downloading sessions and (4) session schedules. Further, a content analysis was completed on three open-ended questions which enabled students to provide additional feedback on the benefits and possible improvements to the Collaborate sessions, in addition to a general question asking for further information regarding their experiences with Blackboard Collaborate. To validate the use of Collaborate sessions in fully online courses, usage data was exported from Collaborate via the LMS through a data dump. The purpose of this was to enable a comparative analysis of student experience (based on their responses to survey questions) and statistical data derived from the actual LMS for which Blackboard Collaborate is operationalised.

Sample selection was purposive and, subsequently, only those students enrolled in a fully online course offered through Griffith University's Bachelor of Business program by means of Open Universities Australia (OUA) were analysed. The use of students enrolled in a Griffith University course offered through the Bachelor of Business OUA was deemed appropriate for analysis so as to reduce the extraneous variation and ensure pertinent respondents were used in the collation of data (Eisenhardt, 1989). Fifteen of thirty courses in the Bachelor of Business OUA actively use Blackboard Collaborate across four majors (i.e., marketing, management, human resource management and International hotel management). On average a course ran six collaborate sessions per teaching period (i.e. 13 weeks duration) with first year introductory courses holding 10> sessions and second/third year courses, 3-6 sessions.

Students enrolled in the first teaching period of the 2016 calendar year were sampled. Acknowledging that students may be undertaking several courses during a teaching period, students were asked to choose one course they were enrolled in to respond to the questions asked in the survey i.e., in reference to Blackboard Collaborate. The survey was open for four weeks for which a follow-up email was sent after two weeks to encourage participation. In total, 2361 students were sent the survey, of which, 301 surveys were completed, yielding a 12.7 percent response rate. Demographically, 67 percent of the cohort were females and 33 percent males, with most students aged within the 26-35 year age bracket (refer to Figure 1). Predominately, most students only studied one course (i.e., 50 percent), 39 percent, two courses, 4 percent three to four courses and 3 percent more than four courses.

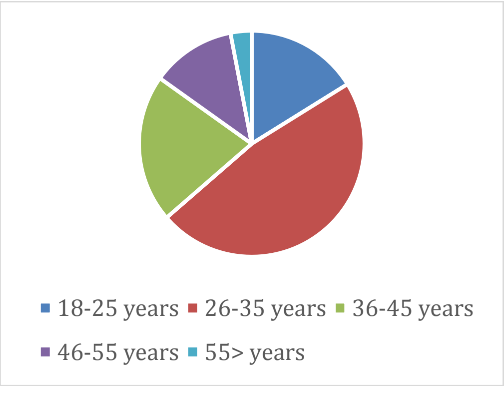

Figure 1: Age distribution of Student sample

Preliminary Findings

Students were initially asked how often they attended a Collaborate session during a teaching period on a four-point scale ranging from all sessions, most sessions (>5), some sessions (1-4 sessions) to no sessions. Across the four options provided, 75 percent of students attended collaborate sessions (i.e., 25 percent all sessions, 23 percent most sessions and 27 percent some sessions). The remaining 26 percent reflected non-attendance at any Collaborate session. Most students reported that they downloaded the Collaborate session recording (i.e., 51 percent), with 33 percent stating access occurred via a mix of live and downloaded recordings and 16 percent stated they attended live. In line with attendance at Collaborate sessions, most students stated they downloaded the recording throughout a teaching period between one and four times, 30 percent revealed all sessions were downloaded, 20 percent, most sessions (>5) and 12 percent, stated they never downloaded a Collaborate session. To accommodate student-learning needs and allow flexibility, students were asked how often they would like Collaborate sessions to be held. Overwhelmingly, 60 percent of students stated once a week with 25 percent of students stating once every two weeks and the remaining 15 percent affirming either twice a week (i.e., 8 percent), once every three weeks (i.e., 2 percent) or the beginning, middle and end of a teaching period (5 percent).

A content analysis was completed on the final three questions which enabled students to provide feedback on the benefits, improvements and general feedback on their experiences with Blackboard Collaborate. Three key themes emerged concerning the *benefits* of Collaborate being, provides interaction and connectedness, support for course content/assessment and tool use. Table 1 provides examples of reflective comments of the three themes.

Table 1: Benefits of Collaborate sessions

Theme	Student reflective comments
Interaction and connectedness	*"It provided live chat to ask questions and discuss with others"*, *"It's like a normal classroom and you can see the interaction"*, *"Feel connected to the class"*, *"Ability to interact with class in addition to facilitator"*, *"The feeling of being a part of something and that you are not alone in your studies"* and, *"Cross pollination of ideas. More often than not, other students ask a question for something you haven't even considered yet"*.
Support course content/assessment	*"Having clear step by step instructions with explanations", "Ability to confirm your understanding of assessment", "Real examples about content" "It expanded on content from the lecture and textbooks. Was a great resource for understanding more complex issues", "Very informative and great to condense and have a clear voice explaining content"* and, *"Cover topics in more depth".*
Tool use	*"Ease of use"* and, *"That the sessions were recorded and that I could access them at a later stage"*

In terms of improvements, two key themes emerged, being, technical issues and structure including purpose of the Collaborate sessions. Table 2 provides an overview of the reflective comments from students in reference to the key themes identified.

Table 2: Improvements to Collaborate sessions

Theme	Student reflective comments
Technical issues	*"Teacher dropping out and the rest of the students unable to hear or other similar technical issues",* *"Difficult when multiple people leading the discussion as it was disjointed and talking over sometimes",* *"Sound clarity"*
Structure including purpose of the session	*"More structured and depth needed",* *"Provide etiquette guidelines for students as often irrelevant chats were going on in the session",* *"Less content in the session as it was a bit of an overload"* *"Don't just go through assessment and case studies, in some of my other courses, they covered general learning of that week which I preferred or at least taught concepts to align with assessment"* *"Use the whiteboard to engage students"*

Students were also asked to provide feedback on non-attendance at the scheduled Collaborate session. Common themes which emerged from students were timing, *"The sessions has usually started by the time I got off work – time zone differences*", interferences with work/family commitments, *"The date conflicted with work or prior commitments",* lack of sessions provided during a teaching period, *"I only had a choice of three to attend"* and value of the session, *"Some were useless as they didn't cover relevant information"* or *"very tedious and long and get off the point"*
.

Finally, in terms of the open-ended questions, students were given the opportunity to provide any further general feedback on their experiences with Collaborate in the course they had enrolled in. Typically, students reported that Collaborate is an effective tool, easy to use and provides a good overall experience with a course, much of which was reflective of the benefits of Collaborate (refer to Table 1).

One of the interesting findings of this study was the data which was exported from Collaborate via the LMS. Whilst increasingly students enrolled in a course within the Bachelor of Business OUA are unable to attend the synchronised 'live' Collaborate virtual classroom sessions, the results from the data dump indicate that a large proportion of students download the recordings after the session. Given that courses hold sessions multiple times during a teaching period (e.g., week 3, 4 etc.), Table 3 provides an overview of the course; student enrolment numbers per course, an *average* of actual attendance during the synchronised sessions (i.e., live attendance) and an *average* of comparable downloads following the session. Across the 13 courses, on average 17 students attended the 'live' sessions and downloaded the recording 42 times following a session[2].

Table 3: Overview of reported data generated from LMS on use of Collaborate.

Course	Student enrolment in course	Attendees at a 'live' Collaborate session	Downloaded recording after each session
Business Statistics	287	37	91
Employment Relations	207	17	30
Management Employee Relations	75	23	22
Human Resource Management	141	19	40
Organisational Behaviour	125	7	46

[2] Acknowledgment that number variances do exist across student cohorts. For example, although average attendance was reported at 17 for 'live' sessions, some courses had fewer than 10 students enrolled in a course. An average was deemed appropriate to provide insight into 'live' attendance across an entire program (i.e., Bachelor of Business OUA).

Training and Development	89	7	26
International Food and Beverages Management	7	4	5
Management Concepts	519	59	133
Managing People in the Global Economy	78	2	26
Intercultural Management	113	9	38
Introduction to Marketing	203	21	50
Retail Marketing	75	14	22
Digital and Social Media Marketing	129	4	31

**Note: there is a natural attrition of students in OUA courses as a proportion of students enrol purely in courses for government funding; two of the 15 courses which offer Collaborate sessions had no results from their sessions as they were structured as informal student discussion and, subsequently, not recorded. Further, results from the self-reported survey and the LMS data dump were unable to be linked to specific students i.e., Student 'A' survey results could not be linked to the LMS data of that student to validate what the student was inferring and what the data was similarly stating. The results are a holistic perspective of students and their use of Collaborate over a program.*

Discussion and Implications

The purpose of this study was to identify student use of Blackboard Collaborate. The findings infer that despite anecdotal evidence from convenors within the Bachelor of Business offered through OUA suggesting a decline in the use of Blackboard Collaborate, this contention appears superficial. The findings from this study provide support for the inclusion of Collaborate in fully online courses. The findings infer that over the *duration*[3] of a course, students commonly attended Collaborate sessions and over half the students surveyed, stipulated that they downloaded the recordings after a session. This was similarly confirmed by the systems export data dump whereby attendance at 'live' sessions were occurring but were disproportionally lower than the session downloads. Firstly, this statistic validates that students use of Collaborate sessions may vary from 'live' attendance to session downloads or a combination of both and, therefore, lack of 'live attendance' is not a worthy reason as to not include Blackboard Collaborate sessions in a fully online course. Secondly, that there may be a myriad of reasons why student attendance at Collaborate sessions are varied across a course offering. In fact, students commonly reported work and family commitments as limitations to their engagement with the scheduled Blackboard Collaborate sessions. This supports Davis et al. (2012) where work and other commitments often determine the level and ability of student involvement in online courses.

Interaction, connectedness, support for course content including assessment, in addition, to the actual Collaborate tool itself were consistently provided as reasons in support for Collaborate sessions. This aligns with Bower et al. (2014) who advocate asynchronous learning methods may not meet all student needs and therefore, the inclusion of synchronous communication including activities and resources may heighten student motivation and involvement in an online course. Similarly, Yamada (2009) confirms that social presence enhances student satisfaction and performance outcomes and as such the high rating of weekly sessions may validate the effectiveness and benefit of Collaborate as a support tool for student learning and engagement, a factor advocated by Palmer and Holt (2009). They argued that online support tools largely drive satisfaction with the learning experience. Although technical issues and structure including purpose of a session were highlighted as areas in need of improvement (in holding Collaborate sessions), technical issues irrespective of mode (i.e., face-to-face or online) will ensue and should be seen as discrete issue indirectly related to the design of a course, rather than a reason not to utilise online synchronised classroom tools, such as Blackboard Collaborate. An interesting acknowledgment by students was the way in which Collaborate sessions were operationalised. Student responses infer that online classrooms should build on course content from the perspective of application which may also include applying concepts related to completion of assessment tasks. Students would prefer to see value in attending the session i.e., apply the knowledge learnt together as a cohort (discuss, engage etc.) rather than revise or rehash content. Although timing of the sessions cannot be

[3] Duration equals 13 weeks in a teaching period. This statement is not based on weekly attendance at the Collaborate session.

overlooked, it is an attribute which offers complexities given the nature of the Bachelor of Business Program (offered worldwide) and the inability to address individual student obligations and commitments.
The practical insights identified from the results of this study confirm the use of Collaborate in fully online courses yet highlight areas of consideration for instructors as to improve the student experience; areas noted as likely factors encouraging student motivation for and engagement with the Blackboard Collaborate tool.

Conclusion and Future research

The current paper draws on the initial stage of a two phase study. Whilst the outcomes of this study have provided insight into student 'use' with Blackboard Collaborate in fully online courses, a second sample of students will be surveyed (as a component of phase one) based on the same questions in a consecutive teaching period. This second collection of data will be completed to further validate student behavioural outcomes of using Blackboard Collaborate.

An additional aim of this study is to further explore the *how* and *why* individuals choose to engage in technology systems (Phase two). Originally based on the Theory of Reasoned Action (Ajzen & Fishbein, 1980), the Technology Acceptance Model (Davis, 1989) has been widely applied in educational and workplace settings to predict user acceptance and adoption of technology. This theoretical model suggests that perceived usefulness and perceives ease of use influence a person's behavioural intention and ultimately use behaviours of technology and, as such, these constructs will be tested in Phase two of the larger study.

References

Adam, S., & Nel, D. (2009). Blended and online learning: student perceptions and performance. *Interactive technology and smart education*, 6(3), 140-155.

Ajzen, M. Fishbein, (1980). Understanding Attitudes and predicting Social Behavior. Prentice-Hall, New Jersey.

Artino, A. R., & Stephens, J. M. (2009). Academic motivation and self-regulation: A comparative analysis of undergraduate and graduate students learning online. *The Internet and Higher Education*, 12*(*3), 146-151.

Azevedo, R. (2005). Using hypermedia as a metacognitive tool for enhancing student learning? The role of self-regulated learning. *Educational Psychologist*, 40, 199-209.

Bonk, C. J., & King, K. S. (1998). Computer conferencing and collaborative writing tools: Starting a dialogue about student dialogue. In C. J. Bonk & K. S. King (Eds), Electronic collaborators: Learner-centred technologies for literacy, apprenticeship and discourse (pp. 3-23). Mahwah, N.J: Erlbaum.

Bower, M., Kennedy, G. E., Dalgarno, B., Lee, M. J. W., Kenney, J., & de Barba, P. (2012). Use of media-rich real-time collaboration tools for learning and teaching in Australian and New Zealand universities. In M. Brown, M. Hartnett, & T. Stewart (Eds.), *Future challenges, sustainable futures. Proceedings Ascilite Wellington 2012*. Wellington, New Zealand.

Bower, M., Kenney, J., Dalgarno, B., Lee, M. J. W., & Kennedy, G. E. (2014). Patterns and principles for blended synchronous learning: Engaging remote and face-to-face learners in rich-media real-time collaborative activities. *Australasian Journal of Educational Technology, 30*(3), 261-272.

Dabbagh, N. & Kitsantas, A. (2004). Supporting self-regulation in student-centered, web based learning environments. *International Journal of e-learning, 3*(1), 40-47.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Davis, E. A. Hodgson, Y., & Macaualy, J. O. (2012). Engagement of students with lectures in biochemistry and pharmacology. *Biochemistry and Molecular Biology Education*, *40*(5), 300-309.

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of Management Review*, 14(1), 57-74.

Hamid, S., Waycott, J., Kurnia, S., & Chang, S. (2015). Understanding students' perception of the benefits of online social networking use for teaching and learning. *The Internet and Higher Education,* 26, 1-9.

Hines, R., & Pearl, C. E. (2004). Increasing interaction in web-based instruction: Using synchronous chats and asynchronous discussions. *Rural Special Education Quarterly*, 23, 33-36.

Kahu, E. R. (2013). The engagement of mature distance students. *Higher Education research & Development*, 32(5), 791-804.

Kim, K-J., & Bonk, C. J. (2006). The future of online teaching and learning in higher education: the survey says…, *Educause Quarterly*, 4, 22-30.

Lee, Y., & Choi, Y. (2011). A review of online course dropout research: implications for practice and future research. *Educational; Technology Research and Development,* 59(5), 593-618.

Leeds, E., Campbell, S., Baker, H., Radwan, A., Brawley, D., & Crisp, J. (2013). The impact of student

retention strategies: An empirical study. *International Journal of Management in Education,* 7(1), 22-43.
Malhotra, N., Hall, J. Shaw, M., & Oppenheim, P. (2008). Essentials in Marketing Research: An applied orientation (2nd Ed.). NSW: Pearson Prentice Hall.
Martin, L., Spolander, G., Ali, I. & Maas, B. (2011). Online student engagement: unfulfilled promises or promises unfulfilled? In S. Greener (Ed.), 10th European conference on e-learning (pp. 449–455). Brighton, UK: Proceedings of the European Conference on e-Learning.
Northey, G., Bucic, T., Chylinski, M., & Govind, R. (2015). Increasing student engagement using asynchronous learning. *Journal of Marketing Education*, 37(3), 171-180.
Palmer, S. R., & Holt, D. M. (2009). Examining student satisfaction with wholly online learning. *Journal of computer assisted learning*, 25(2), 101-113.
Stott, P. (2016). The perils of a lack of student engagement: Reflections of a "lonely, brave, and rather exposed" online instructor. *British Journal of Educational Technology,* 47(1), 51-64.
Svesson, A. & Forssell Eriksson, G. (2014). Conditions for participation within synchronous online Collaborative learning. *In Proceedings twentieth Americas Conference on Information Systems, Savannah 2014.*
Xiaoxia, H., & E-Ling, H. (2012). Synchronous and asynchronous communication in an online environment: Faculty experiences and perceptions. *Quarterly Review of Distance Education*, 13(1), 15-30.
Yamada, M. (2009). The role of social presence in learner-centred communicative language learning using synchronous computer-mediated communication: Experimental study. *Computers & Education*, 52, 820-833.
Yamagata-Lynch, L.C. (2014). Blended online asynchronous and synchronous learning. *International Review of Research in Open and Distance Learning*, 15(2), 189-212.

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Engaging students in the use of technologies for assessment within Personal Learning Environments (PLEs): The development of a framework

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Higher education students use a wide range of information and communication technologies for personal and study purposes, collectively known as a Personal Learning Environment (PLE). The ways in which students use technologies to prepare and complete assessment tasks, however, has not been researched as much as their general use of technology. This paper reports on the process adopted to develop a research-informed framework to engage higher education students in the use and evaluation of technologies for assessment purposes within their PLEs. The method used to construct the framework is presented alongside recommendations for how the framework may be used by lecturers and students.

Keywords: framework, assessment, self-assessment, Personal Learning Environments (PLEs)

Introduction

Unlike students in previous generations, millennials rely upon an ever-expanding collection of technologies to learn. The technologies used by these students have been identified (Conradie, 2014; Gosper, Malfroy, & McKenzie, 2013; Gosper, McKenzie, Pizzica, Malfroy, & Ashford-Rowe, 2014; Johnson & Sherlock, 2014). As technological advances continue to infiltrate teaching and learning practices in the higher education sector, the speed with which this happens does not always allow for considered reflection on how these technologies impact students' learning experiences. Because of the impact of assessment upon the learning process, it is important to understand how students use technology to complete assessment tasks. Although some research has recently been conducted into the specific technologies used by students to prepare and submit assessment tasks which constitute the required components of undergraduate and postgraduate courses (Lounsbury, Mildenhall, Bolton, Northcote, & Anderson, 2015), more research is needed. This paper continues the previous research, outlining the development of a framework to engage higher education lecturers and students in the use of *and* evaluation of technologies for assessment purposes within students’ Personal Learning Environments (PLEs).

Background

Personal learning environments

Higher education students' use of technologies, within their personal learning environments (PLEs) impacts their learning and study practices which, in turn, influences how they use technology to prepare, complete and submit assessment tasks. Personal learning environments (PLEs) are defined as "all the different tools we use in our everyday life for learning" (Attwell, 2007, p. 4), These tools can include "feeds for collecting resources and other data; conduits for sharing and publishing; services for interacting with organisations; personal information management; and ambiguity of teacher-learner role" (Milligan et al., 2006, p. 509). Although PLEs may consist of a variety of electronic or even non-electronic tools, social media plays a central role in most discussions about PLEs (Attwell, 2007). Social media are capable of bringing learners into educational relationships with others by helping them identify networks of people, content and services which may be used to enhance their learning (Attwell, 2007; Cochrane & Withell, 2013; Wang, Niiya, Mark, Reich, & Warschauer, 2015). These networks have the potential to address the learner's changing needs and learning goals, rather than requiring the learner to adapt to a learning system (Attwell, 2007).

As well as showing how learners use technology in individual and social settings, Dabbagh and Kitsantas (2012) highlight how PLEs support learners' abilities to "aggregate and share the results of learning achievement, participate in collective knowledge generation, and manage their own meaning making" (p. 1). As students develop their capacity to learn with technology in formal educational settings, they refine their skills both in the selection and use of the technologies that can be applied as lifelong learning skills in professional settings.

Formal and Informal Learning

Personal learning environments are a "potentially promising pedagogical approach for both integrating formal and informal learning" (Dabbagh & Kitsantas, 2012, p. 2). Formal learning often occurs in artificial, non-authentic settings (e.g., classrooms), and is tied to educational goals which are defined by someone other than the learner. Informal learning, on the other hand, often occurs spontaneously outside formal settings, and is typically learner driven (Le Clus, 2011; Marsick, Volpe, & Watkins, 1999). Lounsbury et al. (2015) report that when different technologies are used side-by-side in students' PLEs, the distinction between formal and informal learning become less noticeable. The use of PLEs has the potential to bring these two types of learning together (Dabbagh & Kitsantas, 2012; Melo Filho, Carvalho, Tavares, & Gomes, 2014) and to reduce the need for the instructional walls of the learning management system (LMS) (Hustad & Arntzen, 2013; Sclater, 2008; Stantchev, Colomo-Palacios, Soto-Acosta, & Misra, 2014; Weaver, Spratt, & Sid Nair, 2008).

The importance of assessment

Biggs (2003) and Cohen (1987) demonstrate the importance of alignment between instruction and assessment in increasing achievement. Performance on assessment is related to how students approach studying (Marton & Säljö, 1976; Rossum & Schenk, 1984; Van Rossum, Deijkers, & Hamer, 1985). The study of technology-laden PLEs has the potential to further this research into the relationship between assessment and study practices. As this paper is focusing on assessment within the higher education context is important to note that James, McInnis and Devlin (2002) assert that assessment is central to higher education learning. It is therefore logical that assessment will be central to the creation of the PLE in the tertiary context. The authors have noted a lack of research on the role of assessment in tertiary students PLES (2015) and therefore it is important and timely that there is a research focus on this area. Through undertaking this research there is the potential to gain a cohesive understanding into the relationship between assessment and study practices in higher education.

Need for a flexible, dynamic learning environment

Wilson, Liber, Johnson, Beauvoir and Sharples (2007) emphasise that an educational system should focus on "coordinating connections between the user and a wide range of services offered by organisations and other individuals" (p. 32). Academic teaching staff must now focus on teaching within this environment rather than over-relying on the typical LMS environment which, as mentioned above, tends to foster a static learning environment. However, promoting and supporting students to operate within their own PLE may bring new pedagogical challenges. For example, students frequently wish to incorporate Web 2.0 technologies into their higher education learning, including web-based tools, environments and services (Margaryan, Littlejohn, & Vojt, 2011). Students need technological and pedagogical support if they are required to access this broad range of technologies and use them with skillful application in their university studies.

A Personal Learning Environment framework

When supporting students in selecting technologies, which form the students' PLE, academic staff require support to instruct students on how to use these technologies in individual and collaborative learning spaces. The purpose of a framework, such as the framework outlined in this paper is to "support teachers in the delivery of high quality teaching and learning that will improve the students' ability to learn and understand the material that they are being taught", provide "a structure around the philosophy of teaching and learning" (McGuire College, 2014, p. 2), and give guidance to faculty staff regarding research-based, best practices in providing the most effective educational experience (McGuire College, 2014). Heibert (2006) created such a framework for describing students' PLEs. In the framework he outlined how students operate and participate within a social network. He identified how self-directing learning tools can serve as the connection between the learning process (i.e., reflecting or collecting) and the participation in learning (i.e., "what you are learning or what are you doing" (2006, para.1).

Dabbagh and Kitsantas (2012) explored how to engage teaching staff in the support of students' use of technologies for learning purposes in their PLEs. The framework consisted of three levels of interaction with social media: (1) personal information management, (2) social interaction and collaboration, and (3) information and management (p. 5). Their framework is useful for considering how the teachers' pedagogy may change so they can support student learning within a PLE. The framework drew on Zimmerman's (2002) work on self-regulation which sees the student become increasingly able to monitor their own learning progress while selecting appropriate technologies to complete their learning tasks. Thus, by helping academic teaching staff understand how students use technology, pedagogical frameworks can guide the design of effective instruction. By encouraging students to create their own PLEs, rather than relying on passively receiving information within teacher-designed educational systems (Wilson et al., 2007), learners can be supported to be more actively involved and metacognitively aware about their own learning processes (Melo Filho et al., 2014). Recent research has confirmed the benefits of engaging in metacognitive activities (Chick, Karis, & Kernahan, 2009; Laird, Seifert, Pascarella, Mayhew, & Blaich, 2014).

Level 3 of Dabbagh and Kitsantas' framework (2012), involves the use of technology to enhance metacognitive skills. Students can metaphorically 'stand back' and understand how the different technologies have contributed to their learning as an effective learner. In this dynamic process, sophisticated users of PLEs are aware of what technologies they are using and how effective they are for their learning. This cyclical process incorporates increasing levels of interactivity enabled through social media.

Phase 1 of the research study

Phase 1 of the current research study was conducted in 2015 and focused on approximately 100 university students' use of specific technologies within their Personal Learning Environments (PLEs) (Lounsbury et al., 2015). The first phase of the study was designed to discover the technologies and devices being used by students for university assessment tasks. Two Australian higher education institutions were involved in Phase 1 of the study: Edith Cowan University (ECU) in Western Australia and Avondale College of Higher Education in New South Wales. The ECU students who responded to the survey and participated in the focus groups were drawn from two urban campuses. The majority of these students were in the second or third year of their degrees. All of the students in the study were enrolled as on-campus students.

During the first phase of the study, students were invited to complete an online survey in which they were asked demographic questions as well as questions which asked them to identify the most common types of hard and soft technologies they used to prepare for their college and university assessment tasks. In all, 39 students completed the survey, 24 from Edith Cowan University and 15 From Avondale. They were required to list the online sites or technologies they used. Students were also presented with a selection of technologies (e.g., websites, online communication methods, search tools) and were asked to rate the frequency with which they used these technologies for the purposes of completing assessment tasks.

After the completion of the surveys, small focus groups of students in each institution were questioned more deeply about how they used technologies for assessment preparation and completion. Of the nine students who participated in the focus groups, 5 were from Edith Cowan University and four were from Avondale. The focus group participants were asked to comment on the importance of mobility in technology as well as to draw a graphical representation of their own PLE. Students then labelled these drawings and identified relationships between the technologies they drew as part of their PLE.

The data from the surveys were analysed by calculating frequencies and descriptive statistics. This analysis provided the study with demographic details as well as specific responses to the questions posed to students about PLEs. Frequencies were obtained for the questioned categories and specific responses grouped together. Once this was completed, conclusions could be drawn about the technologies or sites that the students used or did not use. The overall response data were summarised and the frequencies were tabulated and means calculated to provide specific information about each category. Data from the focus groups were analysed slightly differently. Transcripts were made of the discussions and were then reviewed to determine trends in the use of technologies and devices by the students as well as their perceptions about how their peers used technologies and devices. The transcripts were analysed using NVivo and the frequency of devices and technologies used was calculated. The information was broken down into categories to enable commonalities among the data to be easily determined. Likewise, the mapping exercises completed by the students in the focus groups were analysed to identify the technologies being used, and not being used, by the students when completing assessment tasks, as well as the connections between the technologies.

The results of the survey were compared with those of the focus group analyses to determine credibility and establish whether or not the findings between the two data sets were consistent. This comparison made it possible to establish links between the data sets and gave an overall picture of the technologies used for assessment purposes within the students' PLEs. The results showed that students definitely preferred technologies that were portable and available across variable hard technologies and their primary concerns were for freely available connectivity, particularly in the form of power-outlets and Wi-Fi. When it came to soft technologies, students were most likely to use online library databases and search engines, and they appreciated technologies that allowed them to share ideas in the process of preparing assessment tasks. Interactivity was important to the students, along with flexibility, though innovation was not, and students were less likely to use new technologies that came with a "steep learning curve", particularly when they were planning and executing assessment tasks.

Overall, the findings from the first phase of the research project suggested that the students who participated in Phase 1 of the study were conservative in their technological choices when it comes to the preparation and completion of assessment tasks. They appeared to be less reliant on the institution's hardware (e.g., printers and desktops) and software (such as the institution's LMS). Furthermore, the students appeared to be more independent and device-wise than in the past. They appeared to be less likely to try new technologies when working on an assessment task and were primarily concerned with Wi-Fi connectivity and freedom to study in any location. The findings from Phase 1 of the study allowed the researchers to develop a deep understanding of students' PLEs and how educators may be able to interact with and guide students' choices to create a broader PLE for assessment purposes.

Phase 2 of the research study

Phase 2 of the research study began in 2016, immediately after Phase 1 of the study. In Phase 2, the researchers focused on creating and producing a pedagogical framework that was beneficial for both teachers and students by providing guidance about the use of technology for assessment purposes. The PLE Framework for Assessment, was developed as an instructional tool for use by university lecturers who are interested in integrating technology in a meaningful way into their courses, through their students' use of technologies for assessment purposes. The content, intentions and structure of the Framework was informed by the findings of Phase 1 of the study (Lounsbury et al., 2015). The Framework that was developed in Phase 2 is intended to provide guidance on how to engage students in the use of self-regulating and self-evaluating practices in their selection of appropriate online and offline technologies to use within their PLEs. As such, it is anticipated that the Framework could be used to guide teachers in the design and teaching of courses, as well guiding teachers in how to give advice to students about using technology to complete assessment tasks. The Framework may also guide students in the use of technologies in self-regulated ways in order to produce assessments more efficiently. The development of the Framework was guided by the following foundational understandings:

> **Use and application of a PLE.** A PLE is a self-constructed collection of technologies which a learner selects and uses for a particular purpose, usually related to activities associated with learning or studying. Furthermore, for assessment purposes, university students typically use a range of formal (e.g., technologies made available by the institution) and informal technologies (e.g., social media). Modelling the use of technologies within PLEs by the lecturer may facilitate students' use of appropriate technologies in their learning, studying and/or assessment practices.

Assessment. In the context of this study, an assessment task is defined as an assigned activity, project, examination or task that students are required to complete for the purpose of demonstrating their learning within a university course. Assessment tasks are typically allocated grades, marks or scores which form the basis of the student's university qualifications. Examples of assessment tasks include essays, tutorial presentations, end-of-semester examinations and digital portfolios.

Learning contexts and PLEs. Learning can take place within a community of practice by a group of learners or at an individual level. Some technologies enhance collaboration and communication, while others facilitate independent activities and promote reflection by individuals. PLEs provide opportunities for collaborative knowledge generation and self-management of information for meaning-making purposes. The self-constructed nature of PLEs encourage students to engage in self-regulated learning practices, involving the self-selection of technologies that facilitate collaborative *and* individual learning strategies, to manage and aggregate information. Students ideally aggregate information about the process of completing assessment tasks and the content or topics associated with an assessment task. The purpose of information aggregation and management is synthesis. By encouraging students to develop their own PLEs, the learning context can assist students to self-evaluate their use of technologies for learning, studying and assessment purposes. The completed assessment task can be viewed as a product of a student's use of technologies within their PLE. Use of various and appropriate self-selected technologies may provide students with opportunities to develop and practise their learning independence as well as their ability to learn collaboratively.

The structure of the Framework outlined in this paper (see Figure 1: PLE Framework for Assessment) has built upon the work by Dabbagh and Kitsantas (2012) who devised three levels of social media use to support self-regulated learning in PLEs: 1) Personal information management; 2) social interaction and collaboration; and 3) Information aggregation and management. We have added a fourth dimension to their framework (i.e., Stage 4, Assessment output) and have reworded the explanations for the previous three dimensions in terms of assessment. The examples of the technologies in our PLE Framework for Assessment were provided by the student-participants from whom we gathered data throughout the previous phases of the project.

The future: Phase 3 of the study

The next phase of the study will involve capturing students' real time use of technologies in their completion of assessment tasks through the use of a program called *ManicTime*. *ManicTime* is known as "personal time management software" for logging and tracking work hours (Mininday, 2009). Student-participants across three higher education institutions will be given a free copy of the software, along with instructions that explain how the software would record the date, time, duration, and type of computer programs used as well as the date, time, and duration of the websites they visited over the semester period of the data collection phase of the study. To broaden the reach of the study, the student cohorts that are targeted for Phase 3 of the study will be different from and larger than the cohorts accessed during earlier phases of the study. *ManicTime* has the ability to incorporate data from cloud storage into analytics for data analysis processes and resides in the background of the computer reducing its intrusion on users' normal computer use. It does not record the content of programs or websites. The data collection is thus not reliant on students keeping records, and consequently, has the potential to yield more accurate information than could be gained from data gathering techniques that rely on self-reported data such as asking students about their computer usage. In these ways, the computer activity data captured from the software will provide an accurate reflection of the participants' *actual* practices in comparison to their *reported* practices as presented previously. By capturing data about students' actual practices in using technologies for assessment purposes, the findings of this ongoing study have the potential to contribute further to our existing framework. Furthermore, during Phase 3 and other future stages of the study, the researchers will investigate how academic teaching staff make use of the PLE Framework for Assessment and how their use subsequently impacts on the students' use of technologies. It is anticipated that this next phase of the study will take place in 2017 and will continue across two semesters.

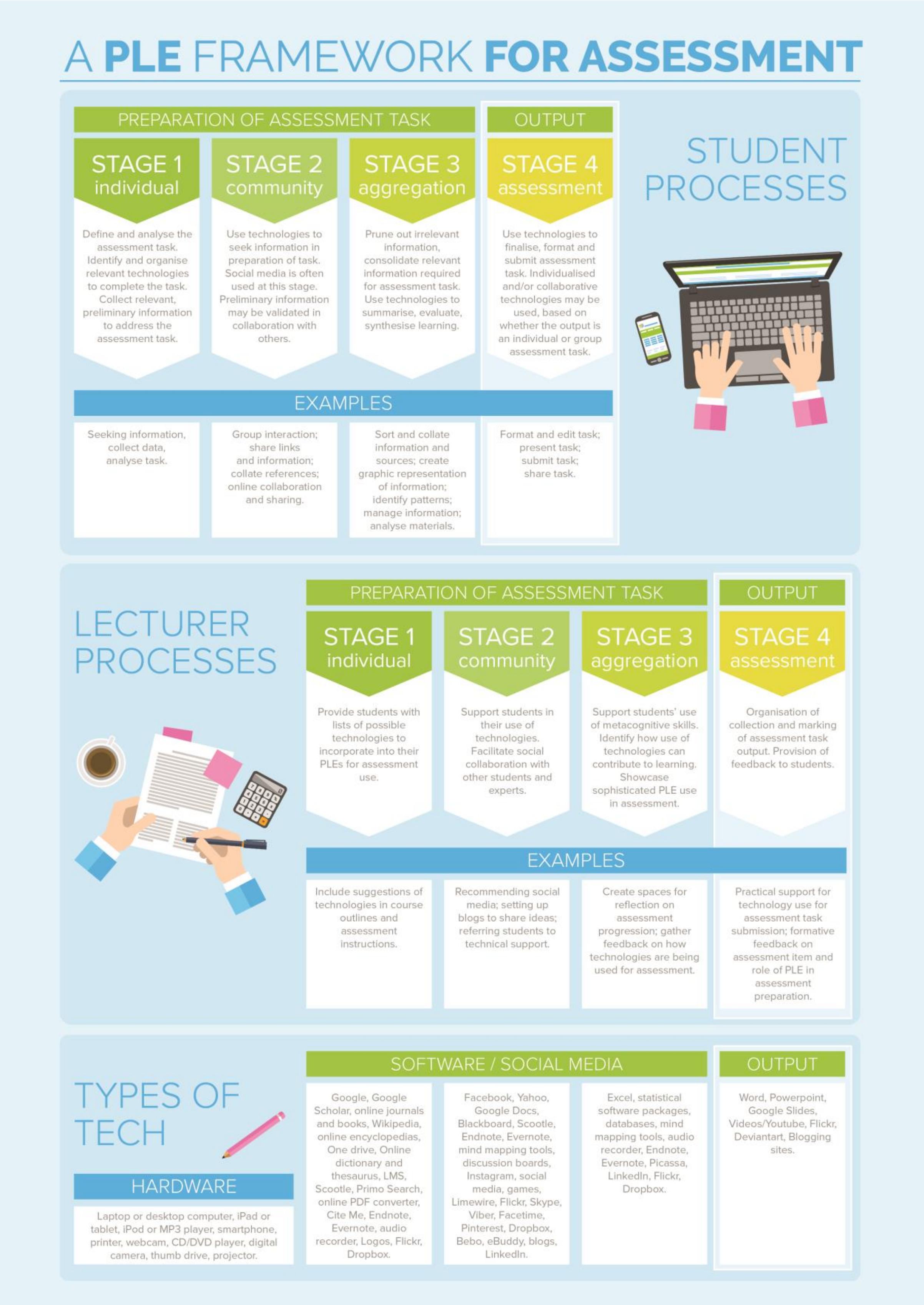

Figure 1: PLE Framework for Assessment[4]

[4] Graphic design work by David A. Page. www.david-page.com

Discussion

The PLE Framework for Assessment is based upon the idea that learning does not just take place in the classroom; it has been developed to extend instruction and foster an interest in the subject matter beyond the traditional on-campus learning contexts: “Activities that students engage in by choice outside the classroom can complement and strengthen classroom-based learning, and can also lead to that learning being extended and updated long after the formal classroom program ends” (Crooks, 1988, p. 463). If assessment is limited to in-class, written tests of surface knowledge, there is little chance that students will develop intrinsic and continuing motivation in the subject matter. The framework is set up to transfer more control over the assessment process to the students, as recently recommended by Boud, Lawson and Thompson (2015). This transition may extend the movement from "sage on the stage" to "guide on the side" style of teaching into the realm of assessment.

While not prescriptive, the PLE Framework for Assessment opens up a range of possibilities for instructors to rethink his or her use of assessment. Rather than focusing upon assessment as an insular activity of an individual student, the framework defines assessment as an authentic experience over which the student is given a significant amount of control and encouraged to self-assess (Yucel, Bird, Young, & Blanksby, 2014). Assessment is not just something which the instructor does to the student in the classroom (Boud & Molloy, 2013); it is something that the student does to demonstrate learning. And by focusing upon the use of technology, the PLE Framework for Assessment places assessment firmly in the student’s sphere of activity.

As mentioned above, the above framework is based upon a similar framework developed by Dabbagh and Kitsantas (2012). While Dabbagh and Kitsantas’s model focuses upon the learning process, it does not directly address assessment, which is the focus of the current model. However, the two models are not that far apart in that learning occurs during an assessment task. In contrast to the way that assessment is sometimes distinct from the learning (Crooks, 1988), the current model views assessment as an extension of and integrated into the learning process as defined by Dabbagh and Kistsantas (2012). Hence, the added column (Level 4: Assessment output) addresses assessment activities as the output of the achievement of learning outcomes.

The inclusion of community, in Stage 2 of the framework, focuses upon learning from others. One of the characteristics of millennials is that they prefer communal over individual learning (Dede, 2005) which involves “diverse, tacit, situated experience, with knowledge distributed across a community and a context as well as within an individual” (Dede, 2005, p. 1). In other words, learning does not come from a single person, but is derived from experiences with others and is then shared with others. These experiences may be facilitated locally through online discussion boards, for example, or globally accessing blogs or social media sites. The framework also can be used by academic teaching staff to guide students' choice of technologies, as they come to learn to distinguish between a casual source and an expert; between an opinion and an evaluation. Using multiple sources will help students learn that even among the informed, there may be a diversity of perspectives. Comparing information from different sources and understanding the diversity of perspectives among professionals in their profession will help the student in becoming more sophisticated in their thinking about the topic, as well as their profession. The PLE Framework for Assessment offers suggestions for relevant technologies to achieve this type of learning.

The focus of Stage 3 in the framework will be upon the evaluation and synthesis of the information gathered in the previous stages. Dede (2005) reports that learning for millennials is “based on collectively seeking, sieving, and synthesizing experiences” (p. 643). This process of sieving and synthesising is not just an individual evaluation, but is done collectively or communally. This can be facilitated by the teacher either setting up structures locally to facilitate the evaluation of ideas, such as groups or discussion boards, or point the student to resources online where they can interact with others about their topic. Posting their ideas online can be positive in that students may grow in their professional confidence by having their ideas validated by experienced professionals.

The PLE Framework for Assessment provides an overall structure for designing assessments within the context of the instruction. However, how the instructor applies the framework to each course will be different, and will depend upon the type of course and subject matter. In any case, the application of the framework to each course will need to be done carefully so as to produce the ideal experience for the students.

Recommendations

Several recommendations have arisen organically out of the creation of the PLE Framework for Assessment. To begin with, further phases of the project will need to analyse the effectiveness of the framework itself in encouraging students to refine and expand their PLEs in regards to assessment.

Another recommendation is that there could be a shared construct of “the use of ICT” in the learning process among students at the university. This construct would ideally come from the institution level (e.g., it may include use of the LMS) as it would then influence the ways academic departments, and thus academics and students within those departments, view and understand the use of ICT in the teaching and learning process. The existence of such a construct is useful, as it would determine the ways ICT is used among students in their academic practices, building on the work of Gosper et al. (2013; 2014). These academic practices include personal information management at the individual level (e.g., OneNote), use of ICT within a community, social interaction and collaboration (e.g., Linkedin), information aggregation and management (e.g., Endnote), as well as assessment outputs (e.g., Academia), to align with the four stages of the PLE Framework for Assessment outlined in this paper.

The study has also illuminated the need for further normalisation of the concept and (ubiquitous) role of ICT in the teaching, learning and assessment processes in higher education (Attwell, 2007; Blaschke, 2012; Dede, 2005; Gasson & Haden, 2014). This would involve rebuilding the “social” (the academics and the students) and the “technical” (the use of ICT) systems so that they could work in a parallel manner in this process, towards the goal of accomplishing a degree in the notion of “the best possible ways”. This parallel relationship could be beneficial in the generation of an optimum educational outcome, in terms of increased productivity of work as well as increased effectiveness and efficiency for academic practices, especially in relation to assessment practices.

The constructs of higher education and technology, with student perceptions focused on “needs” and “outcomes” related to “satisfaction” and “comfort” in relation to ICT could be challenged to embrace efficiency and productivity by introducing a level of academic development focused on application use to support the learning and assessment processes. This may then lead to increases in “computer literacy” promoting changes in thinking and practice, leading to “optimal solutions” in accordance with both “social” and “technical” agendas in a more strategic use of ICT to promote learning and assessment, in accordance with the recommendations of Baskin, Barker and Woods (2003).

Several inherent limitations with the study have also been noted and the challenges arising from these will be work through in future phases of the project. The study has so far only reached a small number of students and further studies will be done to provide greater response potential. The study also needs more qualitative feedback about the value of the PLE guidelines provided by lecturers prior to assessments before it can gauge the value of such a practice. This will be developed and investigated further in the next phase of the study.

Further engagement between the university, the lecturer and the students about ICT for study and, in particular, for their assessment tasks is encouraged; this involvement across students and lecturers for assessment purposes has also been identified by other researchers (Australian Learning and Teaching Council, 2009; Boud & Molloy, 2013). Further investigation into the way this interaction plays out and influences practice is also suggested.

Conclusion

This paper has provided examples of the types of technologies used for assessment purposes which constitute a Personal Learning Environment (PLE) used by selected groups of students in two higher education settings. The data gathered from the student-participants in the study were analysed and used to inform the development of a research-informed, learning-focused PLE Framework for Assessment. The framework is intended to be used by academic teaching staff as a tool to guide their students' appropriate and focused use of technologies for assessment purposes, including the analysis, preparation, completion and submission of assessment tasks. Furthermore, the framework may provide guidance to university lecturers who engage in the design of assessment tasks, resources, instructions and rubrics, by offering specific recommendations to students about the use of relevant soft and hard technologies to use when completing assessment tasks. Although research into students' use of technologies specifically for assessment purposes has not yet been investigated extensively in higher education settings, the outcomes of the research outlined in this paper and the PLE Framework for Assessment that emerged from the research represents two contributions to our current understanding of how students' use technologies as part of their assessment practices.

References

Attwell, G. (2007). The personal learning environments: The future of eLearning? *eLearning Papers, 2*(1), 1-8.

Australian Learning and Teaching Council. (2009). What's happening in assessment? Sydney: Australian Learning and Teaching Council (2008).

Baskin, C., Barker, M. C., & Woods, P. (2003). Towards a smart community: Rethinking the strategic use of ICTs in teaching and learning. *Australian Jounal of Educational Technology, 19*(2), 192-210.

Biggs, J. (2003). *Teaching for quality learning at university* (2nd ed.). Berkshire: The Society for Research into Higher Education and Open University Press.

Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in Open and Distance Learning, 13*(1), 56-71.

Boud, D., Lawson, R., & Thompson, D. G. (2015). The calibration of student judgement through self-assessment: Disruptive effects of assessment patterns. *Higher Education Research & Development, 34*(1), 45-59.

Boud, D., & Molloy, E. (2013). Rethinking models of feedback for learning: The challenge of design. *Assessment & Evaluation in Higher Education, 38*(6), 698-712.

Chick, N. L., Karis, T. K., & Kernahan, C. (2009). Learning from their own learning: How metacognitive and meta-affective reflections enhance learning in race-related courses. *International Journal for the Scholarship of Teaching and Learning, 3*(1), 1-28.

Clark, W., Logan, K., Luckin, R., Mee, A., & Oliver, M. (2009). Beyond Web 2.0: Mapping the technology landscapes of young learners. *Journal of Computer Assisted Learning, 25*(1), 56-69.

Cochrane, T., & Withell, A. (2013). Do 21st Century students dream of electric sheep? A mobile social media framework for creative pedagogies. In H. Carter, M. Gosper, & J. Hedberg (Eds.), *Electric Dreams. Proceedings ascilite 2013 Sydney* (pp. 151-161). Macquarie University: Australasian Society for Computers in Learning in Tertiary Education (ASCILITE).

Cohen, S. A. (1987). Instructional alignment: Searching for a magic bullet. *Educational Researcher, 16*(8), 16-20. doi: 10.3102/0013189X016008016

Conradie, P. W. (2014). Supporting self-directed learning by connectivism and Personal Learning Environments. *International Journal of Information and Education Technology, 4*(3), 254-259.

Crooks, T. J. (1988). The impact of classroom evaluation practices on students. *Review of Educational Research, 58*(4), 438-481. doi: 10.3102/00346543058004438

Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education, 15*(1), 3-8.

Dede, C. (2005). Planning for neomillennial learning styles: Implications for investments in technology and faculty. *Educating the net generation, 5*, 1-32.

Gasson, J., & Haden, P. (2014). Modern digital literacy: The computer science curriculum goes mainstream. In B. Hegarty, J. McDonald, & S. K. Loke (Eds.), *Rhetoric and Reality: Critical perspectives on educational technology. Proceedings ASCILITE Dunedin 2014* (pp. 50-57). Dunedin, New Zealand: Australasian Society for Computers in Learning in Tertiary Education (ASCILITE).

Gosper, M., Malfroy, J., & McKenzie, J. (2013). Students' experiences and expectations of technologies: An Australian study designed to inform planning and development decisions. *Australasian Journal of Educational Technology, 29*(2), 268-282.

Gosper, M., McKenzie, J., Pizzica, J., Malfroy, J., & Ashford-Rowe, K. (2014). Student use of technologies for learning: What has changed since 2010? In B. Hegarty, J. McDonald, & S. K. Loke (Eds.), *Rhetoric and Reality: Critical perspectives on educational technology. Proceedings ascilite Dunedin 2014* (pp. 290-301). Dunedin, New Zealand: Australasian Society for Computers in Learning in Tertiary Education.

Heibert, J. (2006). Personal learning environment model. Retrieved 24 May, 2016, from http://headspacej.blogspot.ca/2006/02/personal-learning-environment-model.html

Hustad, E., & Arntzen, A. A. (2013). Facilitating teaching and learning capabilities in social learning management systems: Challenges, issues, and implications for design. *Journal of Integrated Design & Process Science, 17*(1), 17-35.

James, R., McInnis, C., & Devlin, M. (2002). *Assessing Learning in Australian Universities: Ideas, strategies and resources for quality in student assessment*: Australian, Universities Teaching Committee.

Johnson, M. W., & Sherlock, D. (2014). Beyond the Personal Learning Environment: Attachment and control in the classroom of the future. *Interactive Learning Environments. Special Issue: Learning management system: evolving from silos to structures, 22*(2), 146-164. doi: 10.1080/1049820.2012.74543

Laird, T. F. N., Seifert, T. A., Pascarella, E. T., Mayhew, M. J., & Blaich, C. F. (2014). Deeply affecting first-year students' thinking: Deep approaches to learning and three dimensions of cognitive development. *The Journal of Higher Education, 85*(3), 402-432.

Le Clus, M. (2011). Informal learning in the workplace: A review of the literature. *Australian Journal of Adult Learning, 51*(2), 355.

Lounsbury, L., Mildenhall, P., Bolton, D., Northcote, M., & Anderson, A. (2015). Higher education students' use of technologies for assessment within Personal Learning Environments (PLEs). In T. Reiners, B. R. v.

Konsky, D. Gibson, V. Chang, L. Irving, & K. Clarke (Eds.), *Conference Proceedings ASCILITE 2015: Globally connected, digitally enabled* (pp. 190-203). Curtin University, Perth, Western Australia: Australasian Society for Computers in Learning in Tertiary Education (ASCILITE).
Margaryan, A., Littlejohn, A., & Vojt, G. (2011). Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education, 56*(2), 429-440.
Marsick, V. J., Volpe, M., & Watkins, K. E. (1999). Theory and practice of informal learning in the knowledge era. *Advances in Developing Human Resources, 1*(3), 80-95.
Marton, F., & Säljö, R. (1976). On qualitative differences in learning: I—Outcome and process. *British Journal of Educational Psychology, 46*(1), 4-11. doi: 10.1111/j.2044-8279.1976.tb02980.x
McGuire College. (2014). Pedagogical framework: Teaching & learning. *McGuire College.* Retrieved 14 July, 2016, from http://mcguireco.vic.edu.au/uploaded_files/media/1447018533mcguire_college_pedagogical_framework_final.pdf
Melo Filho, I. J. d., Carvalho, R. S., Tavares, E. L. C., & Gomes, A. S. (2014). Towards the formative accompaniment in e-learning: Conception of a social mechanism between the educational contexts LMS and PLE *E-LEARN 2014-World Conference on E-Learning* (pp. 1330-1339).
Milligan, C. D., Beauvoir, P., Johnson, M. W., Sharples, P., Wilson, S., & Liber, O. (2006). Developing a reference model to describe the personal learning environment. In W. Nejdl & K. Tochtermann (Eds.), *Proceedings of the First European Conference on Innovative Approaches for Learning and Knowledge Sharing* (pp. 506-511). Berlin Heidelberg: Springer.
Mininday, T. J. (2009). Track your time on the computer with Manictime. Retrieved 15 February, 2012, from http://www.makeuseof.com/tag/manage-and-monitor-your-application-usage-with-manictime/
Rossum, E. v., & Schenk, S. M. (1984). The relationship between learning conception, study strategy and learning outcome. *British Journal of Educational Psychology, 54*(1), 73-83.
Sclater, N. (2008). Web 2.0, personal learning environments and the future of learning management systems. *EDUCAUSE Quarterly (EQ)*(13), 1-13.
Stantchev, V., Colomo-Palacios, R., Soto-Acosta, P., & Misra, S. (2014). Learning management systems and cloud file hosting services: A study on students' acceptance. *Computers in Human Behavior, 31*, 612-619.
Van Rossum, E. J., Deijkers, R., & Hamer, R. (1985). Students' learning conceptions and their interpretation of significant educational concepts. *Higher Education, 14*(6), 617-641. doi: 10.1007/BF00136501
Wang, Y., Niiya, M., Mark, G., Reich, S., & Warschauer, M. (2015). Coming of age (digitally): An ecological view of social media use among college students *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing* (pp. 571-582). Vancouver, BC, Canada.
Weaver, D., Spratt, C., & Sid Nair, C. (2008). Academic and student use of a learning management system: Implications for quality. *Australasian Journal of Educational Technology, 24*(1), 30*41.
Wilson, S., Liber, O., Johnson, M., Beauvoir, P., & Sharples, P. (2007). Personal Learning Environments: Challenging the dominant design of educational systems. *Journal of e-Learning and Knowledge Society, 3*(2), 27-38.
Yucel, R., Bird, F. L., Young, J., & Blanksby, T. (2014). The road to self-assessment: Exemplar marking before peer review develops first-year students' capacity to judge the quality of a scientific report. *Assessment & Evaluation in Higher Education, 39*(8), 971-986. doi: 10.1080/02602938.2014.880400
Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice, 41*(2), 64-70. doi: 10.1207/s15430421tip4102_2

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Application of Personal Learning Environment to an Independent Study Experience

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The study applied the concept of personal learning environments to the individualized instruction of a foreign language pre-service teacher in an assessment class. The student was given the opportunity to develop their own personal learning environment by deciding upon specific educational goals, developing lifelong learning resources, and negotiating assessment. The student developed an enthusiasm for the subject matter not seen with other students. However, the situation is unique in that it is an individualized learning situation with a mature, returning student. In the future, attempt will be made to apply the same principles to a whole-class situation.

Keywords: Personal Learning Environments, negotiated assessment, individualized instruction

Introduction

In spite of the recent focus upon progressive pedagogy in education, the focus of traditional university classrooms is typically about the conveying of knowledge. Even if instructors emphasize higher-level thinking in the classroom, instructors often retain tight control over the learning process. While there may be good reasons for maintaining that control, such as institutional requirements for instruction to teach specific content and to demonstrate that students have learned the content, something is lost by not giving more control over the learning process to students - they are not allowed to choose their educational goals, their preferred method of learning, and are not given the opportunity to self-assess their own learning. Because of this, students are not taught to be independent learners. As a result, students may not see the relevance of what they are learning, and may not be motivated to learn.

Background

The recognition of personal learning environments and their application to the classroom provide opportunities to give students greater autonomy in the classroom. Personal learning environments are defined as “all the different tools we use in our everyday life for learning” (Attwell, 2007, p. 4). The development of the concept of personal learning environments has coincided with the development of the Internet and the tools are generally electronic in nature. Specifically, social media has played a central role in personal learning environments (Atwell, 2007). Social media can be used to help students identify and develop networks of people, content, and services which will help inform and extend their learning (Atwell, 2007). The resulting personal learning environment allow students to continue learning beyond the classroom (Atwell, 2007).

Setting and Participant

The following study was done at West Chester University within the teacher preparation program. West Chester University is a public university in southeastern Pennsylvania, consisting of approximately 17,000 undergraduate and graduate students. About of the third of the students are education majors. Most students in the education program are required to take a course in assessment. The focus of the class is upon both classroom and standardized tests, with the emphasis upon using the assessment data to inform instruction. The subject of this study was a student enrolled in foreign language education. The student was taking the class in an independent study format, since she was unable to take it with the regular class. The students was a returning student, and was in her forties.

Methodology

While the assessment class in question is typically taught using group activities, much of the conveyance of the material had been done using lecture. As with most classrooms, the instruction had been done in a controlled learning environment, in which all students follow the same routine. There has been little or no choice of content, instructional methods; or assessment. However, for this independent study, the student was allowed to develop her own personal learning environment. The student was asked to keep two blogs. One blog documented the content of learning, with, the expectations for the blog were very open – the onus was upon the student to demonstrate learning. This approach reflects the concept of heutagogy, which allows for negotiated assessments, and which empowers the student in her learning (Blaschke, 2013). Additionally, the student was to keep a blog with reflections upon the process of learning. In this blog, the students was to document the process of creating her personal learning environment. The use of a blog as a social media tool to document learning and reflection with a personal learning environment is documented in Dabbagh and Kitsantas (2012).

The expectations for general content of the course to be addressed was conveyed to the student at the beginning of the class. This included classroom assessment, standardized testing, performance assessments, as well as portfolio assessment. However, how the student was to address these content areas was left up to the student. To do this, she was to research the assessment needs within her profession, foreign language education, with regards to the specific types of assessments within those general categories, and to issues which were important with regards to those assessments. Thus, the student was being asked to take control over and responsibility for the content of instruction.
In addition, the student was expected to start developing a network which would extend beyond the classroom. And finally, the student was to start identifying and become familiar with important assessment resources in her content area. In this way, the student was start to obtain a broader perspective on assessment foreign language education.

Results

Initially, the student struggled with the technological issues of setting up the blog. Given the independent nature of the instruction, the student did not get into the content as quickly as the instructor had expected. However, after a few meetings with the professor, and with help from the student's son, the initial issues were resolved, and the student began to enthusiastically delve into the subject matter. Indeed, the difference in the student's attitude compared with the attitude of students in the traditional classroom was remarkable. The student ended up exceeding the requirements of the class. An example of this is that while attending a conference on foreign language education and, during the conference, she focused her attention upon assessment topics at the conference– something she admitted she would not have done without the class.

Conclusions

Overall, the experiment worked very well. The student was an enthusiastic participant in the educational experience. The results, however, need to be interpreted cautiously. The student who was taught was a returning student who was a responsible adult with interest in furthering her education. The one-on-one instruction makes it easier to implement such an innovative approach. It is therefore not clear how easily it would be to use the same method with whole-group instruction. But the results are tantalizing enough to make the instructor want to try to attempt such instruction in a whole-class setting. Possible ways this might happen include using a more project-based approach, which could provide both structure and freedom for students to learn and demonstrate their learning. Students would have to organize their own learning and identify the resources needed to address the project. If this were done in groups, it would allow students to give them the opportunity to explore the resources together, so as to help one another develop their own learning environments.

References

Atwell, G. (2007). Personal learning environments: The future of elearning? *eLearning Papers*, 2, 1-7.

Blaschke, L. M. (2013). E-learning and self-determined learning skills. *Self-Determined learning: Heutagogy in action*, 55-68.

Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education, 15*(1), 3-8

Milligan, C. D., Beauvoir, P., Johnson, M. W., Sharples, P., Wilson, S., & Liber, O. (2006, October). Developing a reference model to describe the personal learning environment. In *European Conference on Technology Enhanced Learning* (pp. 506-511). Springer Berlin Heidelberg.

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A national strategy to promote Open Educational Practices in higher education in Australia

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Currently in Australia, there are no policies and regulations at national levels to promote and encourage the adoption of Open Educational Practices (OEP) across the higher education sector. As an attempt to bridge this policy gap, a project proposal was developed by a group of OEP advocates and researchers and then successfully funded by the Australian Government Department of Education and Training (AGDET). This paper explores and discusses the approaches, deliverables and recommendations of this project titled *Students, Universities and Open Education* (OpenEdOz) Project. One of its main deliverables was a National Policy Roadmap, which aimed to assist the government to realise the potential of OEP for the Australian higher education sector and open up opportunities for further national policy development and support in which OEP can flourish. The policy roadmap was informed by a range of national and international evidenced-based case studies related to OEP projects and initiatives.

Keywords: Open Educational Practices, Open Educational Resources, OEP in Australia, OER in Australia, policy for OEP, OEP road map.

Australian context and the rationale of the project

Open Educational Resources (OER) and more recently, Open Educational Practices (OEP) represent an emergent movement that is re-shaping learning and teaching in higher education worldwide. There are several reasons why OER and OEP have been attracting attention from educational institutions, governments, learners and educators around the world. The growth of the open educational trend "is a response to the rising costs of education, the desire for accessing learning in areas where such access is difficult, and an expression of student choice about when and how to learn" (Johnson, Levine, Smith, & Stone, 2010, p. 6). In addition, these learning technologies have the potential to meet the growing demand for higher education worldwide, to provide economy of scale, to increase collaboration between educational institutions, educators and students, to improve learning and teaching through innovation, re-use, remix and translation of open content, to close the gap between formal, non-formal and informal education, amongst other opportunities (Bossu, Brown, & Bull, 2014; Kanwar, Kodhandaraman, & Umar, 2010).

Since being first coined by UNESCO in 2002, the term "Open Educational Resources" has been re-defined several times to meet the fast evolving pace of the movement and to fit into the diverse range of contexts where it has been applied. OER "are educational materials which are licensed in ways that provide permissions for individuals and institutions to reuse, adapt and modify the materials for their own use. OERs can, and do include full courses, textbooks, streaming videos, exams, software, and any other materials or techniques supporting learning" (OER Foundation, 2011). As for OEP, they "are defined as practices which support the (re)use and production of OER through institutional policies, promote innovative pedagogical models, and respect and empower learners as co-producers on their lifelong learning path. OEP address the whole OER governance community: policy makers, managers/ administrators of organisations, educational professionals and learners" (Open Education Quality Initiative, 2011, p. 12).

Currently, many educational institutions, government and funding agencies around the globe have encouraged OEP related initiatives. Many learners have benefited from learning through OER materials, and many educational institutions, including distance education providers, have obtained significant rewards in terms of enhancing their reputations, increasing student enrolment and developing innovative ways to enhance learning at a distance (Wiley & Gurrell, 2009). In Australia, OEP initiatives and programs at higher education levels are still limited compared with other developed countries such as the US, UK and some other European countries (Bossu et al., 2014). However, there are some important developments taking place. For example, at institutional levels, most Australian universities have an open access repository where thesis, research data and outputs from government funded projects and initiatives are made available, typically using open licenses, including Creative Common licenses, for other researchers to use and re-use (Picasso & Phelan, 2014). At government levels, the existing initiatives have been focused on the government's commitment to transparency, sharing of information, and open access to publicly funded research data and outputs. In addition, major research funding bodies have also responded positively to the government position on open access and have supported open practices through their own regulations (Picasso & Phelan, 2014). These funding bodies, particularly the Australian Government Office for Learning and Teaching (OLT), have directly funded projects to promote the adoption of OEP in Australian higher education. These are positive developments of course, but they are not directly focused on opening up education through openly licensed educational resources and practices. In fact, at the time of writing, Australia does not have a specific framework, policy or regulation at national level to encourage the higher education sector to embrace OER and OEP (Bossu, 2016; Bossu et al., 2014).

As an attempt to bridge this policy gap, a project proposal was developed by a group of OEP advocates and researchers and then successfully funded by the Australian Government Department of Education and Training (AGDET) (previous Office for Learning and Teaching). This paper explores and discusses the approaches, deliverables and recommendations of this project titled *Students, Universities and Open Education* (OpenEdOz) (Wills, Alexander, & Sadler, 2016). One of its main deliverables was a National Policy Roadmap, which aimed to assist the government to realise the potential of OEP for the Australian higher education sector and open up opportunities for further national policy development and support in which OEP can flourish. The policy roadmap was informed by a range of national and international evidenced-based case studies related to OEP projects and initiatives.

OpenEdOz Project

The OpenEdOz project was initiated in mid-2014 (with the final report submitted in February 2016), and involved three important partner institutions; each of which provided key expertise needed for the successful completion of the project. The partner universities were: Charles Sturt University (lead), the University of Technology Sydney, and the University of Tasmania. The project team, composed of five members from the universities above, were guided by the project's reference group and the evaluator, who were OEP experts recognised nationally and internationally (for more information about the project team, please visit the website at http://openedoz.org/.

The project had the following aims:
- Focus on the missing voice of students in understanding emerging technology-based open educational practices (OEP)
- Determine how student learning outcomes can be enhanced with open education practices
- Develop case studies that capture university practice and
- Develop a National Roadmap for an Australian Open Education Strategy, fostering relevant uptake of open educational resources (OER) and open courses (Wills et al., 2016)

Project approach

The project partners worked with their students and staff to develop case studies of open, online education including the contribution of our students to co-created curriculum design. Short case studies were the main source of data in this study, supported by the body of knowledge in OEP. Case studies provide rich, in-depth information collected by case reporters who highlight aspects of the case that she or he thinks best describes those particular circumstances (Yin, 2009). While they accurately describe the particular, it is less clear whether the reported circumstances would apply in different situations. One technique used to reduce the particularities of the case studies was for each case to investigate a different example of open practice to then present a collective picture of OEP.

In order to provide guidance regarding the amount of information, and the type of data required in each short case study, a template was developed and tested by the project team. Case studies from international reference group members and international events attended by project team members supplemented the cases documented by the partner institutions. A total of 22 case studies were collected. The case studies can be accessed directly from the project website http://openedoz.org/case-study-themes-2/.

OEP recommendations and strategies for national action emerged from the analysis of these case studies and workshopped at national and international events. These events included:

- International Think Tank – Sydney, Nov 2014;
- Universities Australia Satellite Event – Canberra, Mar 2015;
- National DVCA briefing – Sydney, Oct 2015;
- Education without Borders conference – Albury, Nov 2015.

This strategy enabled the results of this analysis to be considered by key stakeholders within the higher education sector to ensure that the recommendations provided by this project were truly beneficial to the advancement of OEP in Australia. Feedback and suggestions provided by these stakeholders on the case study analysis during these events were collected and then incorporated into the roadmap where appropriate. Below, we discuss the analysis of the short case studies in detail.

Case Study Analysis

In order to better target the types of case studies that would be of benefit to the project, a Theme Matrix was developed and continuously modified as case studies were developed (http://openedoz.org/case-study-themes-2/). The initial themes were derived from international literature and projects on OER policy including 2012 Paris OER Declaration (2012), Commonwealth of Learning (2015), Policies for OER Uptake project (POERUP, 2014), and Open Education Quality Initiative (2011). The top 10 OEP themes that emerged from this analysis were: Student Voice, Institutional Strategy, National Policy, Student Co-creation, Course offered as OER, Degree design based on OER, Module based on OER, Credit Transfer, Accreditation of informal & non-formal learning, and Open Licensing.

A network analysis of the individual case studies was undertaken to discover which components were related to each other and the strength of the association that existed between those elements. This analysis was used to devise a systemic view of who and what influenced open education practices and reveal the patterns within those interactions (McCabe, 2007). It was expected that a visual representation of these patterns would open up alternative interpretations of the complexity and dynamic nature of the interactions than those offered by an in-depth analysis of any particular element alone (see Figure 1). The network analysis looked at whether any relationships identified by the case reporters existed across the case studies. The focus was on the relationships between elements rather than on the individual elements themselves. The relational data that formed the network came from incidental descriptions of connections mentioned in the case studies. These elements were classified and entered into a frequency table with one representing a relationship and zero for no relationship. The resulting matrix formed the basis for the graphic representation of a set of objects connected by links that describes some kind of relationship. The size of the object in the network represented the frequency in which it was mentioned as the object of a relationship (ranging from once for graduates to 22 times for staff). The number of times a relationship was mentioned determined the thickness of the line that linked two objects. All the links between elements were put together to form a network with the closeness of objects defined as the shortest path connecting one element to another (ranging from 2 connections for graduates to 29 connections for staff). Relationships were labelled with the descriptor chosen by the case reporter and a case identifier, with 'awareness' the most commonly used descriptor across the network.

During this analysis, two main clusters and another minor cluster emerged. The strongest cluster of associations was the relationship between the words staff, institutions and students. The strongest bonds that build these relationships came through awareness and sharing. A second set of associations was between institutions, staff, textbooks and resources with the relationships structured around finding OER. The third set of associations was a triad between resources, students and National Policy where the significant issue was about cost.

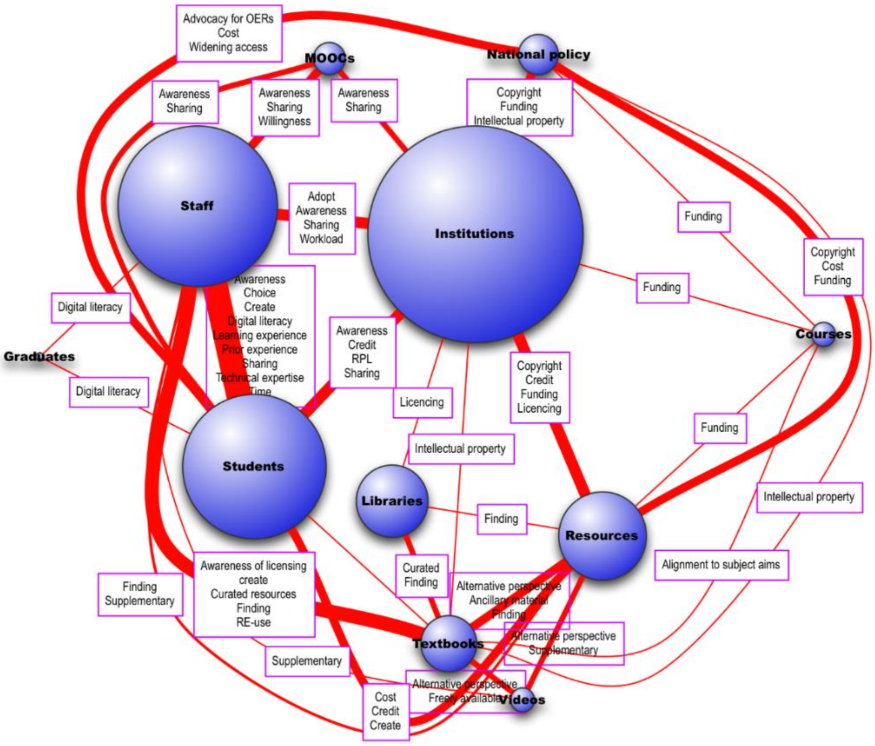

Figure 1: Network analysis of the project case studies

Recommendations for national action

The OpenEdOz project derived three key recommendations for national action from the case study analysis and the feedback from key stakeholders:

1. Agree on a national strategy to leverage contemporary information technology for improving productivity of higher education through use of Open Educational Resources
2. Fund a national body to drive the strategy development
3. Engage relevant national organisations in implementation of elements of the strategy as per the OpenEdOz National Roadmap (Wills et al., 2016)

A number of suggested individual strategies that could contribute to national action are also provided in the Roadmap to a National Strategy (please see Table 1). The Roadmap outlines 10 signposts and 25 contributing strategies which point the way for what a national strategy could look like as well as highlight relevant national organisations that can facilitate action.

Table 1: Roadmap to a National Strategy

Signpost	Contributing Strategies	National Organisations
Advocacy	1. Organise Australian summits, conferences, workshops and develop/collect resources to raise awareness of the importance of open education at the intersection of university business models and university knowledge transfer/social justice commitments	UA, AGDET, ACODE, CAUL, CADAD, CAUDIT, ODLAA. ASCILITE
Students	2. Define new Open Education Literacies as part of Digital Literacies and Information Literacies 3. Research and evaluate student real use and understanding of open resources and open courses in particular their expertise in creation and their understanding of academic integrity in acknowledgment of open sources	UA DVCAs, AGDET AGDET, NUS
Teachers	4. Review foundation teaching courses for university teachers to facilitate understanding of open educational practice and model best practice by using open content in the courses	AGDET, UA DVCAs, CADAD

	5. Weight awards and grants towards teachers' adaptation and use of OER (versus development of new OERs) 6. Encourage and reward the diversity of academic teaching-related roles that flow from potential disaggregation of university services e.g. assessment and RPL expertise 7. Foster community of practice for open resources developers and build their understanding of Open Design	AGDET, CADAD UA, DVCAs ACODE, ASCILITE
Standards	8. Review institutional strategic plans, course policies and RPL policies in light of impact of open content and student-driven degrees on degree pathways, course coherence, evidence of meeting standards	UA, TEQSA
Intellectual Property, Licensing & Copyright	9. Review and report intellectual property policies in education and widely disseminate understanding of the reform 10. Facilitate wider use of Creative Commons licensing – refer universities & academics to forthcoming Toolkit 11. Promote and prepare for libraries role in curating both open and closed resources, in particular student-created open resources 12. Promote development and adoption of open textbooks 13. Establish national support for peer review of open educational content	Aust Digital Alliance, National Copyright Council, Creative Commons Australia, AUSGOAL UA, ACODE, CADAD, NCU ASCILITE, CAUL ACODE, CAUL AGDET, ASCILITE
ICT Infrastructure	14. Accelerate roll-out of broadband access to regional areas in order that no learner is disadvantaged in open use of high quality digital resources by university courses 15. Provide access to a free open platform for delivering open courses 16. Underpin portfolio degrees and student mobility by confirming national collaboration on Digital Student Data Project as per Groningen Declaration	NBNCo, CAUDIT, AARNet OUA UA DVC Corp
Research	17. Facilitate on-going educational research and benchmarking on open education and open design in conjunction with international projects	AGDET, ACODE. ASCILITE
Discoverability	18. Build on Australia's progress with Open Access for research outputs by adding mechanisms, metadata and rewards for sharing educational resources 19. Create "open" librarian roles and "open" educational developer roles for working with academics to discover, evaluate and adapt OERs 20. Build on past experience nationally and internationally that discoverability is best enhanced via discipline-based approaches	AGDET, CAUL, ACODE, AUSGOAL CAUL, ACODE Australian Councils of Deans
Collaboration	21. Foster national and international partnerships for open education and revisit potential broader role for Open Universities Australia 22. Support collaboration across professional groups e.g. librarians, educational technologists, academic developers 23. Foster OEP as a platform for Regional Development 24. Establish productive partnerships with museums and galleries in curating content for openness	UA, OUA, AGDET CAUL, CAUDIT, ACODE, CADAD UA DVC Corp Council Australasian Museum Directors, ABC, SBS, NBNCo
Sustainability	25. Promote OERs as supportive of universities' sustainability goals including efficiencies in production of digital learning resources	UA, AGDET, CAUL

Please find a list of abbreviations of the above national organisations at http://openedoz.org/resources/

Conclusion

This paper presented and discussed key elements of an AGDET funded project titled *Students, Universities and Open Education* (OpenEdOz) *Project*. One of the project's main deliverables was a National Policy Roadmap that is intended to directly support the Australian federal government to take advantage of the full potential of OEP for the Australian higher education sector. The Roadmap to an OEP National Strategy was informed by a series of short case studies that explored national and international OEP projects and initiatives. The project team hope that this Roadmap will further inform national level decision makers of the issues to consider while engaging with OEP. We also hope this roadmap will encourage the development of OEP focused policies and regulations at national levels, so that the Australian higher education sector will be able to fully take advantage of the already globally recognised opportunities of OEP. In addition, national education bodies including ASCILITE need to be fully engaged as the drivers of Australia's OEP Strategy for universities. We invite them to place OEP firmly on their agenda but to do so with a practical and deep understanding of what constitutes "open".

References

Bossu, C. (2016). Open Educational Practices in Australia. In F. Miao, S. Mishra, & R. McGreal (Eds.), *Open Educational Resources: Policy, Costs and Transformation*. France & Canada: UNESCO and Commonwealth of Learning.

Bossu, C., Brown, M., & Bull, D. (2014). *Adoption, use and management of Open Educational Resources to enhance teaching and learning in Australia.* Sydney: Australian Government Office for Learning and Teaching. Retrieved from http://www.olt.gov.au/system/files/resources/CG10_1687_Bossu_Report_2014.pdf.

Commonwealth of Learning. (2015). *Guidelines for Open Educational Resources (OER) in Higher Education* (2nd ed.). Canada: UNESCO/Commonwealth of Learning. Retrieved from http://unesdoc.unesco.org/images/0021/002136/213605e.pdf.

Johnson, L., Levine, A., Smith, R., & Stone, S. (2010). *The 2010 Horizon Report*. Retrieved from Austin, Texas:

Kanwar, A., Kodhandaraman, B., & Umar, A. (2010). Toward Sustainable Open Education Resources: A Perspective From the Global South. *American Journal of Distance Education, 24*(2), 65-80. doi:10.1080/08923641003696588

McCabe, J. (2007). *Network analysis, arquitecture and design*. USA: Elsevier Inc.

OER Foundation. (2011). OER Foundation FAQs - What are OERs? Retrieved from http://wikieducator.org/WikiEducator:OER_Foundation/FAQs/Open_Education_Resources/

Open Education Quality Initiative. (2011). *Beyond OER: Shifting Focus to Open Educational Practices*. Retrieved from https://oerknowledgecloud.org/sites/oerknowledgecloud.org/files/OPAL2011.pdf

POERUP. (2014). *Policies for OER Uptake*. UK: European Commission. Retrieved from http://poerup.referata.com/w/images/2011_4021_FR_POERUP_pub.pdf.

UNESCO. (2012). 2012 Paris OER Declaration. *World Open Educational Resources (OER) Congress*. Paris: UNESCO. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/Events/Paris%20OER%20Declaration_01.pdf.

Wiley, D., & Gurrell, S. (2009). A Decade of Development. *Open Learning: The Journal of Open, Distance and e-Learning, 24*(1), 11-21. doi:10.1080/02680510802627746

Wills, S., Alexander, S., & Sadler, D. (2016). *Students, Universities & Open Education*. Sydney, Australia Australian Government Office for Learning & Teaching. Retrieved from http://openedoz.org/resources/

Yin, R. (2009). *Case study research: Design and methods* (4th ed.). California: Sage Publications, Inc.

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Digital equity and social justice: Whose reality? Reflections from South Africa

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In this paper, the notion of social justice is premised on access to quality, affordable education and digital equity is understood as a leveller of society, a key stimulus for socio-economic growth and development, and a prerequisite for social justice. The ongoing global impetus towards increased digital access and the incremental uptake of ICTs into the traditional higher education space is not only reshaping our understanding of education globally, but it is also evidencing, through research and the benefits of time, a more sober and realistic portrayal of the affordances of digital access and technology in higher education. The emerging picture paints a cautionary tale, particularly in regard to the lived reality of digital equity and social justice in the developing world context. This paper takes the form of an exploratory study of limited scope, of the challenges around digital equity and social justice in distance education, from a developing world perspective. A counter narrative to the prevailing voices and hegemonies is offered to trouble some of the assumptions in dominant discourses, as motivation for a more realistic, contextualized and equitable appraisal of digital equity and social justice. The University of South Africa is used as a point of reference, given its status as the single dedicated comprehensive distance education institution in South and Southern Africa, the largest on the African Continent and one of the world's mega institutions.

Keywords: Policy, context, quality, social justice, digital equity, developing world

Introduction

The digital revolution has been so enduring, far-reaching, pervasive and impactful, that it is increasingly referred to as the "4th Industrial Revolution" (Florindi, L, 2014). Information and communication technologies (ICTs) are the backbone of this revolution. Now, more than ever before, the future of countries, businesses, higher education institutions and individuals will depend on whether, and the extent to which, digital technologies are embraced and utilized effectively. Digital access and the ability to embrace technologies is thus a predictor of future flourishing.

The impact of the digital revolution on higher education has contributed to its internationalization and commodification to the extent that is has become a multinational export industry, meriting its own category in the General Agreement on Trade and Services (GATS). (WTO, 2001). Education is now as much a service that can be bought and sold, as it is a fundamental human right and a public good. Students are called "clients", intellectual property is bought and sold, and those who cannot afford education or who do not have digital access remain largely excluded. The traditional notion of the university as a public good and the primacy of academic freedom and institutional autonomy are increasingly being challenged by the relentless demand for marketable knowledge and skills that will grow economies and make profits. In this view "public good" is being re-conceptualized to include a good return on investment and a profit. (Naidoo, 2003).

Perhaps the most remarkable aspect of the digital revolution is the perceived value of digital access and ICTs as a means of achieving social justice and human flourishing. Unfortunately, inasmuch as we acknowledge the value of digital access and technology adoption as a stimulus and driver of social justice, the majority of those who stand to benefit most from their affordances are not yet connected and this is deepening the digital divide, rather than diminishing it. Nevertheless, on the back of this perceived value and belief, as well as assertions of the universality of technological innovation, application and implementation (which has often put potential before pragmatism) significant pressure has been exerted on higher education institutions in the developing world, including South Africa, to use the economies of scale inherent in ODeL to provide access (and social justice) to the millions of students who are locked out of higher education by dint of personal circumstance.

The Policy for the Provision of Distance Education in South African Universities in the Context of an Integrated Post School System (2014) contextualizes DE in South Africa as follows:

> In recent years, distance education has formed a vital part of the university sub-system, contributing approximately 40% of headcount students and approximately 30% of FTE students. It has provided extensive opportunity to those students who were unable, or wished not, to participate in campus-based and fixed time study, including provision of access for those who experience a range of barriers to learning. Furthermore, distance education has played an important role in providing discrete modules which have allowed students at contact institutions to complete their studies without needing to register for a whole semester or year of additional campus-based study. The further development of distance provision needs to be guided within the broad goals of policy - ongoing transformation of the university education, and increasing access and success, particularly for non-traditional students.

The policy demonstrates the acceptance of distance education as: a key part of South Africa's higher education sector; its seminal contribution to throughput, success and graduation rates in the country; and its critical function as a vehicle for access to higher education and for personal development, where this would not be possible otherwise.

However, despite the promise of technology to break the "Iron Triangle" of "Access, Cost and Quality" (Daniel, J *et al*: 2009) particularly through Open and Distance Education, it is becoming increasingly evident that the divide between the so-called "developed" and "developing" nations, has in fact deepened, largely as a result of a continuing lack of access to the internet in the developing world. (World Bank, 2016). This poses a number of challenges for ODeL in the developing world context, which will be discussed below.

Clarification of Terms

In this paper Distance Education (DE) is used in the context of the definition provided by Keegan (1995.p5) who asserts that distance education and training result from the technological separation of teacher and learner which frees the student from the necessity of travelling to a "fixed place, at a fixed time, to meet a person in order to be trained." This supports the traditional generic notion of distance education, and is often, but not specifically, linked to the older correspondence mode of delivery. The Commonwealth of Learning (CoL) (2000.p1), defines Open Distance Learning (ODL) as "A way of providing learning opportunities that is characterized by the separation of teacher and learner in time or place, or both time and place; learning that is certified in some way by an institution or agency; the use of a variety of media including print and electronic; two-way communications that allow learners and tutors to interact; the possibility of occasional face-to-face meetings; and a specialized division of labour in the production and delivery of courses." Tony Bates (2008) defines e-Learning as "all computer and Internet-based activities that support teaching and learning – both on-campus and at a distance." These three definitions provide evidence of the historical progression of distance education provision, and in this paper the terms are interrelated, but not synonymous, and they have been used interchangeably, according to the context of the discussion.

Digital Equity in this paper is understood in terms of the following definitions:

> Digital equity in education means ensuring that every student, regardless of socio-economic status, language, race, geography, physical restrictions, cultural background, gender, or other attribute historically associated with inequities, has equitable access to advanced technologies, communication and information resources, and the learning experiences they provide….Digital equity also means that all learners have opportunities to develop the means and capacity to be full participants in the digital age, including being designers and producers (not only users) of current and future technologies and communication and information resources. (Solomon, Allen, & Resta, 2003)

This definition is supported by the *Panel on Digital Equity in Developed and Developing Countries* who assert [that] "digital equity can be a state in which both the digital divide and the participation gap are bridged." (DEDDC 2015)

Social justice is understood in line with definitions of Bell (2016); SA Government (RSA, 2016); and Gerwitz and Gribbs (2002). Bell (2016, p3) asserts that social justice is "…both a goal and a process the strives for full and equitable participation, of people from all social identity groups in a society that is mutually shaped to meet their needs, by means of a democratic and participatory process that is respectful of human diversity and group differences, and inclusive and affirming of human agency and capacity for working collaboratively with others to create change. Domination cannot be ended through coercive tactics that create domination in new forms." *Social justice* in South Africa refers to the extension of principles enshrined in its Constitution (1996) of human dignity, equity, and freedom to participate in all of the political, socio-economic and cultural spheres of society. Gerwitz and Gribb's (2002) plural conception of social justice views social justice as possessing a variety of facets that entail the equal redistribution of socio-economic amenities, as well as the recognition and promotion of difference and cultural diversity (Gerwitz & Gribb, 2002 p499)

Methodology

In preparing this paper a literature search was conducted of relevant literary sources, legislation and policy, reports, research reports and articles, journal and press articles, Internet and social media sources and other relevant information on issues relating to digital access, ICT uptake and social justice in Open, Distance e-Learning (ODeL) globally and in South Africa. Literary sources and articles relating to socio-economic development issues in South Africa and on the continent were also interrogated as these not only highlight additional challenges facing higher education and distance education provision, but they also provide the framework within which such challenges are occurring, particularly in terms of socio-economic, technological and communication dynamics, locally and globally.

Locke, Spirduso and Silverinan (1987) are of the opinion that the researcher's perceptions could make a positive, rather than a detrimental contribution to the research. *Standpoint Theory* similarly posits that that authority is rooted in an individual's knowledge and perspectives, which are shaped by his or her social and political experiences. Standpoints are multifaceted rather than essentialising and the consolidation of a person's many experienced dimensions form a point of view, or "standpoint" through which he or she sees and understands the world. Emphasis is placed on the use of the everyday experiential, concept of knowing as epistemology. This standpoint "shapes which concepts are intelligible, which claims are heard and understood by whom, which features of the world are perceptually salient, which reasons are understood to be relevant and forceful, and which conclusions credible". (Sprague-Jones, & Sprague, 2011)

In this view it can be stated that my personal experiences and understanding of this topic have been informed, deepened and moulded by my employment at the University of South Africa. Furthermore, as a Director in the Office of the Principal, my research responsibilities have, over the years, provided me with broad and in-depth exposure to a variety of higher education policy, trends and dynamics at global, continental and national levels. Secondly, my involvement in a number of institutional strategy and planning activities, as well as other executive management activities, have exposed me to a level of institutional knowledge and understanding that would be difficult to acquire elsewhere in the institution, or externally. I have access to primary institutional resources, as well as the views of experts at the university and in the sector. Thirdly, I am a UNISA graduate at both undergraduate and postgraduate levels, and as such I have first-hand experience and knowledge of ODL from the student's perspective. This means that I have brought to the study knowledge, sensitivity and an awareness of the many challenges faced by higher education, higher education institutions and students, especially ODL students in the current policy environment, both globally and nationally, particularly in regard to issues of digital equity and social justice.

I am aware that my acquired knowledge and experience has brought to this paper certain assumptions and biases. Although every effort has been made to ensure objectivity, these biases may have shaped the way in which I viewed, understood and interpreted the resources consulted. However, I feel that my knowledge and experience may also provide a depth to the analyses which may otherwise have been absent and in line with Standpoint Theory, they reflect my understanding of the world. This paper was therefore approached from the perspective that the current emphasis on digital equity through access to and the uptake of ICTs in higher education delivery, especially in ODL as a prerequisite for social justice, largely reflects dominant "western" or "developed world" views and assumes a universality of application and experience that does not necessarily reflect the lived reality, or possible viable alternatives and narratives of the developing world, in this case, as represented by UNISA.

The Relevance of Context

While the 21st Century higher education institution is undoubtedly reorienting itself to new ways of thinking and doing, it will need to do so cognizant of its national and global contexts.

The Policy Context

At a global level the UNESCO *Position Paper on Education Post-2015* raises and addresses higher education dynamics that have emerged and been added to the remit of higher education responsibilities in the 21st Century. These include primarily, a growing social and sustainability transformative dimension that focuses on the wellbeing of people and their right to an improved quality of life through quality education, as well as the notion of "responsible citizenship". (UNESCO 2015b:3). A number of guiding principles are proposed to guide the future education agenda, including: education as a fundamental human right[5] which contributes significantly to the realization of other rights; education as a public good requiring the participation of all stakeholders for quality education; education as a foundation for human fulfilment, peace, sustainable development, economic growth, decent work, gender equality and responsible global citizenship; and education as a key contributor to the reduction of inequalities and poverty by bequeathing the conditions and generating the opportunities for better, sustainable societies." (UNESCO 2015c, 3:13) The Position paper further states: "The use of technology for online and distance learning will become a critical component in the provision of quality education (UNESCO 2015d, 5:17).

One discerns in these guiding principles a clear commitment to social justice through access to education, as well as a focus on responsible global citizenship and stakeholder and community participation. There is a strong emphasis on the reduction of inequalities and poverty towards more sustainable societies. This speaks at a fundamental level, to social justice through access to education. The primary means of ensuring such access is undoubtedly deemed to digital access and technology. It is suggested that access to quality education and access to digital capacity and technologies have over time become mutually dependent. Globally ODeL is seen as a primary means of accommodating both of these imperatives.

At national levels higher education institutions function within disparate policy and regulatory environments which are aligned to national needs, while being cognizant of global policy imperatives. This is also true of ODeL, which is manifestly different in terms of its understanding, conceptualization and delivery model from one country to the next.

An example of such a policy and regulatory influence can be seen in the Protection of Personal Information Act, 2013 (RSA, 2013) newly promulgated in South Africa, and the Patriot Act 2001, (USA, 2001) recently amended, in America. Both have very significant implications for higher education institutions and for ODeL in particular, in an increasingly digitized environment, specifically as it pertains to the vast data banks of personal information of hundreds of thousands of students. At the university of South Africa enrolments in 2015 stood at 354 802 students, which represents a large amount of data that is very valuable in terms of data mining and analytics, but which is subject to very strict privacy and protection regulation.

UNISA as representative of the developing world context

The University of South Africa has a rich and illustrious history as an exemplar and representative of ODeL in the developing world. UNISA has exerted a fundamental influence and impact on DE continentally and globally and continues to do so. The Founding of the African Council for Distance Education (ACDE) at Egerton University in Njoro, Kenya in 2004, was conceived at the Standing Committee of Presidents and Vice-Chancellors (SCOP) at the International Council for Distance Education (ICDE) held at UNISA in October 2002, **t**o further the aims of ODL provision in Africa, which at that time did not have its own association of distance education providers. UNISA's Principal and Vice Chancellor is also the President of the International Council for Distance education (ICDE). UNISA's long history

[5] Article 26, Universal Declaration of Human Rights (1948), and the UNESCO Convention against Discrimination in Education (1960).

UNISA is the only dedicated comprehensive distance education in the country and the largest on the Continent. UNISA offers both formal and vocational qualifications from diploma and undergraduate degree level to doctoral level, as well as a number of short learning programmes (SLPs) that comprise a very small percentage of its very substantial Programme and Qualifications Mix (PQM). UNISA is a key pillar of South Africa's higher education sector and is subsidized by the state at 50% of the face-to-face subsidy levels at undergrad level. At post grad levels UNISA receives the same funding as South Africa's face-to-face institutions. UNISA's offerings are quality assured, accredited and mainstreamed in South Africa's higher education system. UNISA is the largest higher education provider in South Africa, enrolling approximately 40% of South African university students (RSA,,2014a). While third stream income is a definite consideration, it is not core business. UNISA's education duties are set out in a Higher Education Act (1997), an Institutional Statute and various other related policies and regulations, which are aligned to the country's National Development Plan (NPC, 2011).

In 2015 UNISA graduated 40 046 students. This number comprises undergraduate degrees, diplomas and certificates, honours, masters and doctoral degrees and other post graduate qualifications (RSA 2014b). The majority of UNISA's peers from across the globe cannot make the same claim. Very few, if any, produce the volume of quality assured, accredited graduates that UNISA does, and few can equal UNISA's almost one-and-a-half centuries of existence and experience. UNISA's traditional benchmark peer, the Open University of the United Kingdom (OUUK) recently changed its business model and is in the process of adjusting to the effects of its implementation. (Havergal, 2016) The OUUK can no longer be used as a benchmark.

UNISA's strategy is underpinned by a commitment to social justice, which it aims to achieve by leveraging the affordances of technology. UNISA currently uses a blended model but plans to move increasingly online as the national socio-economic context allows. However, several key challenges must however be overcome if this is to be achieved. These challenges can be identified as: access to technology resources (including connectivity, hardware and software); concerns around quality; culturally relevant and responsive content (including its creation); and human ICT capacity and skills

Barriers to Social Justice

Access to Up-to-Date Hardware, Software, and Connectivity

There is a yawning gulf globally and nationally, between those who have access to the internet and those who do not and even where there is access, between its speed, reliability, cost and affordability. Successful quality ODeL is contingent upon available, affordable, reliable high speed internet connectivity. In most developing world contexts this is not available nor is it likely to be a reality any time soon.

Even within countries such as South Africa, where 52% of people purportedly have access to the internet at home, this is likely to be via mobile phones connecting to cellular providers' masts and not via personal computers or other such devices connecting via Wi-Fi. Most homes in South Africa do not have Wi-Fi. Furthermore, connection and download speed remain hugely problematic. This is especially challenging in regard to establishing an efficient and an effective transactional environment for students, not to mention a quality teaching and learning (and assessment environment.
Stanlib (2015) asserts:

> The global average connection speed is 5Mbps while the global average peak connection speed is 29.1 Mbps. South Korea has the world's fastest average internet speed, at 25.3 Mbps, although Singapore has the fastest peak speed at 98.5 Mbps, followed by Hong Kong (92.6 Mbps), and South Korea (79.0 Mbps). South Africa chugs along with an average connection speed of only 3.4 Mbps, and a ranking of only the 90th fastest average connection speed in the world. South Africa's peak connection speed was measured at 16.8 Mbps in the first quarter of 2015, giving us a world ranking of 112th. So, in practice, while you load a YouTube video in South Africa, you can press the down arrow to play a game of Snake before the video loads.

The cost of data in South Africa also remains an intractable problem that continues to have a deleterious impact on d social justice through to the equitable delivery of ODeL. The majority of students are only able to access the internet via their mobile phone or via computers at their places of work, study centres, or internet cafes. Furthermore, expecting students to use their phones for study does little to promote social justice as the costs for downloading or uploading materials, and communicating with the institutions gets transferred to the students who are simply not able to purchase large volumes of "airtime".
Stanlib (2015) further asserts [that]

> Data released in a survey done by the SA Institute of Race Relations indicates the average monthly cost of broadband South Africa is more than 10 times higher than in the UK. In comparison, it found that the UK enjoys a broadband speed that is five times higher than South Africa's. Another instance, South Africa's broadband speed is about a fifth of that of the US but its average monthly broadband cost is over five times as high as that of the US. The average cost of broadband for a South African internet user is around R337 a month. For the average user in the UK, the cost is about R36 a month. Not only are the UK and US's services cheaper, they are also faster and have a higher amount of users.

The implication of these structural, socio-economic and political realities in South Africa has meant that UNISA has had to align its business model with the realities of the context in which it functions, and this is impeding its commitment to digital equity and social justice.

Concerns Around Quality

An incontestable correlation between poor quality education and low learning levels and learning deficits or inequalities, has ensured that the provision of quality education remains at the forefront of the global education agenda. This concern has been bolstered by an increasingly fragmented global higher education environment and various new conceptualizations of "education" stemming from the affordances of technology, globalization and marketization, as well as an appreciation of the fact that equitable access to quality education is an indisputable prerequisite for social justice.

21st Century graduates are generally perceived to be under-prepared for the world-of-work, especially in developing nations. Dibba-Wadda (2016) states: "….employers are still complaining that universities have failed to produce graduates with the right skills, leaving many graduates unemployable."

Further exacerbating the problem, attempts to achieve some kind of consonance between existing quality assurance (QA) frameworks are hindered by legal and administrative restrictions, including, for example, national legislation and higher education policy; qualifications authorities and policy; customs; visas; telecommunication laws; and intellectual property rights. (Van Damme, 2001: pp 420 – 430.) In addition, the level of institutional commitment to internationalization, the involvement of academic authorities, the extent of quality metrics in national policies, levels of funding and the role of strategic leadership at an institution, especially in regard to the acceptance, adoption and implementation of corporate governance and citizenship principles, all contribute to impeding or facilitating shared quality principles. The majority of these challenges have become more complex with the increasing uptake of ICTs.

Not surprisingly, there is growing recognition and agreement that the development of generic quality values and principles that are universally practicable, currently presents the most viable and feasible option for a shared global quality framework. The subsequent adaptation and formalization of these generic principles and values into individualized quality assurance frameworks and guidelines for higher education institutions, for use in curriculum and pedagogical reform, will ensure a measure of global conformity and consonance in regard to Quality in higher education, which currently does not exist.

This need prompted the Council for Higher Education Accreditation International Quality Group (CHEA/CIQG) [6]to draft "seven (7) guiding principles ….intended to serve as a framework for international deliberation about quality in higher education. Their aim is to seek common ground and establish a foundation for understanding quality" (CHEA/CIQG: 2015)

Establishing appropriate, relevant synergies between policy/context and quality will require not only a fundamental re-envisioning of understandings and practice of higher education quality in an environment of quite dramatic growth and transformation, but also of the nature of the education provided, be it formal credentialized, informal or social for-profit, or completely free. At the moment there are no truly satisfactory answers. There is talk of badges, credits, certificates, of OER, virtual and online universities, of joint degrees, of sharing courseware and institutional capacities, of having the student pay for assessment via the institution that will confer a formal qualification, and so on; but so far we have not been able to provide the kind of quality assurance that will give these modes of provision the gravitas and status that would ensure mass buy-in and uptake.

Culturally Relevant and Responsive Models and Content (Including Its Creation)

Over time the Western World has offered some excellent models of ODeL (Moore and Kearsley 2005: 23-24; Taylor; 2001) setting out "phases" or "generations" of distance education which are aligned to technological development in their countries. Yet, as comprehensive as these are, they do not provide a suitable fit for many of the DE institutions in developing nations, which are premised on a world views, cultures, contexts and needs that are inherently different. How, in such models, does one for example, factor in the realities of a yawning digital divide within the same institution and nationally; national socio-economic and cultural disparities and backlogs; political whimsy; excruciating and disparate levels of poverty; and little or no access to the internet? These are the realities of the developing world and it should be acknowledged that ODeL models need to be context-bound conceptually, and not externally imposed or assumed to be universal in line with technological developments.

When it comes to digital equity and social justice, the question thus arises as to how students who have varying levels of access and opportunity may nevertheless be afforded the opportunity of a quality education. While higher education institutions are unambiguously tasked by global sentiment, policy and commitment to be [the] "foundation for human fulfilment, peace, sustainable development, economic growth, decent work, gender equality and responsible global citizenship" and "a key contributor to the reduction of inequalities and poverty by bequeathing the conditions and generating the opportunities for better, sustainable societies" (UNESCO, 2015f: 13, 3).This presents a number of complex challenges. Infrastructural lacks, entrenched and persistent poverty, a lack of political will and political whimsy, cultural diversity and a host of well documented socio-economic and political factors continue to exclude a majority of potential higher education students in the developing world.

Anecdotal evidence as captured in the e-mail below, received from a University of South Africa student encapsulates the dilemma faced on a daily basis, ODeL providers and students in developing nations, where access to the internet and the affordances of technology, which are the bases for digital equity and social justice, are regularly juxtaposed and in conflict with the lived realities of infrastructural and socio-economic lacks and lags, as well as cultural practices and demands that regularly militate against their attainment.
In this instance the student had clearly done the work. Her dilemma is self-explanatory. She explains as follows:

> I received my assignment which was mailed back to me. I had a letter which says, that my assignment was not marked because I did not submit it online. My question to you guyz is. I had to attend a funeral in Rural Eastern Cape and I had no internet connection therefore I submitted my assignment via post. How can we move forward about this? Please. Please find attached documentation[7]

[6] The CHEA International Quality Group (CIQG) is a rewarding and important forum for colleges, universities, accrediting and quality assurance organizations and others worldwide to address issues and challenges focused on quality and quality assurance in an international setting.
Accessed: http://www.cheainternational.org/

[7] The Student name and number have been withheld in compliance with South Africa POPI Act 2013

The dilemma facing the university with in excess of 350 000 students is that the system for this course was set up in such a way that the work had to be submitted online. Failing direct intervention this student would have been denied access to her final examination, and social justice.

This simple missive encapsulates the polemic around the notion of digital equity and social justice and the extent to which this is bounded by geographical location, contextual realities and most importantly inherited and sustained structural and systemic business models, and processes that are western in conceptualization and application and that are increasingly dissonant with growing assertions of "otherness" as it pertains to culture and identity. This is the reality of ODeL in a developing nation especially with their very diverse student profiles, and the question arises as to how under these circumstance, genuine and general digital equity and social justice can be achieved, on scale (if at all). In this view, digital equity and social justice remain an intractable striving.

UNISA's transformation trajectory has brought with it the realization that traditional DE delivery pedagogies and epistemologies conceptualized predominantly in the so-called "West" are becoming increasingly dissonant with, and a barrier to, the articulation of African identity and culture and the concomitant development of African epistemologies. The current violent #*fees-and-coloniality-must-fall* movement[8] that is paralyzing so much of the higher education sector in South Africa is symptomatic at a very deep level of centuries of accumulated rage, disappointment and frustration with an education environment that has been shaped and imposed by "others," and with epistemologies that have continued to assert so-called "colonial" discourses and canon at the expense of the development of African ones.

The dominance of the western narrative and world view is in fact so deeply entrenched that context is routinely universalized with the assumption that is the lived experience of the *world* [my emphasis]. For example, Harvard University has recently been in the news as it celebrates one of the longest studies on human happiness. The Harvard Grant Study claims to be an incredibly in-depth study spanning 75 years, studied human happiness. It also claims to be one of the largest and comprehensive studies in history, even though the population (which was identified in 1938) comprised 268 Harvard undergraduate men from all walks of life, who were followed for 75 years, and measured on aspects such as intelligence levels, alcohol intake, relationships and income. In 2012 their "astonishing" findings were published in a book titled *Triumphs of experience: The men of the Harvard Grant Study*. Vaillant, G. E. **(**2012). Vaillant describes the study as being the only one of its kind not just because it happened over such a long period of time, but because the 268 men allowed researchers to present their lives in a three-dimensional way, resulting in a book is a combination of statistics and anecdotes about the *human* experience [my emphasis].

This writer will not venture into a criticism of the research methodology and selection of the population which amongst others, excluded females and other ethnic groups. These have been dealt with by many commentators and are not the focus of my critique. Of concern is the assumption that the population of men can provide evidence of what determine *human* happiness and *human* experience and not merely happiness in the context of predominantly white male America. The universality of the findings is assumed in all of the commentary that the study has elicited. What constitutes happiness is as diverse as humankind itself, but the assumption of universality suggests a narrow world view that is not sensitive to the contexts and cultures of the rest of the world.

The foregoing discussion speaks to the counter narrative of developing world educationists and researchers that must surely be accorded space and respect as it addresses digital equity and social justice from multiple platforms of redress and asserts its voice as a peer, and not as a voice from the sidelines of global higher education.

At the same time it must be acknowledged that the development of African ODeL models and epistemologies and the assertion of the African voice into the global higher education narrative can only happen where there are sufficient numbers of appropriately skilled and capacitated academics and support staff, and this critical issue is addressed below.

[8] The #FeesMustFall campaign began on 10 March 2015 a group of University of Cape Town students flung human faeces on the statue of Cecil John Rhodes calling for the monument to be taken down and asserting their disgust and protest at this ever-present reminder of continued white supremacy and colonial oppression at the university. This #RhodesMustFall movement found its echoes in campuses across the country, generating a momentum that contributed to the #FeesMustFall movement, which soon engulfed many higher education institutions. What started as resistance to fee increases for 2016 subsequently morphed into a campaign against any form of university fee payment and this was swiftly followed by the #OutsourcingMustFall campaign which demanded that general workers employed by external companies and "outsourced" to universities, be absorbed into the staff complements of universities, along with significantly increased salaries and conditions of service. The "Decoloniality" demand issue has emerged together with the fees issues as the second critical demand.

Contrary to popular opinion, quality ODeL is not cheap**,** despite the perceived potential of large scale delivery. Course design and development for quality online education is a specialised field requiring trained developers, and getting the supporting systems in place is an extremely costly exercise. It takes time - a long time - to create anew or convert (and quality assure) existing courses into online format, especially where there is a quality assurance regime in place. There are significant logistical considerations in terms of timelines, staff training (professional development for faculty), student support and implementation, assessment models, monitoring and evaluation. There are also leadership, cultural and governance dynamics that have to be addressed, including for example, fears around job losses or redundancy, staff (and some student) resistance to the uptake and learning of new technologies, as well as a multitude of unanticipated technological and political challenges, which can be extremely onerous and costly to resolve. How, in this type of context, will we quality assure ODeL on scale, towards the social justice that seems to remain so elusive? Digital equity will, one suspects, not come from access and scale, but rather from political will and higher education and institutional analytics, and equally importantly, capacity development, which will improve the learning experience and enhance student support.

Conclusion

While higher education institutions are unambiguously tasked to be promoters of digital equity and social justice, this presents a number of complex challenges. Infrastructural lacks, entrenched and persistent poverty, a lack of political will and a host of well documented socio-economic, political and contextual realities continue to exclude a majority of potential higher education students in the developing world. Furthermore, the ongoing hegemony of the “West” in terms of the production and dissemination of technologies, digital access, knowledge content and cultural capital (which are entrenched via assumptions of their universality) is subduing the counter narrative of developing world contexts and lived realities, continuing its marginalization and domination and hampering the genuine striving for social justice. This is the current reality of ODL (or any form of online education) in a developing nation especially with a very diverse student profile, and the question arises as to how under these circumstance, genuine and general digital equity and social justice can be achieved, on scale (if at all). In this view, digital equity and social justice remain an intractable striving.

References

Bates T. (2008). *What is e-learning?* Retrieved from http://www.tonybates.ca/2008/07/07/what-is-e-learning/.

Bell, L. (2016). Theoretical Foundations for Social Justice Education. In *Teaching for Diversity and Social Justice.* Eds. Adam, M., Bell, LA., Goodman, D.J., and Joshi, K.Y. Routledge, Taylor and Francis, New York.

CHEA/CIQG. (2015). CHEA *International Quality Group International Quality Principles*. www.chea.org/pdf/Quality%20Principles.pdf.

CoL. (2000). An Introduction to ODL. In *An Overview of ODL, a Training Toolkit.* produced by COL in co-operation with the Asian Development Bank and the International Extension College in the UK. Available at: http://www.col.org/ODLIntro/introODL.htm .

Daniel, J., Kanwar, A., & Uvalic-Trumbic,S. (2009). *Breaking Higher Education's Iron Triangle: Access, Cost, and Quality*. http://www.changemag.org/archives/back%20issues/march-april%202009/full-iron-triangle.html.

DEDDC (2015).Vilnius Presentation: *Panel on Digital Equity in Developed and Developing Countries*. www.ifip2015.mii.vu.lt/file/.../DEDDC_Vilnius_presentation_RMO_short_v3_1_.docx.

Dibba-Wadda, O. (2015). In Producing unemployable graduates wastes time and money. *Wachira Kigotho*, *Issue No:359*. Retrieved from http://www.universityworldnews.com/article.php?story=20150319130200274.

Floridi, L. (2014). *The 4th revolution: How the infosphere is reshaping human reality*, Oxford University Press.

Gerwitz, S. & Gribb, A. (2002). Plural conceptions of social justice: implication for policy sociology. *Journal of Education Policy, 17:499-599.*

Havergal, C. (2016). *Open University posts £7m loss as student numbers slump.* Retrieved from https://www.timeshighereducation.com/news/open-university-posts-ps7m-loss-student-numbers-slump.

Keegan, D. (1995). *Distance Education technology for the new millennium: compressed video teaching*. ZIFF Papiere. Hagen. Germany: Institute for Research in Distance Education.

Locke, L. F., Spirduso., W.W & Silverinan, S. J. (1987) *Proposals that work:* A *guide for planning dissertations and* grant *proposals.* Newbury Park, CA: Sage.

Moore, M. G., & Kearsley, G. (2005). *Distance Education: A Systems View*. Second, Belmont, CA: Wadsworth.

Naidoo, R. (2003). Repositioning Higher Education as a Global Commodity: opportunities and challenges for future sociology of education work. *British Journal of Sociology of Education*. *24 (3)*: 249-259.

National Planning Commission. (2011). *Our future, make it work, National Development Plan 2030*. National Planning Commission, Republic of South Africa. Retrieved from https://nationalplanningcommission.wordpress.com/the-national-development-plan/.

RSA. (1997). Education White Paper 3: *A Programme for the Transformation of Higher Education*. Pretoria, Department of Education.
RSA (2013). Protection of Personal Information Act (2013). GOVERNMENT GAZETTE, 26 November 2013. Act No. 4 of 2013. Retrieved from www.justice.gov.za/legislation/**acts**/2013-00 .
RSA. (1997) Education White Paper 3: *A Programme for the Transformation of Higher Education*. Pretoria, Department of Education.
RSA. (1997). *Higher Education Act, 1997 (Act No.101 of 1997).* Government Gazette No.1655. Volume 390. No. 18515. Pretoria.
RSA (2014). *Policy for the Provision of Distance Education in South African Universities in the Context of an Integrated Post School System*. Retrieved from http://www.gov.za/ss/documents/higher-education-act-policy-provision-distance-education-south-african-universities.
RSA (2014). *Statistics on Post-School Education and Training in South Africa*: 2014. Released March 2016. Department of Higher Education and Training. Republic of South Africa.
RSA. (2016) ***Social Cohesion and Social Justice in South Africa Table of Contents.*** Rerieved from www.thepresidency.gov.za/docs/pcsa/**social**/**social**/part1.pdf .
Solomon, G., Allen, N. J., & Resta, P. (Eds.). (2003). *Towards digital equity: Bridging the divide in education.* Boston, MA: Pearson Education Group, Inc.
Sprague-Jones, J. and Sprague, J. (2011). The Standpoint of Art/Criticism: Cindy Sherman as Feminist Artist?*. Sociological Inquiry, 81: 404–430. doi:10.1111/j.1475-682X.2011.00385.x;
(Stanlib 2015) Internet Access Speed in South Africa. Retrieved from http://www.stanlib.com/EconomicFocus/Pages/Internetaccessspeedrsa.aspx
Taylor, J.C. (2001). *Fifth Generation Distance Education*. Retrieved from http://www.usq.edu.au/electpub/e-jist/docs/old/Vol4 no1/2001docs/pdf/Taylor/pdf.
United States. (2001). *The USA PATRIOT Act: Preserving life and liberty: uniting and strengthening America by providing appropriate tools required to intercept and obstruct terrorism*. Washington, D.C.: U.S. Dept. of Justice.
UNESCO (2015). Position Paper on Education. Post -2015 agenda. ED-14/EFA/POST-2015/1. http://hdr.undp.org/en/statistics/hdi/.
Vaillant, G. E. (2012). *Triumphs of experience: The men of the Harvard Grant Study*. Cambridge, Mass: Belknap Press of Harvard University Press.
Van Damme, D. (2001). Quality Issues in the Internationalization of Higher Education Author(s): Dirk van Damme Source: Higher Education, Vol. 41, No. 4, (Jun., 2001), pp. 415-441 Published by: Springer Stable URL: http://www.jstor.org/stable/3448132 Accessed: 09/07/2008 03:55.
World Development Report (2016). Digital Dividends: Retrieved from http://www.worldbank.org/en/publication/wdr20161.
World Trade Organization. (2001). *Guidelines for the Scheduling of Specific Commitments under the General Agreement on Trade in Services (GATS)*. Council for Trade in Services.

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A Strategic Response to MOOCs: What Role Should Governments Play?

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This paper asks the question what role should governments play in supporting a strategic response to the Massive Online Course (MOOC) movement? It describes the growth of MOOCs in Europe and reports on the Irish experience as a case study to discuss whether or not a more formal policy response is required to harness the potential of new models of open and online learning to promote wider access to higher education. Ireland is used to illustrate how different institutions have chosen to respond to MOOCs by tracing the history of several first generation initiatives. The response of government agencies and policy-makers is then discussed in the context of a number of high-level policy initiatives. Set against the backdrop of a lack of serious policy engagement in the development of MOOCs, the paper concludes by explaining why Dublin City University (DCU) has chosen to launch Ireland's Open Learning Academy.

Keywords: MOOCs, Strategic Drivers, Open Learning Academy, Dublin City University, Ireland,

Introduction

There have been many bold claims made about the promise and perils of the Massive Open Online Course (MOOC) movement (Krause & Lowe, 2014). While some believe the MOOC bubble has burst they continue to generate debate (see for example, Sharrock, 2015) and the level of interest from learners is growing annually at an impressive rate. In 2015, for example, over 35 million people are claimed to have registered for a MOOC, which is almost twice the number from the previous year (Online Course Report, 2016). Arguably, no other educational innovation has attracted the same level of media coverage since the Sputnik era of the 1960s when there was a perceived crisis in the need for greater Science and Technology Education, which in turn has fuelled public interest and brought MOOCs to the attention of senior academic leaders, politicians and policy-makers (Brown, 2016). However, the response to MOOCs varies greatly both across institutions and countries. While some countries such as France and Norway have developed national MOOC strategies they appear to be the exception.

This paper briefly outlines the European response to MOOCs and then presents a case study of the experience in the Republic of Ireland in framing a bigger question in terms of the role governments and policy-makers should play in supporting new models of open and online learning. The basic premise is that the situation described in Ireland is likely to be similar in many other countries and this raises the more general question of whether a more strategic policy response is required in the future. After all, arguably MOOCs are not just about MOOCs but rather provide an opportunity to engage in bigger ideas around equity, innovation and new open delivery models for a more inclusive and sustainable future (Brown & Costello, 2016). After tracing the development of several first generation MOOCs in Ireland the paper contrasts these initiatives with the current policy landscape, which has largely failed to engage in the challenges and opportunities presented by the growth of new models of online learning. We conclude by reporting after considerable deliberation how one Irish institution is currently implementing an enterprise-wide MOOC initiative using a new platform that aligns with high-level strategic drivers and its commitment to an innovation culture.

The European Response

While the level of interest in MOOCs in the United States appears to be waning with fewer institutions indicating their intention to develop free online learning initiatives (Allen & Seaman, with Poulin, & Taylor Straut, 2016) this is not the case in Europe. A recent survey of European institutions suggests that MOOCs are still on the rise (Jansen & Schuwer, 2015). Figure 1 taken from this survey shows the proportion of responding European institutions offering or intending to offer MOOCs in comparison to the percentage in the United States responding to the annual Babson survey (Allen & Seaman, 2015). Some questions from the Babson survey were incorporated within the European study and the results show notable differences between both continents. For example, 'a large majority of European higher education institutions disagree with the statement that credentials for MOOC completion will cause confusion about higher education degrees while a majority in the US agrees' (Jansen & Schuwer, 2015, p.4). Moreover, over 80% of European institutions agrees with the statement MOOCs are important for learning about online pedagogy; in contrast this figure has decreased in the United States from 44% in 2013 to 28% in 2014 (Allen & Seaman, 2015). Similarly, the number of institutions reporting that they believe MOOCs to be sustainable fell in the United States from 28.3% in 2012 to only 16.3% in 2014 (Allen & Seaman, with Poulin, & Taylor Straut, 2016). In the European survey more than half of the institutions agree with the statement that MOOCs are a sustainable method for offering courses.

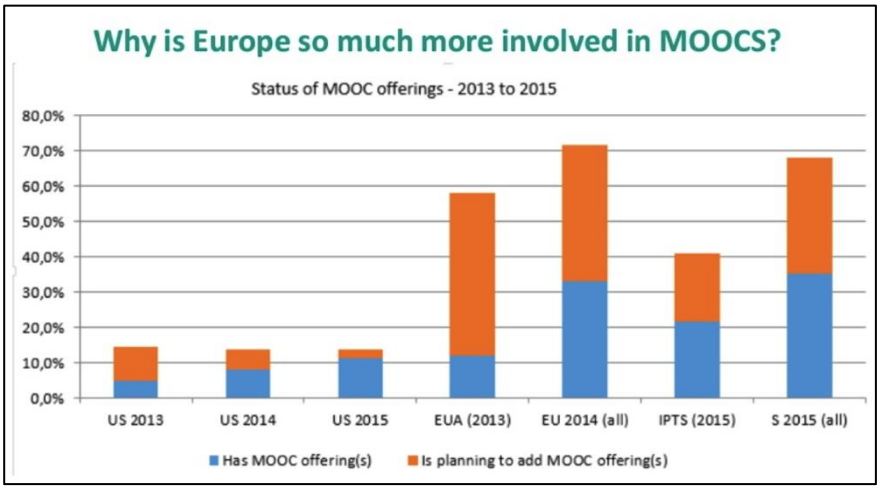

Figure 1: Comparison between US and Europe of MOOC offerings (Jansen & Schuwer, 2015)

Also there appears to be interesting differences in the strategic drivers for many European MOOCs as opposed to those offered by North American institutions. In the United States using MOOCs for student recruitment is reported as the most important primary objective of institutions, while in Europe the most commonly mentioned driver is to reach new students and creating flexible learning opportunities (Jansen & Schuwer, 2015). Although speculative there is reason to believe that the case for MOOCs in Europe is linked to the long tradition of promoting life-long learning and access to higher education. With the notable exception of the United Kingdom it needs to be noted that in Europe higher education is still largely framed from a policy perspective as a public good, as distinct from private or personal commodity. This tradition along with major differences in the business model for higher education, the availability of European Commission funding for MOOCs, and the mechanism of the European Credit Transfer System (ECTS) may help to explain such differences.

The Irish Context

The Republic of Ireland offers an interesting case study in terms of the European response to MOOCs. According to *Forbes* magazine Ireland has the distinction of hosting the world's first MOOC through the ALISON platform (High, 2013). A recent study on ALISON published by the European Commission's Joint Research Centre Science Hub (Souto-Otero, et. al., 2016) reports that the platform first established in 2007 has reached more than six million learners. Although not a recognized institution offering accredited qualifications, according to the company by December 2015 there were over 750,000 ALISON graduates worldwide. If this figure is accurate then this makes ALISON one of the largest free online course providers. Data from the above case study also notes that 'Aside from the UK (545,001 learners) and Ireland (97,245 learners), European learners make up the minority of ALISON enrolments (122,944 from other European Countries)', which is probably explained by most courses being delivered through English (Souto-Otero, et. al., 2016, p. 99).

The claim of being the first Irish formally accredited institution to offer a MOOC is shared by Dublin Institute of Technology, Hibernia College, and IT Sligo (Brown & Costello, 2016). On 14th February 2013, IT Sligo was first to issue a press release announcing their intention to offer a MOOC (Irish Independent, 2013) but this free online course on the topic of *Lean Sigma Quality,* which attracted over 2000 learners, was not actually taught until November (IT Sligo, 2013). In the meantime, the Minister for Arts, Heritage and the Gaeltacht formally launched at Hibernia College on 10th April 2013 what was described at the time as Ireland's first MOOC (Education Matters, 2013). However, this MOOC on the theme of *Irish Identity*, with notably an introductory video from the Prime Minister (Taoiseach) did not start until 27th May 2013. Only a few weeks earlier starting on 13th May 2013 the Dublin Institute of Technology, together with GetReskilled, began what appears to be the first MOOC delivered by an Irish institution (PharmaMooc, 2013). This MOOC, known as *PharmaMooc*, targeted people interested in working in the Pharmaceutical Industry and attracted a global audience of over 800 learners from 71 different countries worldwide. For historical purposes, Figure 2 illustrates some of the websites and promotional material related to these first generation Irish MOOC initiatives.

It is interesting to note that despite these early initiatives the draft *Digital Roadmap: Phase 1* released in May 2014 (National Forum for the Enhancement of Teaching and Learning in Higher Education, 2014), with the aim of building digital capacity in Irish higher education, made no explicit reference to MOOCs. Whether this was a deliberate decision at the time by the writing team is unclear and perhaps it was simply an oversight due to a very short consultation process. With the benefit of hindsight, whatever the reason, the absence of MOOCs from the draft Digital Roadmap was surprising, particularly since a section of the document reviews wider European and global developments. Moreover, the Digital Roadmap endorses the principles of open education to support future developments in higher education and states the need for greater vision and leadership in planning the digital future.

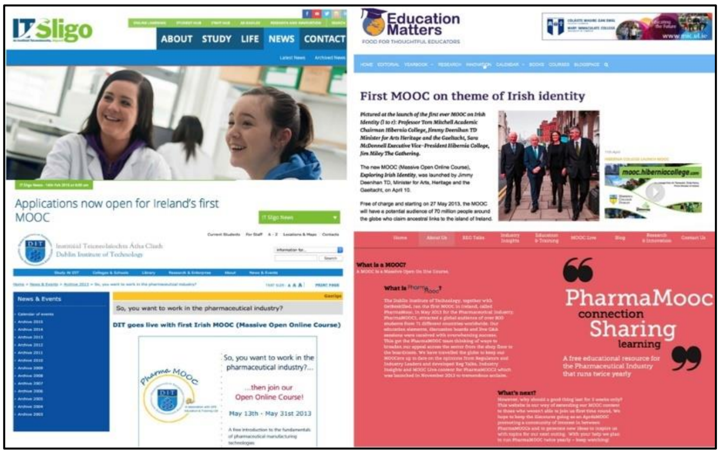

Figure 2: Examples of first generation Irish MOOC initiatives

In May 2014, the National University of Ireland (NUI), a unique overarching body serving the interests of four member universities and several colleges, invited interested groups to tender on the feasibility of a collaborative National online education initiative, encompassing MOOCs, for the Irish university sector (Brown & Costello, 2016). A brief news item about this initiative featured in the *Times Higher Education*:

> "The new organisation, which would include Irish universities outside the NUI group, may begin by offering a series of MOOCs showcasing Irish education. Depending on the level of public interest, the organisation could then move into profitable accredited programmes" (Powell, 2014, P.6).

Although the tender closed in September 2014, and a written report was expected within several months of the project getting underway, to date there has not been any public statement in response to this initiative. It is known that a report was produced but this has never been widely circulated. However, before the tender process had closed, in June 2014 Trinity College Dublin announced its intention to join the UK-based FutureLearn platform and to offer a MOOC later in the year on the theme of *Irish Lives in War and Revolution: Exploring Ireland's History 1912-1923.* Reportedly almost 14,000 people registered for this MOOC, which started in September (Kenny, 2014).

In 2014, another particularly interesting development in Ireland was a high profile visit from a delegation from Tata Consulting Services. Founded by Jamsetji Tata in 1868, the Tata Group 'is part-owned by Pallonji Mistry, the richest Irish citizen alive, and run by his son' (McCabe, 2014, P.1). The Tata Consulting Group is a global enterprise headquartered in India, with operations in more than 100 countries employing over 500,000 people worldwide. In August 2014 a high-level delegation from the Tata Group met with senior Irish politicians and institutional presidents with the objective of making Ireland the centre of the world for online degrees (Brown, 2016). The aim, as reported by the *Independent* newspaper, was to negotiate 'a deal to transform Ireland into the world's first stop for e-learning and earn millions for the country's floundering universities' (McCabe, 2014, P.1).

Following the Tata delegation's visit, in early December 2014, the Irish Government's *Joint Committee for Education and Social Protection* held a special meeting to discuss the future of online learning. Dublin City University, Trinity College Dublin and the UK Open University and were invited to give short presentations to the Joint Committee. The written submission prepared by Professor Mark Brown on behalf of Dublin City University drew on the Porto Declaration on European MOOCs (EADTU, 2014), which was developed as part of the HOME Project, and observed:

> "Arguably, by analogy with the invention of the steam engine, there is a lot of huff, puff, single-track thinking associated with MOOCs as many traditional universities rush to follow early adopters to secure some form of advantage. In many cases the drivers for adopting MOOCs are not well aligned with institutional missions and there is a sense in which the initial head of steam is motivated by fear of missing out" (Brown, 2014, P.2).

A problem not exclusive to Ireland is the lack of detailed literature in the public domain on the expression and development of institutional MOOC strategies in higher education. While IT Sligo deserves credit for its work in developing a MOOC for the transition between school and higher education, funded by the National Forum, and for efforts to promote low-cost MOOCs through the Erasmus+ LoCoMoTion project, at this stage Dublin City University (DCU) is the only institution to publish its strategic institutional response to MOOCs (Brown, Costello, Donlon & Nic Giolla Mhichil, 2015). The decision to adopt a new MOOC platform known as Academy, which is described in the final section of this paper, is primarily driven by the goal of fostering a rich ecology of innovation in teaching and learning.

The only other published institutional report on the island of Ireland is available from the University of Ulster, which highlights the scale of the challenge facing institutions along with many of the opportunities presented by the MOOC movement (Hamber, Jaffrey & Murphy, 2015). Importantly, the Ulster report identifies MOOCs as part of a much wider movement to open up learning. With this last point in mind it needs to be noted that a report on *Learning Resources and Open Access in Higher Education Institutions in Ireland*, published in 2015 by the National Forum for the Enhancement of Teaching and Learning in Higher Education (2015b), claims the big headline-grabbing MOOC story has muddied the waters somewhat in relation to the 'open' project'. Therefore, the report deliberately chose to focus on what it describes as 'little OER' rather than literature on 'big OER', which it claims are less relevant in the Irish context at this time.

Irish Institutional MOOC survey

A follow up European survey on MOOCs in higher education institutions was conducted towards the end of 2015. In light of the lack of evidence of the perceived relevance of 'big OERs' in the Irish higher education a country specific analysis of the nine Irish institutional responses was undertaken by Costello and Brown (2016). The analysis of the findings for Ireland shows that there is no single primary objective across the sector for adopting MOOCs. Of the three Irish institutions in this sample already offering or developing MOOCs the primary objective was spread between Innovative Pedagogy, Reach New Students and Increase Institution Visibility. Although only a small sample the results suggest that institutional culture plays an important role in shaping or determining the primary objective.

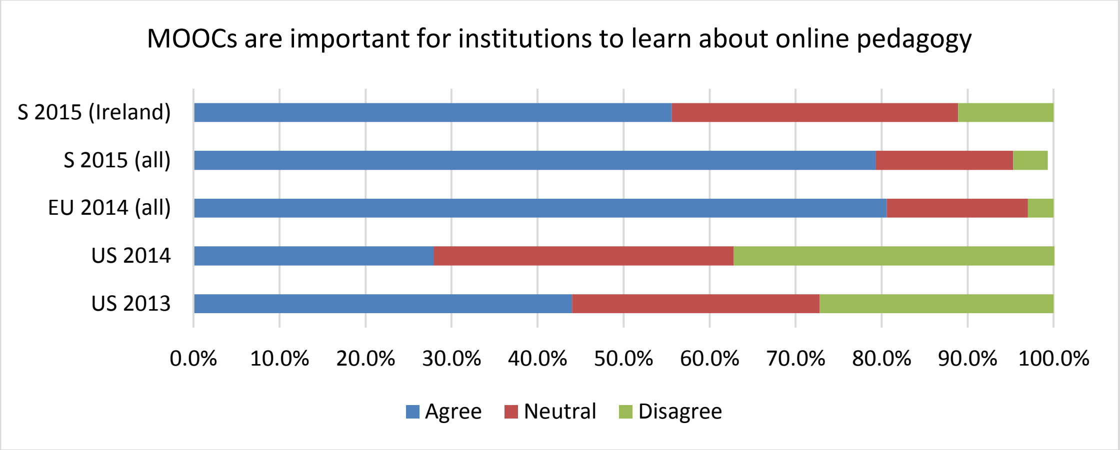

Figure 3: Value of MOOCs to Irish institutions in terms of learning about online pedagogy

That said, Figure 3 illustrates that Irish respondents value the contribution MOOCs can make to learning about online pedagogy more than those participating in the Babson survey, although not at the same level as reported across Europe more generally (Costello & Brown, 2016).

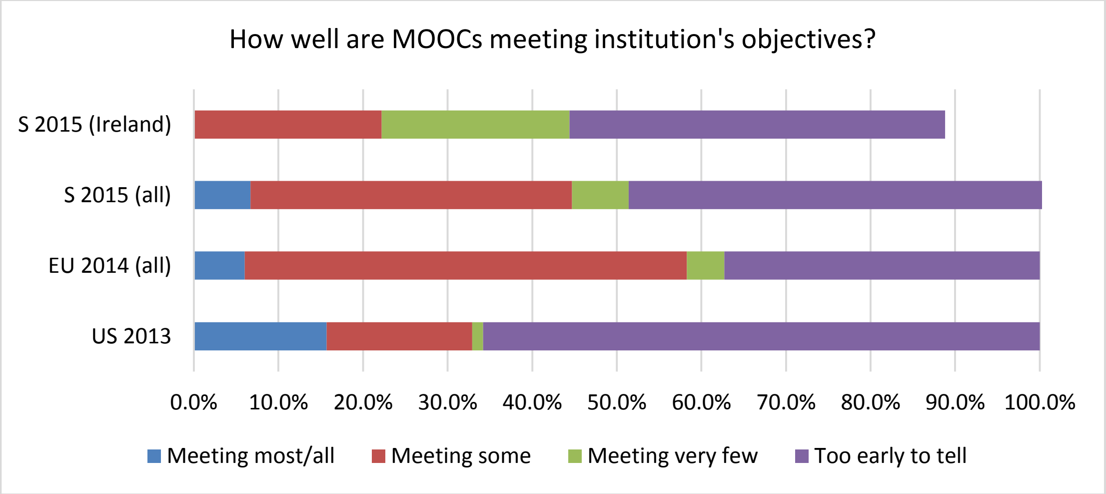

Figure 4: Evidence of how well MOOCs are meeting institutional objectives

The extent with which previous and current MOOC initiatives in Ireland are meeting institutional objectives is shown in Figure 4. The results for Ireland are relatively consistent with the previous 2014 survey and the preliminary analysis of the wider 2015 European sample (Costello & Brown, 2016). In approximate terms it would appear that MOOCs are meeting institutional objectives for Irish providers at a higher percentage of respondents to the equivalent Babson survey.

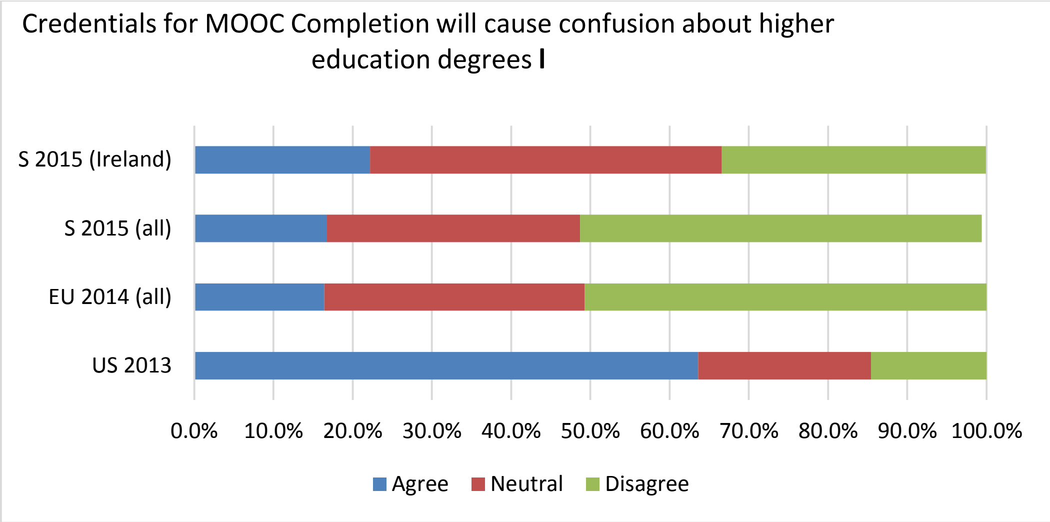

Figure 5: Perceived extent that offering credentials for MOOCs might cause confusion

Again, in contrast to the Babson survey, the sense that offering credentials for MOOCs completion will cause confusion is perceived by Irish institutional respondents to be less of a concern than those in the United States completed the Babson survey (see Figure 5). However, fewer Irish institutional responses disagree with the statement about MOOCs contributing to credentials than the wider European sample where around 50% of institutions do not perceive this as a serious problem (Costello & Brown, 2016).

In summary, the paper has so far outlined the European response to MOOCs making comparisons with institutions in the United States. It has traced the early development of MOOCs in Ireland and reported some of the preliminary findings of a 2015 country specific survey. The next section shifts attention to the national policy context with the intention of highlighting an important gap between the Irish response and major European and international initiatives.

Irish Policy response

In April 2015, a more complete *Roadmap for Enhancement in a Digital World 2015-2017* was published to help advance a shared vision of 'a [higher education] culture that fully embraces digital learning and digital innovation' (National Forum for the Enhancement of Teaching and Learning, 2015a, p.iv). Given the above discussion it is not surprisingly the updated Roadmap makes very few references to MOOCs, with this term completely absent from the Executive Summary and policy recommendations (see Figure 6). Although the Roadmap has other commendable features, the initiative arguably favours more traditional campus-based models of higher education and does little to address a major barrier to the growth of online delivery as a result of Ireland's restrictive funding model. As Brown and Costello (2016) note the current model limiting off-campus delivery due to no government contribution to study is at odds with recent European reports from the High Level Group on the Modernization of Higher Education (2014) for more inclusive funding approaches that help to open up education, develop more flexible modes of delivery, and diversify student populations.

Figure 6: Evidence of the absence of MOOCs from National Roadmap

Similarly, MOOCs do not feature in the *Digital Strategy for Schools: Enhancing Teaching, Learning and Assessment 2015-2020* (Department of Education and Skills, 2015) launched in October 2015 by the Minister for Education and Skills. Nevertheless, in January 2016 the same Minister was present to launch Ireland's first MOOC for teachers—a collaborative effort between Dublin City University, H2 Learning and Microsoft—on *21st Century Learning Design*.

Even more recently the *Strategy for Technology-enhanced Learning in Further Education and Training 2016-2019* (Education and Training Boards Ireland | Further Education and Training Authority, 2016) fails to address the challenges and opportunities posed by MOOCs. This oversight is particularly surprising given the Strategy has a vision by 2019 of technology-enhanced teaching and learning providing greater access to further education and training, and moreover achieving positive outcomes for learners, enterprise, and wider society and the economy.

The disconnection between national policy initiatives and wider macro level MOOC developments in Europe and globally is particularly obvious in the *National Plan for Equity of Access to Higher Education 2015-2019* (Higher Education Authority, 2015) published in December 2015. MOOCs and the potential contribution of new models of higher education do not figure in this plan, and nor do they appear in Ireland's National Skills Strategy 2025 (Department of Education and Skills, 2016a) also launched by the Minister for Education and Skills in January 2016 (see Figure 7). Despite recognising that technology's pervasiveness means people of all ages increasingly need to be 'technologically literate' in order to participate fully in society, referring to e-health, online banking and online supermarket shopping, there is no acknowledgement of the potential of online learning for improving lives, creating better places to live and work, and driving more sustainable economic growth.

Figure 7: Evidence of absence of MOOCs from National Skills Strategy

The absence of MOOCs and new models of online learning more generally from the above policy documents no doubt explains why they do not feature in a recent comprehensive briefing paper for the new Minister for Education and Skills (Department of Education and Skills, 2016b). Thus, the reality of the situation is that currently in the Irish context MOOCs do not feature prominently in policy-level discussions and speculatively may even have been deliberately dismissed by influential educators and policy-makers as nothing more than a passing fad (Brown & Costello, 2016). There appears to have been a failure to recognise that the MOOC movement is not on an independent trajectory but rather entwined within a complex constellation of social, technological and educational change (Brown, 2016).

On one hand, the MOOC movement symbolizes so-called Silicon Valley values, the growth of the influence of neo-liberal policies, the emergence of new labour model for the teaching profession, and the ultimate goal of an unrestricted global market for higher education (Peters, 2013). In this regard 'the MOOC is not on an independent trajectory and cannot be uncoupled from wider debates over issues of power and privilege and the struggle to win control of the higher education system' (Brown, 2016, p.39).

On the other hand, MOOCs, or variations of them, provide a real opportunity to address the Iron Triangle of reducing costs, enhancing quality and opening access to meet increasing demand for higher education (Daniel, 2012). Without engaging in the MOOC debate at a policy level, there is a risk that Ireland may be inadequately prepared to respond to the new global online learning environment, especially as the movement evolves and new types of courses and formal credit earning pathways emerge from reputable institutions and international consortia.

In summary, in the Republic of Ireland there has been no clear policy direction or nationally co-ordinated approach to the growth of (MOOC movement. Arguably, the policy gap around MOOCs is part of a bigger issue concerning the lack of government funding for online, off-campus, distance students, which in European terms remains a significant barrier to the goal of opening up more flexible modes of delivery to meet the needs of a diverse population. If, as the *National Plan for Equity of Access to Higher Education* states, "As a country we have everything to gain and nothing to lose by increasing levels of participation in higher education among all Irish citizens" (Department of Education and Skills | Higher Education Authority, 2015, p.i), then Ireland would benefit from a more strategic response to the MOOC movement. As previously stated, MOOCs are not just about the provision of free online courses but rather provide a real opportunity to engage in bigger ideas around promoting equity, fostering innovation and developing new open delivery models for a more inclusive and sustainable future.

Set against this wider context the question is how should Ireland strategically respond to the MOOC movement? Is it already too late? Does it need to respond? After all, the first generation MOOC initiatives described above were largely one-offs and may be evidence that most Irish institutions have other priorities. Nevertheless, what lessons can be learnt from a more direct policy and coordinated response taken in other countries around the world? What role does the small nation state have in the provision and development of online education in an increasingly globally connected digital world? Why would Ireland bother when there is already a plethora of MOOCs available to Irish citizens through the major platforms? This raises the question where to next for Ireland?

Dublin City University's response

In May 2015, the National Institute for Digital Learning (NIDL) at Dublin City University hosted a National MOOC Symposium to promote greater debate and awareness of the challenges and opportunities within the Irish context. Also to promote wider discussion and strategic foresight in May 2015 the NIDL in partnership with the Irish Learning Technology Association (ILTA), and the US based New Media Consortium, launched Ireland's first Horizon Report for higher education (Johnson, Adams Becker, Cummins, Estrada & Freeman, 2015). The NIDL has also played a leading role in two European funded MOOC related projects (HOME and SCORE 2020) led by the European Association for Distance Teaching Universities (EADTU). Apart from these initiatives and the feasibility study commissioned by NUI, as demonstrated above there has not been a dedicated effort to develop a national response to MOOCs.

Figure 8: Example of the DCU Open Learning Academy

Therefore, after considerable deliberation, building on the above initiatives Dublin City University has made a strategic decision to implement a major second generation MOOC initiative using a new platform known as Academy (see Figure 8), which has been developed over the last 18 months by Moodle HQ. This decision was not taken lightly. It follows a lengthy process of identifying the key institutional drivers for any such initiative and a review of existing platforms to evaluate their alignment and suitability in terms of the University's primary objectives (Brown, Costello, Donlon & Nic Giolla Mhichil, 2015). Notably, the most influential factor in selecting Academy was the opportunity to shape the design and direction of MOOCs rather than be a client of an existing platform dominated by major institutions and elite universities, with little ability to influence future developments. Dublin City University, a major leader in the use of Moodle in Europe, is the first institution in the world to adopt the new platform, which will be described as Ireland's Open Learning Academy. More specifically, drawing on an ecological perspective on digital resilience (Weller & Anderson, 2013) the intention of the Academy initiative is creating a "third space" for innovations in teaching which enable more agile and future-focussed responses to the opportunities presented by MOOCs for both off-campus and conventional on-campus learners.

The first MOOC on the new Academy platform known as 'Head Start Online' was piloted in August 2016. This MOOC was designed after a synthesis of the literature and review of digital tools at other major online/distance education providers (Brunton, et. al., 2016) to promote the readiness and success of prospective mature, part-time, online learners during the initial stages of the study life-cycle. Future MOOCs include a course on the Irish language and culture (Irish 101) along with three designed from a contemporary perspective to build on the 100-year commemoration of the 1916 Easter Rising. Three other MOOCs have been chosen for their focus on teacher education and explore Learning Leadership, 21st Century Skills for Teachers and Coding for Teachers. Future MOOCs are planned and already there is clear evidence of the benefits of working in a new platform that enables the University to be a future-maker rather than future-taker.

Conclusion

The Irish case study reported in this paper suggests that there is a strong argument for governments and policy-makers around the world to take a more strategic and coordinated approach to the rapidly evolving MOOC movement. The future of MOOCs is not trivial work. Based on the Irish experience, early first generation MOOC initiatives have not been sustainable and appear to have taken place largely in parallel to more mainstream policy developments. Although the future of MOOCs remains uncertain, central and regional governments have an important role to play, especially if countries and local institutions wish to shape and actively contribute to new models of higher education for new times in today's globalised world. Arguably, in the case of Ireland the Country would benefit from a high-level policy forum to engage key stakeholders on the future challenges and opportunities of new models of online teaching and learning, including MOOCs. It remains a major point of disconnection that ironically in the so-called Silicon Valley of Europe that the funding model for higher education in Ireland does not recognise the need to support diverse and geographically dispersed online distance learners. If MOOCs serve to highlight this disconnection and lead to a more inclusive funding model, which opens up greater access to higher education, then they will have done the people of Ireland a great favour.

References

Allen, E., & Seaman. J. (2015). *Grade Change: Tracking Online Education in the United States*. Babson Survey Research Group and The Sloan Consortium. Available from http://www.onlinelearningsurvey.com/reports/gradelevel.pdf

Allen, E., & Seaman, J., with Poulin, R., & Taylor Straut, T. (2016). *Online report card: Tracking online education in the United States*. Babson Survey Research Group and Quahog Research Group.

Brown, M. (2016). MOOCs as social practice: A kaleidoscope of perspectives (pp. 31-41). In E. De Corte, L. Enwall, & U. Teichler (Eds.). *From Books to MOOCs? Emerging models of learning and teaching in higher education.* Wenner-Gren International Series, 88. London: Portland Press.

Brown, M. (2014). *Online learning in the Irish context.* Submission to Joint Committee on Education and Social Protection, Dublin, 3rd December. Retrieved 16th April 2014 from http://ni4dl.org/2014/12/10/online-learning-in-the-irish-context-submission-to-jointcommittee-on-education-and-social-protection

Brown, M., & Costello, E. (2016*). MOOCs in the Republic of Ireland: A gap in the policy landscape (pp.67-73).* In D. Jansen & L. Konings (Eds.). European policy response on MOOC opportunities. Overview of papers representing a European policy response on MOOC opportunities as presented during the HOME policy forum in Brussels, 28th June.

Brown, M., Costello, E., Donlon, E., & Nic Giolla Mhichil, M. (2015). A strategic response to MOOCs: How one European university is approaching the challenge. *International Review of Research in Open and Distributed Learning, 16, (6),* 98-115.

Brunton, J., Brown, M., Cleary, A., Costello, E., Delaney, L., Fox, S., Galvin, C., Gilligan, J., O'Regan, L., & Ward, J. (2016). *Lost in transition: A report on enabling success for flexible learners.* Dublin: Dublin City University.

Costello E., & Brown, M. (2016). *Irish response to European institutional MOOC survey.* Unpublished preliminary findings. National Institute for Digital Learning, Dublin City University.

Daniel, J. S. (2012). Making sense of MOOCs: Musings in a maze of myth, paradox and possibility'. *Journal of Interactive Media in Education,* 1-20, [Available from http://jime.open.ac.uk/jime/article/view/2012- 18]

Department of Education and Skills. (2016a). *Ireland's National Skills Strategy 2025.* Dublin Available from https://www.education.ie/en/Publications/Policy-Reports/pub_national_skills_strategy_2025.pdf

Department of Education and Skills. (2016b). *Organisation and current issues: A brief for the information of the Minister for Education and Skills.* Dublin. Available from http://www.education.ie/en/Publications/Ministers-Brief-/Ministers-Brief-2016.pdf

Department of Education and Skills. (2015). *Digital Strategy for Schools: Enhancing Teaching, Learning and Assessment 2015-2020*. Dublin: Department of Education and Skills. Available from https://www.education.ie/en/Publications/Policy-Reports/Digital-Strategy-for-Schools-2015-2020.pdf

Department of Education and Skills | Higher Education Authority. (2015). *National Plan for Equity of Access to Higher Education 2015-2019*. Dublin. Available from http://www.hea.ie/en/policy/national-access-office/national-plans-equity-access-higher-education/2015-2019-access-plan

EADTU (2014). *Porto Declaration on European MOOCs.* Heerlen: European Association for Distance Teaching Universities. Retrieved 24th April 2014 from http://home.eadtu.eu/images/News/Porto_Declaration_on_European_MOOCs_Final.pdf

Education and Training Boards Ireland | Further Education and Training Authority. (2016). *Strategy for Technology-enhanced Learning in Further Education and Training 2016-2019*. Dublin. Available from http://www1.solas.ie/SolasPdfLibrary/TEL_Strategy.pdf

Education Matters. (2013; 20th April). *First MOOC on theme of Irish identity.* Retrieved 15th June 2016 from http://educationmatters.ie/em_news/first-mooc-on-theme-of-irish-identity

Hamber, B., Jaffrey, A., & Murphy, B. (2015). *MOOCs and Open Learning at Ulster University.* Ulster University. Retrieved 24th November 2015 from http://addl.ulster.ac.uk/docs/0006_DraftMOOCReportLrg.pdf

High Level Group on the Modernisation of Higher Education (2014). *Report to the European Commission on new models of learning and teaching in higher education.* Retrieved 24th April 2014 from http://ec.europa.eu/education/library/reports/modernisation-universities_en.pdf

High, P. (2013) *Lessons from the CEO oft he first ever MOOC.* Forbes, 31st December. Available from http://www.forbes.com/sites/peterhigh/2013/12/31/lessons-from-the-ceo-of-the-first-ever-mooc/#3ce8eae45d02

Irish Independent. (2013; 12th February). *College joins online learning revolution with free course*. Retrieved 15th June 2016 from http://www.independent.ie/life/family/learning/college-joins-online-learning-revolution-with-free-course-29068745.html

IT Sligo. (2013; 31st October). *2,000 sign up for Ireland's first MOOC on 'quality'.* Retrieved 15th June 2016 from https://itsligo.ie/2013/10/31/2000-sign-up-for-irelands-first-mooc-on-quality

Jansen, D., & Schuwer, R. (2015). *Institutional MOOC strategies in Europe Status report based on a mapping survey conducted in October - December 2014.* EADTU – HOME project. Available from http://eadtu.eu/documents/Publications/OEenM/Institutional_MOOC_strategies_in_Europe.pdf

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., & Freeman, A. (2015). *2015 NMC Technology Outlook for Higher Education in Ireland: A Horizon Project Regional Report.* Austin, Texas: The New Media Consortium.

Kenny (2014; 1st September). Almost 14,000 begin free online history course at Trinity College. *Irish Times,* Available from http://www.irishtimes.com/news/education/almost-14-000-begin-free-online-history-course-at-trinity-college-1.1914318

Krause, S., & Lowe, C. (2014). *Invasion of the MOOCs: The promise and perils of massive open online courses.* San Francisco: Parlor Press. [Available from http://www.parlorpress.com/pdf/invasion_of_the_moocs.pdf]

McCabe, S. (2014, 31st August). Indian giant Tata Group to sell Irish degrees worldwide. *Independent, Business World.* Retrieved 16th April 2014 from http://www.independent.ie/business/world/indian-giant-tata-group-to-sell-irish-degreesworldwide-30548175.html

National Forum for the Enhancement of Teaching and Learning, (2015a). *Teaching and learning in Irish higher education: A roadmap for enhancement in a digital world 2015-2017.* Dublin. Available from http://www.teachingandlearning.ie/a-roadmap-forenhancement-in-a-digital-world-2015-2017

National Forum for the Enhancement of Teaching and Learning in Higher Education. (2015b). *Learning Resources and Open Access in Higher Education Institutions in Ireland*. Focused Research Report No 1. Dublin. Available from http://www.teachingandlearning.ie/wp-content/uploads/2015/07/Project-1-LearningResourcesandOpenAccess-1607.pdf

National Forum for the Enhancement of Teaching and Learning in Higher Education. (2014). *Principles and first insights from the sectoral consultation on building digital capacity in Irish higher education. Digital roadmap – phase 1.* Available from http://www.teachingandlearning.ie/wp-content/uploads/2014/05/Digital-Roadmap-PHASE1MAY282014.pdf

Online Course Report. (2016). State of the MOOC 2016: A year of massive landscape change for massive open online courses. Available from http://www.onlinecoursereport.com/state-of-the-mooc-2016-a-year-of-massive-landscape-change-for-massive-open-online-courses/

Peters, M. (2013). Massive open online courses and beyond: The Revolution to Come. *Truthout,* August 17. [Available from http://www.truth-out.org]

PharmaMooc. (2013). *What is PharmaMooc?* Retrieved 15th June 2016 from http://www.pharmamooc.org

Powell, N. (2014, 8th May). Irish bid for a tiger share of online market. *Times Higher Education.* Retrieved 19th November 2015 from https://www.timeshighereducation.com/news/irish-bid-for-a-tigers-share-of-online-market/2013113.article

Sharrock, G. (2015). Making sense of the MOOC debate. *Journal of Higher Education Policy and Management, 37 (5),* 597-609.

Souto-Otero, M., Inamorato dos Santos, A., Shields, R., Lažetić, P., Castaño-Muñoz, J., Devaux, A., Oberheidt, S., Punie, Y. (2016) *OpenCases: Case Studies on Openness in Education.* Institute for Prospective Technological Studies, Joint Research Centre, European Commission.

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Staying the distance: Using digital readiness tools to support effective transitions into higher education for flexible learners

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The Student Success Toolbox project is a nationally funded research and technology development project focusing on facilitating effective flexible learner transition into higher education. The project targets programme teams/institutions with adults engaged in undergraduate, part-time or online/distance-learning during the initial stages of the study lifecycle. The project has developed a toolbox of eight digital readiness/preparation tools, leveraging digital technologies to establish approaches to assist advisors in helping applicants to assess their own readiness for flexible learning and in providing learners with relevant, timely feedback to enhance their chances of success. These are Open Educational Resources (OERs) with a Creative Commons Licence (CC-BY), made openly available to, and actively shared with, programme teams/institutions. Alongside the tools is a guide on using the tools as part of a strategic flexible learner socialisation program and, where appropriate, directions on technically augmenting the tools for a specific programme or institution.

Keywords: Flexible learning, study lifecycle, digital readiness/preparation tools, student success, Open Educational Resources

Introduction

The Student Success Toolbox project is funded by the National Forum for the Enhancement of Teaching and Learning in Higher Education Building Digital Capacity fund. It involves four project partners: Dublin City University, specifically the National Institute for Digital Learning (lead partner); Sligo Institute of Technology; Maynooth University; and Dundalk Institute of Technology. The primary aim of the Student Success Toolbox project is to provide a supportive resource for programme teams/institutions, in order that they can effectively support flexible learners during the key transitions in the initial stages of the study lifecycle. Thinking about study, making choices, registration and the first few weeks of the course represent these early stages. A premise of the project is that the foundations for student success are established in the earliest stages of the study lifecycle, and that there has been both a paucity of empirical research and attention within institutions toward the importance of the stages prior to flexible learners formally commencing their study. It is also assumed that this vital transition period may be aided by the ready availability of specially designed digital readiness and preparation tools, which support prospective learners and those about to commence part time or online study for the first time.

There were five phases to this project:

- *Phase 1* - Project establishment, including formalizing the project team, partner agreements and scope of the work packages;
- *Phase 2* - Analysis of relevant literature and audit of digital readiness tools currently available internationally to support successful transitions for flexible learners;
- *Phase 3* – Design and development of a strategically targeted suite of eight research-informed digital readiness tools for flexible learners;
- *Phase 4* – A series of pilot evaluations of the digital tools across the partner institutions to gather feedback on their fit for purpose;

- *Phase 5* – A guide for institutions on how to support flexible learners and effectively deploy the suite of digital readiness tools along with a series of dissemination events.

An iterative, Design-based Research (DBR) methodology (Reeves, 2006) was adopted to plan, develop and pilot a total of eight digital readiness tools. The project began in February 2015 with the design of the digital readiness tools phase commencing in August through the development of initial storyboards. These storyboards went through several iterations over the next few months as the wider project team peer reviewed proposed solutions and our design specialists provided expert advice on particular features within each tool. Based on both the Phase 2 synthesis of existing literature, and on the analysis of existing tools in use internationally, five overarching principles were adopted for the design of a suite of eight digital readiness and preparation tools for flexible learners: (i) self-regulation, (ii) personalization, (iii) customization, (iv) information at the point of need, and (iv) language and framing of the tools in the world of the prospective learner.

Tool 1, 'Am I Ready for Study?', invites prospective flexible learners to self-assess if they are ready to commit to part-time online/distance study. The tool involves a brief quiz comprising six sections: (i) Previous Study, (ii) Work and Family, (iii) Study Intentions, (iv) Study Skills, (v) Computer Skills and (vi) Work Habits. The second tool, 'Do I have Enough Time?', provides a self-reflective 'life calculator' where prospective flexible learners are encouraged to think about the amount of time they can realistically spend on different activities during a typical week. More to the point this tool is intended to help people make better choices in terms of how much spare time they might have to allocate to study. The third tool, 'Who can I Ask?', offers prospective flexible learners the opportunity to think about their support network and how they might garner support to help them successfully complete their studies. In Tool 4, 'Am I Computer Ready to Learn?', prospective flexible learners are given guidance on the necessary computer skills needed in higher education. They are also informed of the technology they will need, and the computer services offered by colleges and universities. The fifth tool, 'My First Assignment', navigates through a narrative relating to what it is like to plan out and develop a first assignment in higher education. Advice on how to start an assignment, develop a plan, break down a research question is also provided, with key elements within a plan being presented. Tool 6, 'Head Start Online: First Steps to Flexible Study, is a five week openly available online course that provides prospective flexible learners with key tips and lessons about how to prepare for studying at higher education level. This tool, which is built on a new MOOC platform, incorporates a number of the other tools within its structure. The seventh tool, 'Study Tips for Me', is designed to provide support for flexible learners from crowd sourced tips and suggestions from other flexible learners. This tool is based on the Tumblr platform. Finally, Tool 8, 'Online Orientation', takes a different form in providing a guide for those who wish to create an online orientation for new online/distance learners. This guide describes the elements that should be present in an effective online orientation for their program or institution. The tools can be viewed on the project website, and six tools can be obtained from the project's Github webpage. The project has also produced a guide (Brunton, 2016) for the sector detailing the tools, their uses, the level of customisation needed for each tool, along with advice on how the tools can best be utilised as part of a strategic flexible learner socialisation strategy. A transition plan audit tool (Brunton, 2016b), was also produced to compliment the guide.

References:

Brunton, J. (2016). *Guide for Supporting Flexible Learner Transition*. Student Success Toolbox Project, Dublin.

Brunton, J. (2016). *Guide for Supporting Flexible Learner Transition, Appendix One: Transition Plan Audit*. Student Success Toolbox Project, Dublin.

Reeves, T. (2006). Design research from a technology perspective. In J. V. D. Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational design research* (pp. 52–66). New York: Routledge.

Simpson, O. (2009). Motivating learners in open and distance learning: Do we need a new theory of learner support? *Open Learning: The Journal of Open and Distance Learning, 23(2),* pp. 159-170.

Please cite as: Brunton, J., Brown, M., Costello, E., Cleary, A., Delaney, L., Fox, S., Gilligan, J., O'Regan, L. & Ward J. (2016). Staying the distance: Using digital readiness tools to support effective transitions into higher education for flexible learners. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 97-98).

Note: All published papers are refereed, having undergone a double-blind peer-review process.

Head Start Online: A MOOC for effectively supporting flexible learner transition into higher education

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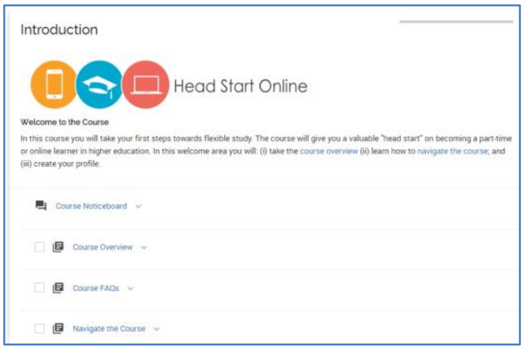
Head Start Online is a five week, free, online course (MOOC) that is designed to support prospective and/or new flexible learners' transitions into higher education. Enhancing retention and completion rates of this group of learners, in order to facilitate successful widening of access, is a significant global challenge. Head Start Online is focused on the initial stages of the study-lifecycle, as the foundations for student success are laid early. Head Start Online has emerged out of the Student Success Toolbox project, a nationally funded research and technology development project that developed a toolbox of eight digital readiness/preparation tools. Head Start Online brings together a number of these tools together in a cohesive pre-induction socialization course that aids new/prospective learners to, for example: assess their readiness for flexible study; plan and budget their time; assess their computer skills; identify their sources of support; learn about the process of writing assignments.

Keywords: Flexible learning, study lifecycle digital readiness/preparation tools, student success, Open Educational Resources

Head Start Online: First Steps For Flexible Study

The Head Start Online MOOC seeks to address the problem of effective transitions and the foundations for student success during the initial stages of the study lifecycle with a specific focus on flexible learners. In the context of this project a broad definition is adopted of flexible learners, which includes adult learners engaged in part-time and online/distance learning. Enhancing retention and completion rates of this group of flexible learners is a significant problem both globally and within the Irish context.



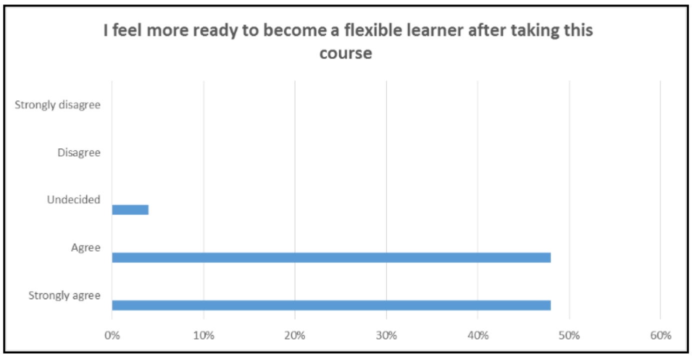
The particular focus of the Head Start MOOC is on early support for flexible learners: from thinking about study, making choices, the registration process and through to the first few weeks. A basic premise of the project is that the foundations for student success are laid early in the study lifecycle, and that insufficient attention has been given in the literature and within institutions to the importance of the period before flexible learners formally commence their study. A related underlying assumption is that this crucial transition period may be enhanced by the availability of appropriately designed digital readiness and preparation tools, which help to scaffold both prospective students and those about to embark on part time or online/distance study for the first time. This MOOC utilises a number of the digital readiness/preparation tools developed as part of the Student Success Toolbox project. These tools were developed following an analysis of the existing literature relating to flexible learning, student success, and effective transitions into higher education, as well as an analysis of the existing tools in use internationally for socialising flexible learners into higher education. Each of these tools was developed using an iterative, design-based research methodological approach.

The Head Start Online course has been developed on a new Moodle-based MOOC platform, DCU Academy. The MOOC runs over five weeks with a welcome area, with a brief welcome/course overview and instructions relating to creating a course profile, opening a few days before the start of week one. The time commitment involved for participants is approximately two hours per week. In each week of the MOOC a new section of the course is made available to participants. While the sections of the course are released week to week it is acknowledged that that not everyone will want to take the course in the same way. If participants want to begin the course after it has started or work through the activities at their own pace then this is also possible, and is expected. There are five sections to the course:

1. A good beginning - What is this course about? Who else is here?
2. What to expect - What should you expect of part-time/online learning?
3. Time is precious - How much time do you have for study? What supports do you have in your life?
4. Skills for success - What computer skills do you need? What is required to produce a successful assignment in your first semester of study?
5. Next steps - Where next? Is online learning for you? What will you decide to do?

Each section of the course involves videos, activities, and opportunities for participants to interact with the course facilitators and their fellow course participants. The video content includes key messages about what to expect from higher education and how to best prepare for flexible study from higher education staff who have experience supporting flexible learners and from graduates from part-time or online/distance education programmes. The activities within the MOOC are largely focused on the digital readiness/preparation tools, produced by the Student Success Toolbox project, that aid new/prospective learners to, for example: assess their readiness for flexible study; plan and budget their time; assess their computer skills; identify their sources of support; learn about the process of writing assignments. Other activities were developed within the Moodle-based MOOC platform to complement the content (text, video, digital tools). The MOOC participants are also encouraged to interact with the course facilitators and the other MOOC participants through typical discussion forums and also through a more informal 'Share With Others' chat-box-style discussion forum. Week five of the MOOC serves to 'outboard' the participants, with the key messages of the course being reiterated and advice/resources relating to making informed study choices being given to participants.

At the end of the MOOC a statement of completion will be issued to those participants who have completed a defined set of the core course activities over the five weeks.



A small pilot of the MOOC ran from the 15th Aug to the 19th Sept 2016, on a new MOOC platform called Academy built by Moodle HQ, and this was the first MOOC to run on the new, evolving platform. We had 150 people enrol on the course, 105 signed into the course and 50 of those went on to receive a certificate of completion. Those selected to take part in this small pilot were prospective flexible learners planning to start courses in Ireland in the2016/2017 academic year, and also a cohort of approximately 70 learners from a German organisation, Kiron, who support refugees in gaining access to higher education. The feedback received indicates that a course such as this, that uses these digital readiness tools, has a positive impact on prospective flexible learners. When asked if they felt more prepared to become a flexible learner after taking the course 12 of 25 respondents agreed that they did and another 12 strongly agreed. The feedback also indicates that the tools do what they are designed to do, for example MOOC participants perceived that the time management tool helped them understand how to better manage their time. At the end of the course 8 of 25 respondents agreed that they felt better able to manage their time and another 15 strongly agreed.

Embedding Classroom Practice in a 21st Century Learning Design (21CLD) MOOC framework

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This poster explores the potential of MOOCs for teacher professional learning. It describes an innovative model that has evolved over a decade and how this could be implemented through different MOOC formats. Designed as a robust yet flexible framework that meets teachers' expressed needs, the model supports school-focused, job-embedded teacher professional learning, which challenges more traditional instructional environments. More specifically, it infuses digital technologies and other elements of 21st century skills into the teaching and learning experience. Employed initially in face-to-face contexts, the most recent development has been the design of a MOOC which maintains key elements and signature pedagogies from the initial phases to support a scalable and sustainable model of teacher professional learning.

Keywords: Teacher education, 21st century skills, MOOCs, peer learning, learning design, ICT.

Towards a scalable & sustainable model of teacher professional learning

This programme of professional learning is distinctive for the way it is school-focused, job-embedded and directly related to teachers' experiences.

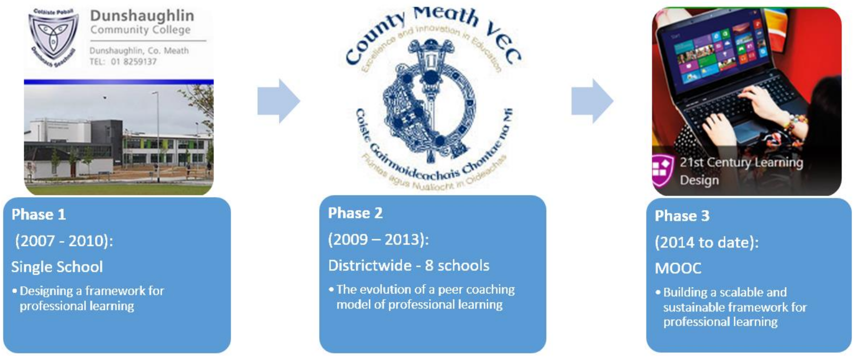

Figure 1: Phases in the development of a scalable & sustainable model of teacher professional learning

The initiative now spread over three phases (Figure 1) has two aims (i) to help post primary teachers examine and change their classroom practices, particularly in relation to innovative uses of digital technologies to support the development of 21st century skills; and (ii) to promote the transfer and tangible benefits of this professional development for students' learning. In response to an expressed desire among school leaders and teachers alike, the initiative was also directly linked to a university postgraduate accreditation process (Butler & Leahy, 2015).

Table 1: Impact of the model of professional learning on classroom practices & student learning

Emergence trends in classroom practices	Positive impact on student learning,
• Student-centred learning • Project based learning rather than discrete lesson plans • Students working collaboratively in groups rather than individual learning • Focus on learning not on subject "content" • Awareness of / designing lessons with opportunities for students to develop 21st century skills • Increase in teacher confidence to use a greater range of pedagogical strategies / digital technologies • Collaboration across and between subject departments	Learners: • taking control of their own learning • having greater ownership of the learning activities • demonstrating more engagement / participation • increased collaboration • being active rather than passive in their learning taking on new leadership roles

In order to change classroom practice, teachers need to ask questions about their existing practices (Butler, 2004). The Learning Activity/Student Work (LASW) framework (Shear et al., 2009) provided this context. It enabled the teachers to design learning activities in which they embedded 21st century learning principles, develop the meta-language to describe such learning environments and reflect on their teaching and student learning (Butler & Leahy, 2015).

The model of professional learning enabled participating teachers to design learning environments which were more student-led and characterised by the use of a range of digital technologies supporting an enquiry process that demanded the use of essential skills such as knowledge construction, problem-solving and innovation, self-regulation, skilled communication and collaboration.

Issues of Scalability: Can a MOOC address this challenge?

The challenge is to design learning experiences that support large numbers of teachers to engage in a model of co-learning (Avalos, 2011 in Laurillard, 2016). Building on the successes of phases 1 & 2 (see Table 1) the latest phase is exploring the potential of scaling the initiative through a MOOC. We know from the literature that:

- MOOCs are most appropriate for those learners who already hold an undergraduate college degree or higher (e.g. Ebben & Murphy, 2014).
- Prior level of schooling is a predictor of achievement in MOOCs (Greene, Oswald, and Pomerantz, 2015); Suggesting teachers completing a MOOC for professional development might be more likely to complete it than other participants (Hodges et. al., 2016).
- There is growing interest in how MOOCs can support teacher professional learning (e.g. Hodges, Lowenthal and Grant, 2016). Indeed, Lauillard (2016) considers MOOCs as "a perfect fit" for continuing professional development of teachers.

In phase 3 a MOOC, 21st Century Learning Design (21CLD) has been developed on the Microsoft Educator Community Platform. The core module content is built using the LASW Framework and how innovative teaching practices can support student learning to develop the key 21st skills of collaboration, knowledge construction, self-regulation, problem-solving and innovation, skilled communication, and the use of ICT for learning. A key challenge faced in the implementation of the 21CLD MOOC, is how to recreate the collaborative nature of peer-coaching and develop communities of practice that can sustain the culture of self-evaluation. To this end:

- We have built into the design of each module some opportunities for "more collaborative and constructivist engagement with teachers" (Laurillard, 2016).
- We want participants to be able to work in peer groups, sharing experiences, ideas and expertise. This also aligns with our job embedded approach that recognises the value of the experience and expertise that teachers can offer each other (Butler & Leahy, 2015).
- A preferred design element in a massive course would ideally offer university accreditation (Jobe et al., 2014) thereby addressing the issue regarding the acceptance of accomplishments by employers.

At this point in the evaluation of our work we have developed a conceptual model that envisions a series of layers with different delivery options depending on the context which draws on the 21CLD MOOC assets (see Figure 2). The next stage is to pilot these delivery options to better understand the potential of MOOCs for teacher professional learning.

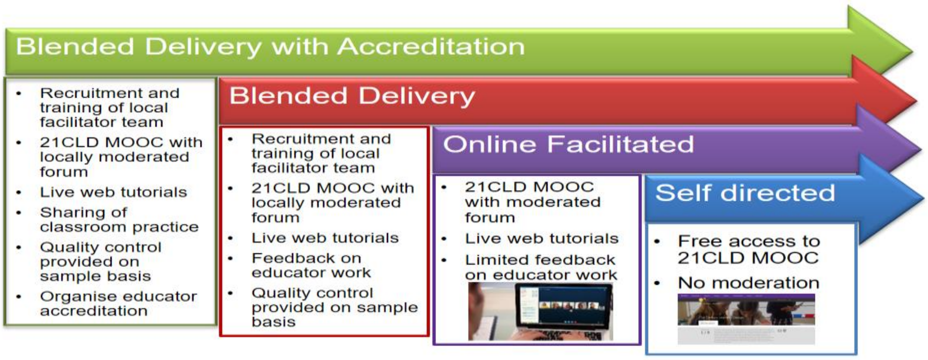

Figure 2: A framework for harnessing the potential of MOOCs

References

Bang, J., Dalsgaard, C., Kjaer, A., & O'Donovan, M. (2015). *Building OOC layers on top of existing courses.* Paper presented at the HOME Conference, MOOCs in Europe Rome.

Butler, D. & Leahy, M. (2015). "Moving towards innovation: The development of a sustainable framework for teacher professional learning" in Shaping the Future: How technology can lead to educational transformation.

Ebben, M., & Murphy, J. S. (2014). Unpacking MOOC scholarly discourse: a review of nascent MOOC scholarship. *Learning, Media and Technology*, 39(3), 328-345

Please cite as: Butler, D., Leahy, M., Hallissy, M. & Brown, M. (2016). Embedding Classroom Practice in a 21st Century Learning Design (21CLD) MOOC framework. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 102-104).

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Introducing pre-service education students to university experiences through an augmented reality game

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Augmented reality has come into its own recently due to the advent of Pokémon Go. However, this technology has been around for several years and there is an increasing body of knowledge available. This study reports on an augmented reality game (ARG), called the UQ Amazing Race, that was developed for a first year education course for students studying to be teachers. Students had the opportunity to complete the UQ Amazing Race in class tutorials and then report on their experiences by completing a survey a week later. Students' experiences were investigated particularly regarding how the experience is different by gender and comfort with technology. Results suggest the game was engaging for all students but particularly positive for female students. Students with more comfort with technology reported significantly higher participation in the ARG.

Keywords: Augmented reality game; ARG; pre-service teachers; educational technology

Introduction

Due to increased access to fast Internet and mobile devices, augmented reality games (ARGs) are becoming more common, particularly those used in education. This was increasing prior to the release of Pokémon Go in July, 2016. However, now there is much talk in educational circles about how augmented reality can be used for educational purposes (Vercelletto, 2016; Yoder, 2016). This talk is occurring by teachers of the younger years through to high school and also in tertiary education. Students increasingly have their own devices that they can use in their studies and students in schools also often have access to various types of devices. This means that ARGs can readily be used by academics to enhance student learning and engage them.

The augmented reality game (ARG), called the UQ Amazing Race, described in this paper was developed by one of the authors in order to enhance the learning experience of the large first year course and to expose future teachers to the possibilities of using ARGs in teaching. This paper reports on the game development as well as the learning experiences of students playing an ARG as part of a first year School of Education course *Learning Tools for the 21st Century*. This paper also covers aspects of the ARG pedagogy as well as the experience for the students at The University of Queensland and how the ARG assisted with their course experience. The aim of the UQ Amazing Race was to introduce students to various locations and useful information about the campus. Locations included the faculty office, student services, computer lab location, the library and where to locate wireless internet assistance.

Literature Review

Augmented Reality is "an enhanced version of reality created by the use of technology to overlay digital information on an image of something being viewed through a device (as a smartphone camera)" (Merriam-Webster, Inc, 2014, p. 1). For instance, mobile phones can be used as "viewfinders" through which a user looks while textual information about various objects in the physical space are overlayed on the objects on the screen.

Educational ARGs often revolve around a central mystery that students must solve either individually or in a group. Through the process of solving this challenge, students utilise a technological medium (e.g. iPad) to gather virtual data from their environment that provides the learning upon which the event is initially based. Thus, learning on the topic is necessary to successfully solve the mystery. Research shows that playing educational ARGs generally has a positive effect on student engagement and motivation (O'Shea & Folkestad, 2010; O'Shea, Mitchell, Johnstong, & Dede, 2009; Squire & Jan, 2007). It is possible that there are differences between students in their use of the ARG based on their gender and technology level. According to Kimbrough, Guadagno, Muscanell, and Dill (2013) women use mediated communication more frequently than men. The research project reported in this paper has the following research questions:

1. What are the student levels of engagement when using an ARG game in a teacher education course?
2. Is that experience different by students' gender and comfort with technology?

Methodology

This study involved students enrolled in a first year School of Education course *EDUC1049 Learning Tools for the 21st Century* who were undertaking a Bachelor of Education (Secondary) degree. There were approximately 350 students enrolled in the course with all students who attended the tutorial class in week 1 of classes having the opportunity to complete the UQ Amazing Race in class time. In their groups, students completed the treasure hunt in any order they wished with students working in groups of approximately four students. The students were able to complete a survey on their experiences using the ARG, the UQ Amazing Race, during class the next week. The survey consisted of both closed and open-ended questions with only the closed questions are reported here.

The research sample consisted of mostly, first and second year education students. 219 students responded to the survey about their experiences in using the ARG. In some of the following analyses the total sample size may be different because missing values were treated analysis by analysis, in other words only complete data was used for each analysis depending on the available data for each variable. 69% of students who completed the survey were enrolled in first year, with 19% of students in their second year of the course, 9% in third year, 2% in fourth year and just 1% in their fourth year of the course. This distribution of students who participated in the survey is representative of the spread of the students in the course, which is mostly undertaken by first year students.

Game Development

The development of this game came about due to a researcher from the United States visiting the university with a University of Queensland travel grant. At this time professional development was conducted for school teachers and one of the researchers was involved with the workshop development and thus attended the workshops (O'Shea and Campbell, 2016).

The ARG was created using Aurasma (2014), a program to create an ARG as well as a website to have the back bone of the game. Numerous aspects of campus life were investigated and then chosen ones were included in the game. A website was set up for students to access. Videos were also created to give students information on various topics, including the game introduction, electronic course profile information and computer lab information. The game was conducted in class tutorials. Students had 30 minutes to gain as many points as possible. Students would go to the location, use Aurasma to bring up a website and information. Then points were given for successfully completing the tasks and answering questions including the opening hours of the Faculty office, the name of one person in the School of Education office, library location and how to get assistance in setting up Eduroam. For locations where the image may change regularly (for example, daily due to different bikes being racked) points were also given for students locating, taking a photo and then emailing the tutor a photo of the bicycle racks. Assistance to the researcher was given by the Faculty Educational Designer who assisted with testing of the game as well as problem solving anything that was difficult to use.

Results

Overall, on a scale from 1 (strongly disagree) to 5 (strongly agree), students reported a positive experience of participating in the UQ Amazing Race ARG game, with means equal to 3.50 or above for all the statements, as presented in Table 1. Also investigated were the differences between students according to gender and their comfort level with technology.

Table 1: Descriptive statistics of experience of using an ARG in a pre-service teacher education course.

Statements	**Strongly disagree (%)**	***n***	**Disagree (%)**	***n***	**Neither disagree or agree (%)**	***n***	**Agree (%)**	***n***	**Strongly agree (%)**	***n***	**Mean**	***sd***
1. I enjoyed participating in the ARG.	3.69	8	11.98	26	23.96	52	51.61	112	8.76	19	3.50	0.94
2. I found playing the ARG engaging.	3.23	7	10.14	22	17.97	39	55.76	121	12.90	28	3.65	0.94
3. Through the ARG I got to know some of my classmates.	0.47	1	3.72	8	6.98	15	57.21	123	31.63	68	4.16	0.74
4. Through the ARG I learned some aspects related to university services and facilities.	2.30	5	11.98	26	27.19	59	47.00	102	11.52	25	3.53	0.93
5. I actively participated in the ARG.	0.46	1	1.84	4	6.45	14	60.83	132	30.41	66	4.19	0.67
6. I feel more confident now to participate in a future ARG.	2.76	6	6.45	14	25.81	56	47.93	104	17.05	37	3.70	0.92
7. Participating in this ARG expanded my vision of technology use in education.	4.15	9	9.68	21	24.42	53	47.00	102	14.75	32	3.59	0.99
Total (N=217)											*3.76*	*0.88*

As can be seen in Table 1, students scored active participation in the game as the highest statement, with a high mean score of 4.19. They found playing the game engaging with 68.66 (n=149) responding they either agreed or strongly agreed, and enjoyable with 60.37% (n=131) of students either strongly agreed or agreed that they enjoyed participating in the ARG. Students can be anxious when first attending university and they are often in courses outside of their friendship circle. One of the advantages of students completing the game is that they got to know others in their tutorial class in an informal way (walking around the university completing the game), thus the high score for statement 3 with 88.84% (n=191) agreed or strongly agreed, with a high mean score of 4.16.

Differences according to Gender

As presented in Table 2, there were significant difference between males (mean=3.63) and females (mean=3.81) in the overall experience of using the ARG. A closer look at the item-level, significant differences only appear for items 4 (mean for males=3.33, mean for female=3.60) and 5 (mean for males=4.01, mean for female=4.28) at the alpha level .05. All of these differences mean that female students had a more favourable experience than male students.

Table 2: Independent samples t-test according to gender (N=211)

Statements	Variance	t	df	Sig. (2-tailed)
1. I enjoyed participating in the ARG	Equal variances assumed	-1.046	209	.297
	Equal variances not assumed	-1.048	144.463	.296
2. I found playing the ARG engaging.	Equal variances assumed	-1.610	209	.109
	Equal variances not assumed	-1.577	135.820	.117
3. Through the ARG I got to know some of my classmates.	Equal variances assumed	-.672	209	.503
	Equal variances not assumed	-.639	125.467	.524
4. Through the ARG I learned some aspects related to university services and facilities.	Equal variances assumed	-2.038	209	**.043**
	Equal variances not assumed	-1.972	131.289	.051
5. I actively participated in the ARG.	Equal variances assumed	-2.846	209	**.005**
	Equal variances not assumed	-2.728	128.109	.007
6. I feel more confident now to participate in a future ARG.	Equal variances assumed	-1.190	209	.235
	Equal variances not assumed	-1.154	132.086	.251
7. Participating in this ARG expanded my vision of technology use in education.	Equal variances assumed	-.973	209	.332
	Equal variances not assumed	-.916	122.144	.361
Total (Average of all statements)	Equal variances assumed	-2.047	209	**.042**
	Equal variances not assumed	-1.969	129.313	.051

Differences according to Comfort with Technology Use

We used one-way analysis of variance (ANOVA) to test if students' experiences were different based on their comfort with technology use (see Table 3). There was no significant difference according to the overall experience. The only difference based on was in statement 5 "I actively participated in the ARG".

Table 3: ANOVA Results for Differences in ARG experience according Comfort with Technology Use (N=211)

Statements		Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	3.085	4	.771	.856	.492
	Within Groups	185.664	206	.901		
	Total	188.749	210			
2	Between Groups	5.087	4	1.272	1.445	.220
	Within Groups	181.254	206	.880		
	Total	186.341	210			
3	Between Groups	2.294	4	.573	.817	.515
	Within Groups	144.503	206	.701		
	Total	146.796	210			
4	Between Groups	6.243	4	1.561	1.864	.118
	Within Groups	172.477	206	.837		
	Total	178.720	210			
5	Between Groups	5.815	4	1.454	3.540	**.008**
	Within Groups	84.602	206	.411		
	Total	90.417	210			
6	Between Groups	5.284	4	1.321	1.592	.178
	Within Groups	170.906	206	.830		
	Total	176.190	210			
7	Between Groups	4.974	4	1.243	1.278	.280
	Within Groups	200.486	206	.973		
	Total	205.460	210			
Total= Average of all statements	Between Groups	3.012	4	.753	1.994	.097
	Within Groups	77.787	206	.378		
	Total	80.800	210			

Post-hoc analysis using Fisher's least significant difference (LSD) test shows that the differences were only significant between students who reported a level 2 comfort with technology use and the three higher levels (3, 4, and 5), as can be seen in Table 4. This means that students with more comfort with technology (levels 3: mean=4.29, level 4: mean=4.15 and level 5: mean=4.24) reported significantly higher participation in the ARG, compared with the lower level (specifically level 2, mean=3.20). One limitation of this finding is the small number (*n*=7; 3.3%) in the lower levels (1 and 2) of comfort with technology compared with the higher levels.

Table 4: LSD Post hoc results for item 5 according to comfort with technology use (N=211)

Levels of comfort with technology use ((1=Least comfortable; 5=Most comfortable)		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
2	1	-.800	.536	.137	-1.86	.26
	3	**-1.089***	.302	.000	-1.68	-.49
	4	**-.949***	.295	.001	-1.53	-.37
	5	**-1.050***	.296	.000	-1.63	-.47

*. The mean difference is significant at the 0.05 level.

Discussion and Conclusion

The positive results with the ARG show agreement with the current literature that suggests motivation and student engagement are enhanced through the use of ARGs in class (O'Shea & Folkestad, 2010; O'Shea, Mitchell, Johnston, & Dede, 2009; Squire & Jan, 2007). Students were also able to get to know their classmates which may have assisted in their enjoyment of the game and activity.

The results for this study show that students enjoyed participating in the ARG and that the female students had a more favourable experience than the male students. The differences in the student's experience depending on their comfortable with technology need to be taken with caution because of the small sample size in the lower level of comfort with technology use; the majority of students are comfortable with using technology in this study. For the small minority who still feel uncomfortable with technology use, it is expected that they will struggle with playing computer games. This small minority may have been the older students who were taking the course. In addition, this factor may have also been diffused in this study as students completed the game in groups.

Future directions include having students learn the necessary skills to create their own ARGs so that they are be able to use ARGs with their future students. As ARGs are such a new teaching tool there is limited research on university students creating ARGs, investigating if the amount of time it takes to learn the design process outweighs the effort. However, with games such as Pokémon Go there is now renewed interest in using ARGs for educational purposes and thus new interest is added to game creation in educational contexts.

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References

Aurasma (2014). Aurasma Augmented Reality Browser. Retrieved August 8, 2016 from http://www.aurasma.com/

Dobies, T., & Nelson, C. (2016). Snapchat: Higher education's new key to current and prospective student engagement. *Journal of Education Advancement & Marketing*, *1*(1), 17-25.

Kimbrough, A. M., Guadagno, R. E., Muscanell, N. L., & Dill, J. (2013). Gender differences in mediated communication: Women connect more than do men. *Computers in Human Behavior,29*(3), 896-900.

Merriam-Webster, Inc. (2014). Augmented Reality. Merriam-Webster, Incorporated. Retrieved August 8, 2016 from http://www.merriam-webster.com/dictionary/augmented%20reality

O'Shea, P.M. & Campbell, C. (2016). The theory and process involved with educational augmented reality game design. In D. Russell and J. Laffey, *Handbook of Research on Gaming Trends in P-12 Education.* (pp. 151-163). ICI Global.

O'Shea, P., & Folkestad, J. (2010). *Evaluation of the augmented reality project at the School in the Park*. Unpublished Manuscript.

O'Shea, P., Mitchell, R., Johnston, C, & Dede, C. (2009). Lessons learned about designing augmented realities. *The International Journal of Games and Computer Mediated Simulations*, 1(1).

Squire, K.D., & Jan, M. (2007). Mad city mystery: Developing scientific argumentation skills with a place-based augmented reality game on handheld computers. *Journal of Science Education and Technology*, *16*, 1, 5-29.

Vercelletto, C. (2016). What's after Pokemon Go? Explore augmented reality Sept 13: SLJ ISTE Webcast Series. Retrieved from http://www.slj.com/2016/09/industry-news/whats-after-pokemon-go-explore-augmented-reality-sept-13-slj-iste-webcast-series/#_

Yoder, M. (2016). Use these resources to bring augmented reality to your classroom. Retrieved from https://www.iste.org/explore/articleDetail?articleid=739&category=Toolbox&article=

Please cite as: Campbell, C., & Al-Harthi, A. (2016). Introducing pre-service education students to university experiences through an augmented reality game. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 105-110).

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Snapchat at school – 'Now you see it…': Networked affect – cyber bullying, harassment and sexting

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Snapchat is one of the most popular social media applications among Australian young people. Its global impact has grown rapidly in recent years. Reported is a mixed methods case study located in New South Wales schools. An online survey was conducted with education practitioners to enquire into their experiences of Snapchat in their school settings. The researchers used survey responses and comments from follow up interviews to consider how networked affect is enacted through Snapchat. Networked affect can be seen as a visceral movement of emotion through the intra-action of social media and human bodies. Both corporeal affect and Snapchat have received increased attention by researchers over the last five years although little has been written to link the two. We highlight the importance of reading the affective social impact of Snapchat use among young people and the potential of looking beyond its abuses to the affordances of the application.

Keywords: Snapchat, affect theory, cyber bullying, harassment, sexting, social media, schools

Introduction

Snapchat is a disappearing media application (app) that has taken youth social networks by storm: marketed to the 13 to 34 age bracket, there are over 100 million daily users (Ingram, 2015). Although it is well established in youth networked publics (boyd, 2010), there is little international research on its use (Vaterlaus, Barnett, Roche & Young, 2016) and even less on its use as a conduit for 'sexting', cyber-harassment and cyber-bullying (Ringrose, Gill, Livingstone & Harvey, 2012). In this paper we investigate how Snapchat aligns with networked affect (Handyside & Ringrose, 2016; Paasonen, Hillis & Petit, 2015) in New South Wales (NSW) school settings. Networked affect is a relational flow between bodies and objects. More than emotionality, it emerges though material–discursive entanglements wherein bodies, photos, cameras, and expressed selves are intertwined (Warfield, 2016). In these entanglements, technological objects (software and hardware) are influential and exert agency on other objects and on humans as "agential matter" (Bolt, 2012, p. 3).

Snapchat facilitates relationships in teen peer networks by providing a medium for images to be disseminated. 'Selfies', typically embedded with text, 'doodles' and other photos are used to communicate with friends and family as an "'easier and funnier' alternative to other instant messaging services" (Piwek & Joinson, 2016, p. 358). Snapchat's unique point of difference has been in its ephemerality. There are new features included on a regular basis to sustain the interest of young users. Comical 'selfies' can be sent of carnivalesque distortions, creating shared spaces for fun and frivolity between sender and recipients. Filters enable users to cloak themselves in masks and feathers, or transform themselves into comedic animals. In a world of fast responses, sending images ('snaps') is easy, quick and fun. Although Snapchat use in cyber networks can provide opportunities for creativity, we can also witness the underside of teen relationships. We provide research data to illustrate networks of affect circulating in educational settings through and around the use of Snapchat.

Background and context

We are a multi-disciplinary team of researchers at the University of New England (UNE) in the Schools of Education, Health and Law, who have conducted research into the use of disappearing media among young people since 2014. Our research commenced with an investigation into the use of Snapchat among students in higher education. Recognising that the ephemerality was an interesting feature of the technology, we commenced a project in 2014 to investigate parents' experiences of Snapchat (Charteris, Gregory & Masters, 2016). This project involves both educators and high school students. The data for this paper is drawn from research into the experiences of school practitioners with Snapchat in their school settings.

Literature review

Snapchat offers rich social opportunities for creative image sharing. It is “a temporal fastness and ephemerality” where image “exchanges can be used as various forms of relationship currency” (Handyside & Ringrose, 2016, p. 1). The application has been linked with flirting and finding new love interests (Utz, Muscanell & Cameran, 2015). It is viewed as a “lightweight channel for sharing spontaneous experiences with trusted ties” (Bayer, Ellison, Schoenebeck & Falk, 2016, p. 956). The majority of adults surveyed by Roesner, Gill and Kohno (2014) considered that security was not a major concern. They recognised that, rather than a violation of the sender's trust, capturing screenshots was common and expected. Most of their respondents understand that messages can be recovered. It is uncertain whether this is the case among young people and there can be serious repercussions when an image ‘goes viral’ (Charteris & Gregory, 2016).

Looking closely into the use of disappearing media among young people, we can learn about both power relations and the underside of teen peer culture. Scholarship associated with the affective turn has increased over the last decade. Affect theory, with its origins in the work of Deleuze and Spinoza (Deleuze & Deleuze, 1978), can be seen as more than internalised emotion. It is the influence of emotion as an embodied experience that flows between humans and which can pass through the non-human as objects are seen to be agentic in their own right (Bolt, 2012). Scholars have used affect to explore the relations between embodied experiences of humans and the technologies that are incorporated into their lives. “Materials, surfaces, scapes, sounds, and images leave traces on the human sensorium that are decidedly extralinguistic, and can only be accounted for through recourse to the more intuitive concepts and looser worldviews afforded by affect theory” (Baulch, 2016, p. 288). Scholarship on networked affect weaves together affect, emotions, and feeling with new and emerging media (Paasonen, Hillis & Petit, 2015). We consider networked affect through an analysis of practitioner comments about the use of Snapchat in their school contexts.

Method and methodology

To execute this mixed methods case study, we invited 3,353 NSW primary and secondary schools to participate via email and received an 8% response rate. Although the response rate was low, those who responded were possibly those who had exposure to Snapchat use in schools. An online survey was used to preserve participants’ anonymity. A total of 276 participants (184 female, 92 male) agreed to participate of whom 28% were practitioners in school leadership positions. The other participants were classroom teachers (66%) and school counsellors (1.4%). The research received ethical approval from the UNE Research Ethics Committee.

In this paper we focus particularly on responses to the following survey question: *In your school, what have you seen children do with disappearing media (e.g. Snapchat)?* The survey comments were manually coded in relation to the reported nature of Snapchat use in the participants’ schools. Follow up semi-structured interviews were conducted with 12 consenting school leaders and teachers. Supporting samples of survey and interview comments are used to elaborate on the emerging themes from the survey that are outlined in Table 1.

Findings

Survey results and open-ended comments

Overall, 51% of educators in this research indicated that social media influences their teaching with 42% reporting that their classroom has been influenced by Snapchat. The findings found that educators are taking action, with 90% of respondents discussing issues related to social media with their students. Responses to the survey question on the use of Snapchat by students in schools, witnessed by educators, are categorised in Table 1. Due to the generic nature of comments on bullying and harassment, there is likely to be a crossover into the area of sexting. Sexually explicit material can be used to harass and the networked effect of these activities cross gender matrices. Nevertheless, significant research in the field highlights that existing double standards around girls’ sexuality can lead to social media harassment that can be significantly damaging (Ringrose, Harvey, Gill & Livingstone, 2013). In the data, bullying and sexting intertwine and the nature of the harassment was unclear from the comments.

Table 1: Teachers' perception of student Snapchat use

Use of Snapchat	Percentage of Practitioner Respondents
No visible use of Snapchat in the school	26.8%
Playful use - sending images, videos, messaging	45.1%
Bullying/harassment	11.8%
Sending inappropriate images/text	12.4%
Sexting	1.8%
Self-harm	0.9%
Parental involvement/complaints	1.2%
Total	**100%**

The following comments map networked affect in schools and their wider communities. Although it is uncertain from these comments how subjects experience the distribution of their 'snaps', it is likely that their acquisition and digital curation evoke a range of embodied responses including amusement, shame and humiliation. Images of 'vulnerable' people (both students and teachers) can be recorded at school and used to evoke affect among peers through the circulation of unflattering material. Some comments by principals and teachers: "Students send photos of other children or make comments they wouldn't normally make simply because they believe there isn't a record"; "They take images and videos of vulnerable students. They covertly record teachers, particularly teachers for whom they have little respect"; and "They send inappropriate photos/videos of other students without their permission. It is used to tease, embarrass and bully others" demonstrate this.

Teachers reported that although students thought explicit images would disappear, they were saved and distributed. The following comment highlights the interplay between sexting and bullying, and the juxtaposition of love and trust with betrayal and harassment. It also reveals the complexity of the emotionality of self-harm when it is mediated and magnified through Snapchat as networked affect. "I am aware of some students sending sexualised comments and images (adolescents) believing they will disappear. I am also aware of images and comments being saved (screenshot) and misused later. I am also aware of photos of self-harm being distributed using disappearing media".

The next comment highlights a range of affective interrelations promulgated through Snapchat in school settings. Screenshots of 'snaps' can be used to bring bullying to the attention of teaching staff, yet these same images can also 'go viral'. Evidenced, Snapchat networks draw in a range of students, teaching staff and parents who respond and contribute to webs of affect: "They send mean texts and students have screenshot them before they disappeared. Students respond inappropriately and create bullying issues at school. Parents respond negatively towards other children. Young teachers responding to each other during work hours".

Despite its use as a vehicle for sexting, Snapchat can support 'light hearted' activity and produce generative interactions: "I understand anecdotally that some students have been involved with sexting and the like in the past, but for the most part it is used for amusing and light-hearted exchanges between students". As Snapchat is an application that is popular among young people, it is interesting to note that not all teachers are familiar with this form of social media. One teacher noted that they "had to ask what Snapchat was and why it was described as 'disappearing'". This lack of knowledge about the Snapchat application could be a problem if relational issues arise in schools and educators are not aware of its functionality and implications for misuse.

Interview findings

We now turn to examples of networked affect taken from interview data. The respondents were practitioners from two regional high schools in NSW. The comments were selected on the basis that they convey affective flows. Respondent 1 and 2's comments below illustrate a poignant affective paradox. The sender, in sending an affect producing image, is 'insulated' from the impact of their actions. They do not witness the recipient's embodied emotional reaction. The receiver, can be 'devastated' by the 'snaps' sent with significant implications for their wellbeing.

> I think social media becomes an avenue for students to hide behind, to inflict pain on others… They don't understand the full consequences of what they are doing, the full impact, how devastating it can be. I think social media is an avenue for brutality that they see as fairly innocuous, fairly easy to access. There are no apparent consequences. They could sit in their bedroom at 10'clock at night and tell someone to commit suicide because they are so angry at them. If they said it face to face it would be a far more confrontational thing. Saying it via a quick Snapchat means that it comes and it goes and it disappears. They feel anonymous. They feel insulated by that technology and no one has come to me with a good story about it (Respondent 1, Secondary Principal).

> There is depression and anxiety - depression because they're feeling so bad about themselves because these people have made such comments. And they're not willing to get out of bed because of that. They are scared to come to school because of what might happen… So, it can snowball when they're making those comments about each other online - and that's what leads to these anxiety disorders or the depression that, you know, unfortunately we do see an increasing incidence in our school (Respondent 2, High School Teacher).

Although it is unclear whether Respondent 2 is qualified to judge students' mental health, the comments highlight the relational fallout when networked affect 'snowballs' through a school community, isolating and ostracizing individuals.

Discussion

In a world where young people are immersed in a plethora of competing visual images, Snapchat, with its pressure to register attention, focuses the gaze. The publicity associated with 'snaps' when they are disseminated among networks of people can be seen as an affect economy. "In an affect economy, value is sought in the expansion or contraction of affective capacity" (Clough, 2007, p. 25). Through the transmission of 'snaps', there is a clear expansion of affective capacity among relational networks. Prompted through young people's Snapchat use, affect is intensified in the relational flows between peers, parents and educators. Correspondingly, Handyside and Ringrose (2016, p. 7) highlight that Snapchat creates "affective mediated web-like structures through which various emotions circulate and interact" and the "variable intensities and power relations shape what users/bodies can do (or not do)". Snapchat shapes social relations. As the data demonstrates, the sharing of damaging 'snaps' can have negative and far-reaching social repercussions for young people and school communities. In certain cases, this can extend to legal liability if technology is misused to "harass, intimidate, tease, threaten, abuse or otherwise terrorise" peers and teachers (Kift, Campbell & Butler 2010, p. 60).

Through Snapchat circulation, affective corporeal and cyber responses are evoked from peers, teachers and parents. Paasonen, Hillis and Petit (2015, p. 1) note that "the fluctuating and altering dynamics of affect give shape to online connections and disconnections, to the proximities and distances of love, desire, and wanting between and among bodies, to the sense of standing out from the mass". Publicity of self-harm, cyber-harassment and cyber-bullying can be magnified as images sweep through school communities. The school practitioners we surveyed and spoke with were entangled in the networks of affect associated with practices of bullying and sexual harassment. Few spoke of its merits. Many were pleased to have policies where the phones were prohibited in the school during the day, although some spoke about permitting phones and teaching appropriate cyber practices in the form of 'good digital citizenship'.

Future directions and Conclusions

Although Snapchat is a rapidly growing form of social media, as yet there is little research in school contexts. In particular, little has been written about students' experiences with Snapchat in Australian school contexts. Further, there is a challenge in separating harassment associated with sexting and cyber bullying activities. Additional research in this area could explore the moral panic around girls' sexuality (Authors, 2016) and cyber-harassment. There is also an opportunity for further research into the legal consequences, particularly in terms of bullying and harassment (Kift, Campbell & Butler 2010).

The majority of the educator participants in the research reported negative effects of its use in their school contexts. The application appears to have immense popularity among young people. Thus, there is potential to investigate how ephemeral media and the curating of images can be translated into an affordance in both schooling and initial teacher education programs. Affect theory involving the intra-activity of human and non-humans (Bolt, 2012) has become increasingly influential in education research. Embedded in and amplifying the relational flows in schools, Snapchat is instrumental in the entanglements associated with networked affect.

References

Bolt, B. (2012). Introduction. Toward a "new materialism" through the arts. In E. Barrett & B. Bolt (eds), *Carnal knowledge: Towards a 'new materialis' through the arts.* London: I.B. Tauris.

Boyd, D. (2010). Social network sites as networked publics: Affordances, dynamics, and implications. In Z. Papacharissi (ed.), *A networked self: Identity, community, and culture on social network sites* (pp. 39–58). New York, NY: Routledge.

Charteris, J., Gregory, S., & Masters, Y. (2014). *Snapchat 'selfies': The case of disappearing data*. In B. Hegarty, J. McDonald, & S.-K. Loke (Eds.), Rhetoric and Reality: Critical perspectives on educational technology. Proceedings ascilite Dunedin 2014 (pp. 389-393). https://app.box.com/s/016cdyv8dq1pp0yhp1vw/1/2704865194/23032568968/1

Charteris, J., & Gregory, S. (2016, June 16). Snapchat has its risks but it's a powerful tool for youth creativity and socialisation. Retrieved from http://theconversation.com/snapchat-has-its-risks-but-its-a-powerful-tool-for-youth-creativity-and-socialisation-59457

Clough P. (2007). Introduction. In P. Clough and J. Halley, (eds.), *The Affective Turn: Theorizing the Social* (pp. 1–33). Durham: Duke University Press.

Deleuze, E., & Deleuze, J. (1978, January). *Gilles Deleuze, Lecture: Transcripts on Spinoza's concept of Affect.* Lecture. Retrieved from http://www.gold.ac.uk/media/images-by-section/departments/research-centres-and-units/research-centres/centre-for-the-study-of-invention/deleuze_spinoza_affect.pdf

Handyside, S., & Ringrose, J. (2016). Snapchat Memory and Youth Digital Sexual Cultures: Mediated temporality, duration, and affect. Retrieved from https://www.academia.edu/attachments/47268956/download_file?st=MTQ2ODk4NzM2MCwxODAuMTgxLjU4LjgzLDY5Mzg4ODU%3D&s=swp-toolbar

Ingram, (2015). Snapchat's video views are exploding, and it's closing in on Facebook. Retrieved from http://fortune.com/2015/11/09/snapchat-video/

Kift, S., Campbell, M., & Butler, D. (2010). Cyberbullying in social networking sites and blogs: legal issues for young people and schools. *Journal of Law, Information and Science*, *20*(2), pp. 60-97.

Paasonen, S., Hillis, K., & Petit, P. (2015). Introduction: Networks of transmission: Intensity, sensation, value. In K. Hillis, S. Paasonen, S., and P. Petit, (Eds.), *Networked Affect* (pp. 1–24). Cambridge, MA: MIT Press

Piwek, L., Joinson, A. (2016) "What do they snapchat about?" Patterns of use in time-limited instant messaging service. *Computers in Human Behavior 54,* 358–367. http://dx.doi.org/10.1016/j.chb.2015.08.026

Ringrose, J., Gill, R., Livingstone, S., & Harvey, L. (2012). *A qualitative study of children, young people and 'sexting': a report prepared for the NSPCC.* National Society for the Prevention of Cruelty to Children, London, UK.

Ringrose, J., Harvey, L., Gill, R., & Livingstone, S. (2013). Teen girls, sexual double standards and 'sexting': Gendered value in digital image exchange. *Feminist Theory, 14*(3), 305–323. doi:10.1177/1464700113499853

Roesner, F., Gill, B., & Kohno1, T. (2014). Sex, lies, or kittens? Investigating the use of Snapchat's self-destructing messages. Retrieved from http://www.franziroesner.com/pdf/snapchat–FC2014.pdf

Utz S., Muscanell, N., & Cameran, K (2015). Snapchat elicits more jealousy than Facebook: A comparison of Snapchat and Facebook use. *Cyberpsychology, Behavior, and Social Networking*, *18*(3), 141–146. DOI:10.1089/cyber.2014.0479.

Vaterlaus, J., Barnett, K., Roche, C., Young, J. (2016). "Snapchat is more personal": An exploratory study on Snapchat behaviors and young adult interpersonal relationships. *Computers in Human Behavior, 62*, 594–601. http://dx.doi.org/10.1016/j.chb.2016.04.029

Warfield, K. (2016). Making the cut: An agential realist examination of selfies and touch. *Social Media + Society, April-June,* 1–10. doi: 10.1177/2056305116641706

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Toward the development of a dynamic dashboard for FutureLearn MOOCs: insights and directions

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In recent years, many higher education institutions have invested in the development of Massive Open Online Courses (MOOCs). With the increase of available MOOC data, there is an opportunity to provide insights to educators and developers into learners' behaviors through learning analytics. Focusing on the FutureLearn platform (FL), standardized data files are offered to partner institutions. Additionally, a report is offered to stakeholders, but it is limited in a number of ways: it is static, it is limited in presenting relevant information and, most importantly, it does not provide 'real-time' access to data. This paper provides an overview of the rationale and the development process of a dynamic and near real-time dashboard. It explores the viability of different types of visualizations with the available data, lessons learned, comparisons with similar efforts, and future directions are discussed.

Keywords: FutureLearn MOOCs, Dashboards, Visualizations, Sense-making, Learning Analytics.

Introduction

Following the hype of MOOCs (Massive Open Online Courses) our institution entered the field in the consolidation phase of the hype cycle (Linden & Fenn, 2003) and invested in the experimentation with two very different platforms: Coursera and FutureLearn. Over the past two years UNSW developed and delivered over 20 MOOCs focusing on innovative pedagogy and variety over a mass-production approach. This was specifically to steer away from the media focus, which has been predominantly on a few characteristics of MOOCs – i.e. free courses, massive numbers, massive dropouts and implicit quality warranted by the status of the institutions delivering these courses. Instead, aligning with the rapidly growing research interest the idea was to question the effectiveness of MOOCs for learning and their pedagogies (Bayne & Ross, 2014; Yuan & Powell, 2013) and the possibility to take what we learnt in the process 'back to mainstream' of institutional practices. Questioning pedagogies, has driven the need to understand, analyze and evaluate MOOCs. Within an institution, this tends to rely on data analysts (Kandel, Paepcke, Hellerstein, & Heer, 2011) to interpret, translate and sometimes deduce academic and institutional requirements before modelling of data can take place, often before being able to deliver usable research outputs. Yet, despite the hype of big data in education and the potential associated with the ability to collect and analyze large amounts of information about students' learning behaviors, one of the biggest limitations has been finding a way to expose this data in a meaningful and relevant way to stakeholders. Visualization of data and the ability to manipulate visualizations in dashboards has been demonstrated to offer useful insights (Duval, 2011; Macfadyen & Dawson, 2010), but brought an over-expectation of benefits (Verbert et al., 2014). The focus of dashboards has been on providing awareness, reflection and sense-making, however, dashboards in and of themselves, do not automatically confer learning or awareness gains. It is a combination of effective design, requirements elicitation, and an understanding of user objectives, which can afford these products to aid data exploration and analysis processes.

Coursera provides a dashboard to educators and developers with a live view of their data, but the granularity of the information does not necessarily cater to the needs of all the interests from the different stakeholders. Others like edX, have analytical plug-in modules which users can install on their systems, affording similar functionalities (Cobos, Gil, Lareo, & Vargas, 2016; Fredericks, Lopez, Shnayder, Rayyan, & Seaton, 2016; Ruiz et al., 2014). There are also examples of visualization dashboards (Shi, Fu, Chen, & Qu, 2014) representing a range of behaviors from MOOCs, however a key question remains of whether information presented conveys useful insights. FutureLearn decided not to offer a fully-fledged dashboard to partner institutions. However, they explicitly chose to make simple datasets (in terms of granularity and stability, given that the datasets were designed independently from the inevitable changes and improvements to the user interface) available daily so that interested parties would be able to carry out their own analyses. Furthermore, they gave partner institutions a standard R script to generate pdf reports answering some commonly asked questions. These datasets provided both a challenge and an opportunity: in previous work a workflow was developed to manage analytics for courses in the Coursera platform

(Clayphan, Vigentini, Zhang, & Zhao, 2015). Working with FutureLearn data gave the opportunity to test the process with a different platform. Furthermore, taking advantage of the near real-time release of data, allowed for experimentation with different modes of representation and workflows that had not been possible with Coursera. Incidentally, the work presented here could be compared directly with a similar process developed independently, but around the same time, conducted by colleagues in Europe (Leon Urrutia, Cobos, Dickens, White, & Davis, 2016).

The paper is organized as follows: first the datasets are presented considering some key assumptions and limitations; then the methodology for building the dashboard is explained including some exemplars of the visualizations created; finally, issues and future directions are discussed.

Datasets

Each MOOC published in the FutureLearn website is presented in a hierarchical structure with weeks, activities and steps. Steps contain different types of material and can be recognized by the label next to the step title. In the courses designed at UNSW, eight different step types have been used: article, discussion, video, exercise, quiz, test, audio and LTI activity. Figure 1 shows an overview of a typical FutureLearn MOOC.

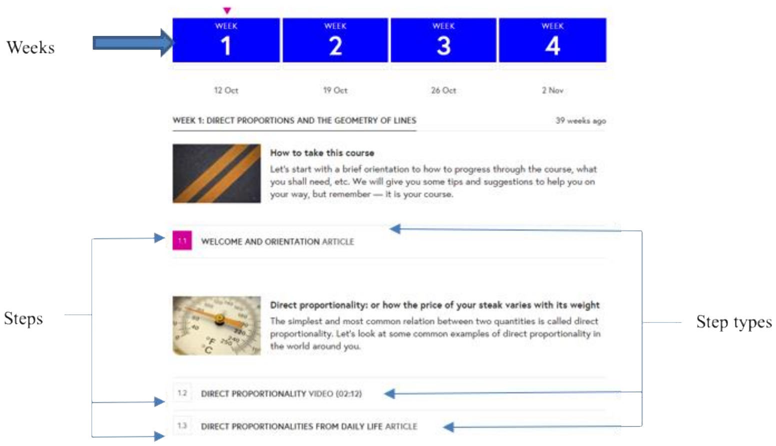


Figure 1: The Overview of a FutureLearn MOOC structure.

By default, FutureLearn provides eight data sources prepared as comma separated values (CSV) files. Table 1 describes each file with detail about their purpose. Conscious that MOOC platforms are relatively young and tend to rapidly develop features to improve the user experience, at the time of writing, the datasets available in FutureLearn have three main limitations: 1) granularity of user activity (currently limited to the time of the first/last access rather than a full interaction log); 2) minimal contextual information (lack of metadata about the learning context, such as video interaction data), and 3) partial demographic information to understand learners (only about 10% of participants have chosen to share personal details in the platform). As mentioned earlier, the limitations are the result of FutureLearn's choice to provide easy to access and stable datasets. These sources provide an excellent starting point to demonstrate the use of analytics in action.

Table 1: FutureLearn Datasets.

File	The purpose of the file
Enrolments	This file provides basic information regarding the enrolled learners and staff. It also includes demographic information of learners derived from the learners' responses to the more-about-you survey such as gender, country, age range, highest education level, employment status, and employment area.
Step Activity	This file stores information regarding step activity from learners in the course, e.g. the time when a step is first visited, and the last time a step is marked as completed.
Comments	Information about learners' contributions to the discussion section in each step is stored in this file. It includes the text of the comment and the timestamp corresponding to when the comment was made. It also stores the number of likes associated with a comment.
Question Response	This file holds information about the quiz activity of learners. It stores learners' responses, its correctness and the timestamp associated when answering a quiz.
Team Members	Information about organization staff such as their ids and names are stored in this file.
Peer Review Assignment	This file provides information regarding peer review assignments including when the assignment was first viewed, when it was submitted and the number of reviews associated with the assignment.
Peer Review Reviews	This file provides information about the reviewers on an assignment, including when the review was submitted, the reviewer's id and feedback text on each of the assignment guidelines.
Campaigns	Information about the referral used to advertise a course is stored in this file, following the number of enrolments and active learners for each referral.

Methodology

The main challenge to develop a sustainable, dynamic and near real-time dashboard outside the FutureLearn platform, are the choice of the appropriate automations to keep the data up-to-date for the visualizations and the construction of re-usable building blocks to answer common questions. A novel architecture was developed around a two-stage model: 1) data extraction and pre-processing and 2) dashboard development (see Figure 2).
The choice of appropriate tools to enable these stages was driven by previous experience with the creation of dashboards for the Coursera platform combined with a preference for experimenting with different products. Python and R were chosen as the scripting languages. Data was hosted in the cloud (Amazon AWS), consisting of a MySQL database, an R server, a Shiny server and an Apache server to serve content.

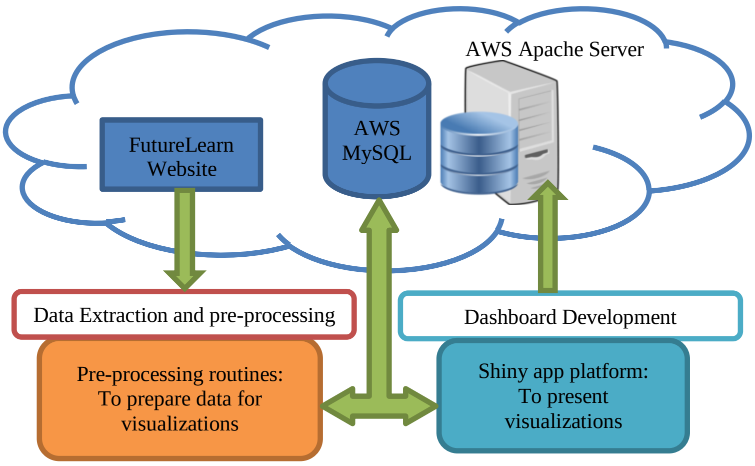
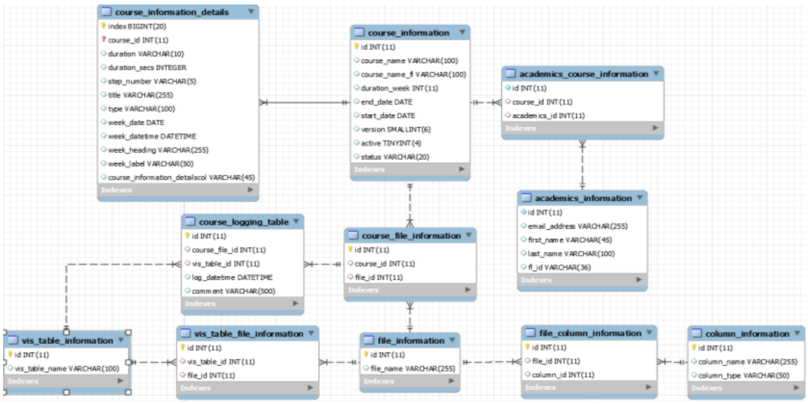


Figure 2. Dashboard architecture for automating dashboard development for FutureLearn MOOCs.

Data Extraction and Pre-Processing

In the data extraction and pre-processing phase, Python scripts were used to automatically login into the FutureLearn platform and download all available files for each course. Each time new CSV files are downloaded, they are stored in a folder, named as per the course title, with previous CSV files archived. To support the automation process for the extraction and processing of raw data, a global database *(futurelearn_courses_information)* was designed, based on a third normal form (3NF) design.
After downloading all course files and loading the data into the database, the preprocessing routines (written as R scripts) prepare the data for the web application and transform the source tables into smaller views, used for individual representations. These are intended to make web data requests more responsive at run-time.



- *course_information:* holds details related to each course such as the course name, the abbreviated course name shown in the URL and the run number;
- *course_information_details:* stores course step details;
- *course_file_information:* stores references to the appropriate files for each course;
- *vis_table_information; vis_table _file_information* stores specific visualization information

Figure 3: The model of the global database. The core table *course_information* stores metadata on each MOOC. The other tables store metadata regarding the CSV files and the visualization tables.

Exploring different types of visualizations

Previous research (Clayphan et al., 2015; Kia, Pardos, & Hatala, 2016; Stephens-Martinez, Hearst, & Fox, 2014) identified five key areas which appear to direct the attention of educators and developers in MOOCs: 1) An overview of the course, 2) Who are the participants/learners, 3) How participants interact/engage with the material, 4) How participants interact in the forums, and 5) How participants perform in the course.
In the design of our dashboard, we took these areas into account as well as principles for designing dashboards in order to showcase critical information to achieve one or more objectives (Few, 2006). Together with more traditional bar charts, line charts, scattergrams and heatmaps, a few examples are presented below to illustrate the types and modes of representation used. The first example (Figure 4 – left) shows a Sankey chart representing a typical sequence step progression in the course. This is modeled similarly to the representation used in Google analytics. However, in the educational context there is a lack of an appropriate conversion metric (i.e. shopping cart or checkout), therefore the visualization in this context is based on the selection of all pathways of N steps available in the data and allows the end user to select the number of steps. Information about step types are included to show the frequency of transitions from one type to another.

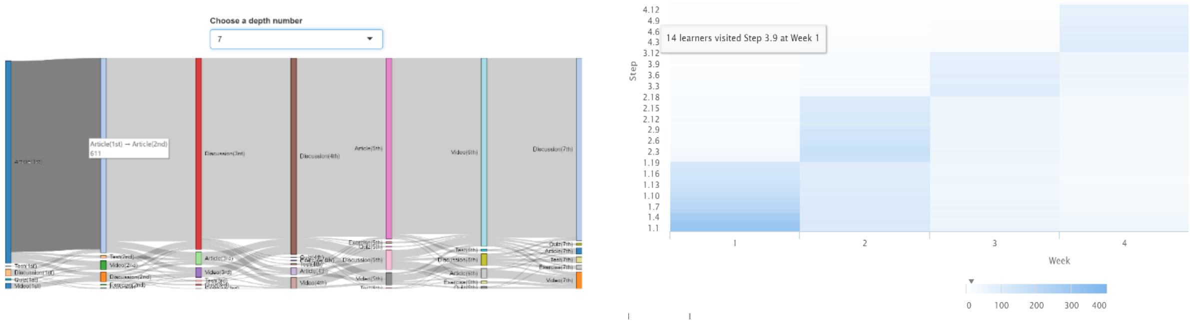


Figure 4. Left: Sankey chart of transitions from step to step labeled by type, Right: patterns of completion by steps (vertical) and weeks (horizontal).

Another interesting representation focuses on learners' sequences of actions (Figure 4 – right). From the heat map shown, we see that the typical learner follows the course in a linear fashion, based on the sequence of steps presented (the middle diagonal). Figure 5 shows an alternative representation of transitions between steps. This highlights that learners follow a linear sequence in a course in most steps, but towards the end of a week, there is a high chance of exploratory behavior, as evidenced by jumping to other steps in different weeks.

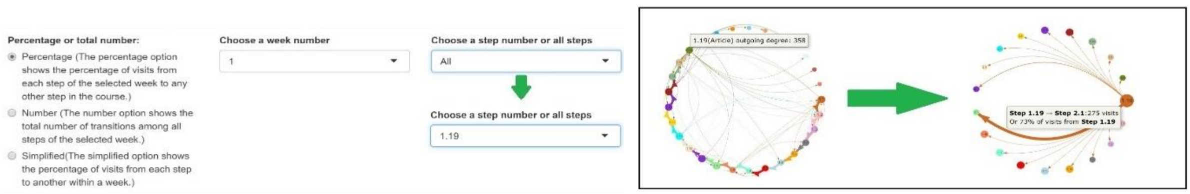


Figure 5. Step transition of learners from each step in the course to another.

The next example (Figure 6 – left) shows the number of comments by date labeled according to step types: this shows that social interaction occurring in ‘discussion’ steps is not the predominant forum for interaction between learners. Additionally, a visualization of sentiment for comments in steps (Figure 6 – right) shows positive and negative scores using a novel algorithm to identify the valence of the comments compared to a reference dictionary and assigning a score to the whole comment, before grouping the comments in the step.

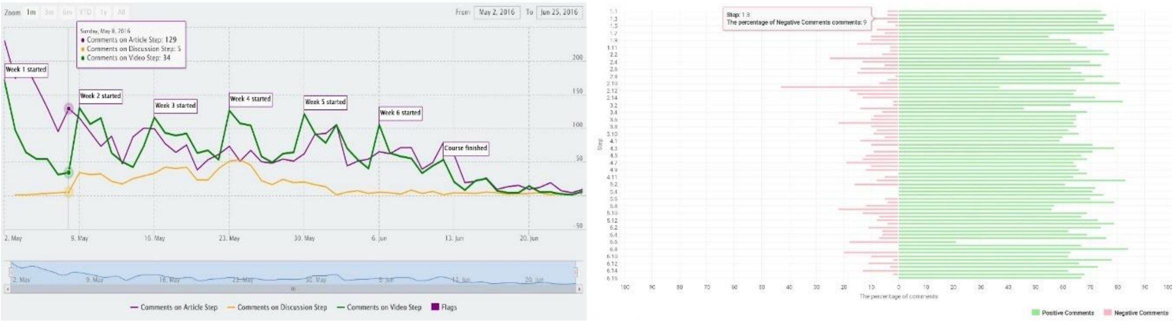


Figure 6: Left: The number of comments on different dates grouped by step types. Right: the sentiment analysis of comments on each step shown as a percentage.

Conclusion and Future Work

This paper demonstrated the rationale and process for beginning to develop an analytics dashboard for the FutureLearn platform delving into some technical details of the implementation. Similar to Leon Urrutia et al., (2016) we opted to develop our visualizations in R, served via a Shiny server. Unlike them however, we focused on creating individual building blocks rather than a complex dashboard interface. This is informed by an attempt to limit the amount of information presented to end-users, a focus on reusability and from our previous experience with end-users from the implementation of dashboards for Coursera MOOCs (Clayphan et al., 2015).

The development process allowed us to explore alternative ways to implement a dashboard that other FutureLearn partner institutions may find useful, with a number of different visualizations explored, as well as consideration of related literature (Stephens-Martinez et al., 2014). Furthermore, a direct comparison with a similar effort by (Leon Urrutia et al., 2016) demonstrates the viability and effectiveness of the implementation. Our implementation provides an opportunity to consider the best ways to use the tool with both educators and students. In the future, opportunities can be easily provided to investigate other sophisticated visualizations and, importantly, test their effectiveness with stakeholders as an activity unfolds, than just at the end of the course.

References

Bayne, S., & Ross, J. (2014). The pedagogy of the Massive Open Online Course: the UK view. The Higher Education Academy, 1-76.

Clayphan, A., Vigentini, L., Zhang, L., & Zhao, C. (2015). Building Dashboards for Massive Open Online Courses. Paper presented at the Australian Learning Analytics Summer Institute (ALASI), Sydney.

Cobos, R., Gil, S., Lareo, A., & Vargas, F. A. (2016). Open-DLAs: An Open Dashboard for Learning Analytics. Paper presented at the Proceedings of the Third (2016) ACM Conference on Learning @ Scale, Edinburgh, Scotland, UK.

Duval, E. (2011). Attention please!: learning analytics for visualization and recommendation. Paper presented at the Proceedings of the 1st International Conference on Learning Analytics and Knowledge, Banff, Alberta, Canada.

Few, S. (2006). Information Dashboard Design: The Effective Visual Communication of Data: O'Reilly Media, Inc.

Fredericks, C., Lopez, G., Shnayder, V., Rayyan, S., & Seaton, D. (2016). Instructor Dashboards In EdX. Paper presented at the Proceedings of the Third (2016) ACM Conference on Learning @ Scale, Edinburgh, Scotland, UK.

Kandel, S., Paepcke, A., Hellerstein, J., & Heer, J. (2011). Wrangler: interactive visual specification of data transformation scripts. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Vancouver, BC, Canada.

Kia, F. S., Pardos, Z. A., & Hatala, M. (2016). Learning Dashboard: Bringing Student Background and Performance Online. Paper presented at the Data Literacy for Learning Analytics (DLitLA 2016), Edinburgh, UK.

Linden, A., & Fenn, J. (2003). Understanding Gartner’s hype cycles. *Strategic Analysis Report Nº R-20-1971. Gartner, Inc*.

Leon Urrutia, M., Cobos, R., Dickens, K., White, S., & Davis, H. (2016). Visualising the MOOC experience: a dynamic MOOC dashboard built through institutional collaboration. In *Proceedings of the European MOOC Stakeholder Summit 2016*.
Macfadyen, L. P., & Dawson, S. (2010). Mining LMS data to develop an "early warning system" for educators: A proof of concept. Computers & Education, 54(2), 588-599. doi:http://dx.doi.org/10.1016/j.compedu.2009.09.008
Ruiz, J. S., #233, D, c. J. P., #237, az, Jos, . . . Kloos, C. D. (2014). Towards the development of a learning analytics extension in open edX. Paper presented at the Proceedings of the Second International Conference on Technological Ecosystems for Enhancing Multiculturality, Salamanca, Spain.
Shi, C., Fu, S., Chen, Q., & Qu, H. (2014, 25-31 Oct. 2014). VisMOOC: Visualizing video clickstream data from massive open online courses. Paper presented at the Visual Analytics Science and Technology (VAST), 2014 IEEE Conference on.
Stephens-Martinez, K., Hearst, M. A., & Fox, A. (2014). Monitoring MOOCs: which information sources do instructors value? Paper presented at the Proceedings of the first ACM conference on Learning @ scale conference, Atlanta, Georgia, USA.
Verbert, K., Govaerts, S., Duval, E., Santos, J. L., Van Assche, F., Parra, G., & Klerkx, J. (2014). Learning dashboards: an overview and future research opportunities. Personal and Ubiquitous Computing, 18(6), 1499-1514. doi:10.1007/s00779-013-0751-2
Yuan, L., & Powell, S. (2013). MOOCs and open education: Implications for higher education. Retrieved on 1/9/2016 from http://publications.cetis.ac.uk/wp-content/uploads/2013/03/MOOCs-and-Open-Education.pdf

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Blended Learning Boot Camps: Invigorating Curriculum Design in Undergraduate Nursing Science

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Academic staff development often follows time-honoured models – a workshop series, individual and small group consultations and the development of complementary online resources. In our experience an annual, two-day Blended Learning Boot Camp with Subject Coordinators from successive year levels has proven to be a successful approach for transforming curriculum delivery with blended learning in the discipline of Nursing, Midwifery and Nutrition.

This poster describes the planning, development and outcomes of this strategic, multi-year project and highlights the changing focus from year-to-year as feedback and evidence dictate.

Keywords: Blended Learning, Curriculum Design, Learning Design, Learning Analytics

Why choose a Boot Camp?

There are many different approaches to professional learning in higher education institutions. Boot Camps are an immersive form of professional learning characterised by focused intensive work with the intent of promoting a change in thinking and/or practice among participants. The Boot Camp model is used to foster an authentic experiential learning cycle (Kolb, 1984), where participants' knowledge is gained through experience, starting with concrete experiences in blended learning. Experiential learning emphasizes the central role that experience plays in the learning process.

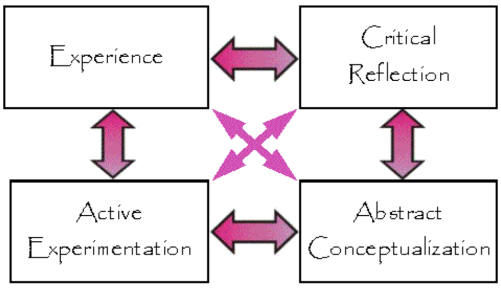

Figure 1: Kolb Experiential Learning Cycle

Boot Camp 2015: Visioning, Storyboarding and Assessment

The design of the first Boot Camp was informed by student activity, success and retention data sourced from the institutional analytics and student data platforms (Cognos and Blackboard Analytics). A curated range of pedagogical support materials was prepared in the form of an iBook providing an easy to access format for participants. Facilitated by Learning, Teaching and Student Engagement (LTSE) staff, the event drew on the work of Professor Gilly Salmon with blueprint and storyboarding activities (Salmon, 2015). Participants were all 1st Year Subject Coordinators and were encouraged to share and discuss teaching practice with a particular focus on assessment.

> I thought it was good for all the Subject Coordinators to be together and really see what the others were doing in their units. I think it will make for a better student experience if we all know what the others are doing especially with their assessment tasks. - Boot Camp 2015 participant survey comment

Boot Camp 2016: The NMN Blended Learning Model

Based on feedback from participating staff in Boot Camp 2015 and a review of the resulting curriculum design, the second Boot Camp was centred around an in-house blended learning model. The NMN Blended Learning Model supported participants, all 2nd Year Subject Coordinators, to prepare a consistent student experience across varying blends of online and face-to-face classroom teaching.

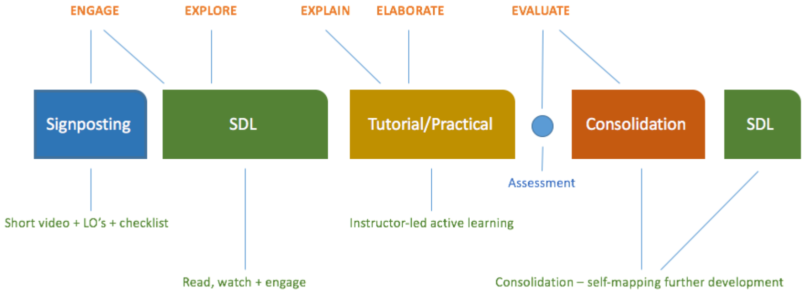

Figure 2: NMN Blended Learning Model

An exemplar subject site in the Learning Management System (LMS) was developed to provide a high level of guidance in the structure and organisation of teaching resources. The 2016 event included teaching staff from outside the discipline to speak on identified key topics such as quiz-embedded video and active learning techniques for lectures and practical sessions.

> The best thing about the Boot Camp was the opportunity to play with some of the programs i.e. Camtasia Studio, GoSoapBox. Small groups allowed for greater depth of discussion into each other's subjects which would not have been possible with a larger group. - Boot Camp 2016 participant survey comment

Boot Camp 2017: A Culture of Continuous Improvement

Planning for the third annual Boot Camp is underway and will involve 3rd Year Subject Coordinators. Participants from the previous events will be asked to share their experiences for the design of the next Boot Camp. An important element of the 3-year Boot Camp plan is being responsive to change and building a culture of continuous improvement through the systematic engagement of successive cohorts of Year Level Subject Coordinators.

Running your own Boot Camp

What do you need to do to plan for, prepare and deliver your own Boot Camp? Provide a vision – how will your approach to blended learning solve the big problems faced by both educators and administrators of your course? Do your homework - build your Boot Camp around educationally sound frameworks or models. Anticipate common challenges that participants may express when encountering new ways of teaching and have evidence to hand to support your ideas. Model god practice - deliver active sessions with carefully planned individual and group activities. Use supporting resources that represent the practice you are seeking to encourage. Bring in experienced educators from within the discipline to share examples of positive learning and teaching outcomes in blended environments. At the end of the day the Boot Camp experience should be challenging but enjoyable.

References

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.

Salmon, G. (2015) *Carpe Diem Learning Design: Preparation and Workshop.* http://www.gillysalmon.com/carpe-diem.html

Please cite as: Cleland, B., Smithson, J. & Knight, C. (2016). Blended Learning Boot Camps: Invigorating Curriculum Design in Undergraduate Nursing Science. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 122-124).

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Designing Virtual Reality Environments for Paramedic Education: MESH360

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Abstract: This paper outlines the first two stages of a design-based research project that aims to develop more authentic critical care educational simulation experiences and learner-centred pedagogies in paramedicine education. The first two stages involve the exploration of mobile virtual reality (VR) to enhance the learning environment, and the design of prototype solutions for designing immersive scenarios and 360-degree video enhanced critical care simulations. Thus far we have identified a set of design principles that will guide the implementation of the project. These design principles will be modified in light of the subsequent project evaluation stages.

Keywords: Virtual Reality, Simulation, Paramedicine education, Heutagogy

Introduction

The aim of the Multiple Environment Simulation Hub (mesh) project is to explore the use of virtual reality (VR) to enhance paramedicine education through the development of more authentic simulation scenarios and exercises. Thus we have named the project Mesh360. As an essentially mobile profession of first responders to emergencies on location, Paramedicine can benefit from mobile technologies that enable communication, link to remote medical knowledge databases, record on the scene experiences, simulate hazardous environments, and use mobile piloted drones for quickly exploring inaccessible crash and disaster scenes. The use of VR for medical and critical care training has been established for over a decade (Hsu et al., 2013) as a means to simulate hazardous environments and provide students with problem based learning scenarios. VR in medical education ranges from dedicated simulation programs through to virtual environments in second life (Conradi et al., 2009). A comparative study by Cone et al., (Cone, Serra, & Kurland, 2011) indicated the efficacy of VR as a platform for paramedic student education. The main challenges of VR in medical education are the development costs, and user familiarity with the VR-based applications (Conradi et al., 2009; Hsu et al., 2013). A focus upon student-generated mobile VR and social media can address these issues. Medical education is already engaging with mobile social media through such avenues as the #foamed (https://twitter.com/hashtag/FOAMed?src=hash) Twitter hashtag (free open access medical education), and the annual SMACC (Social Media and Critical Care) Conference (http://www.smacc.net.au/about-us/welcome/) first held in 2013 now attracting over 2000 attendees.

To ensure that the project is founded in pedagogical goals rather than technology focused we have established a community of practice of Paramedicine lecturers and academic advisors to base the project within an educational design research methodology. This begins with the observations of student threshold concepts that limit the effectiveness of critical care simulations, and is followed by ideation and prototyping of technology-enhanced solutions. The following stages of the project will explore mobile VR as a simple approach for paramedicine students to create, share and critique real world experiences linked to the geographical context that simulated environments tend to decontextualise. Clearly one of the main challenges of such an approach to student-generated VR content revolves around the ethical issues of patient anonymity and confidentiality, however critical care often occurs in very visible public contexts, and learning to deal with this aspect of critical care is essential. Later stages of the project will explore these issues.

Literature review

The context of the project is a three-year degree in Paramedicine or critical care education in a New Zealand University. The course focuses upon preparation of students for participation within the critical care profession, and thus ontological pedagogies that connect knowing, doing, and being as students reconceptualise their role from learner to active participant within a professional community in a rapidly changing world.

> A genuine higher education cannot content itself with a project either of knowledge or of skills, or even of both. It has to do with *being*, for it is being that is fundamentally challenged in and by a world of supercomplexity. Neither knowledge nor skills can furnish the wherewithal to form persons adequate to such a situation: on the one hand, knowledge will not just be out of date, but will always be insufficient to describe the novel and unstable situations that present themselves; on the other hand, skills are always addressed to known situations, and cannot be addressed to unforeseen (and unforeseeable) situations. So (human) being itself has to come into view, for the fundamental problem now becomes: how is one to live amid supercomplexity? (Barnett, 2009)

Globally emergency services are being transformed by the ubiquity of mobile social media (Lyon, 2013; Szczerba, 2014; UNESCO, 2013). Virtual Reality (VR) exists on an experiential continuum from direct real world environments to experiencing an immersive simulated environment. Fitzgerald et al., (2013) represent this continuum from Reality to Virtual Reality as a mixed reality approach.

Virtual reality involves the use of a computer to create an interactive immersive experience via some form of head mounted display (HMD) unit, such that the user feels part of the virtual or simulated environment. The development of virtual reality within education is not a new phenomenon, but part of a relatively long history of educational technology development from desktop computing to mobile computing. VR encompasses educational games, simulation and virtual worlds, and has been shown to be “effective in improving learning outcome gains” (Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2014, p. 29). However, VR content has been costly and difficult to develop and deliver (Merchant et al., 2014). The ubiquity of student ownership of smartphones (Dahlstrom, Brooks, Grajek, & Reeves, 2015; International Telecommunication Union, 2015) that are essentially high powered computers with small yet high definition screens has created a new era of potential for student generated VR in education. “The differences between modern VR compared to the concept of VR presented two decades ago is that the technology is finally at the stage where it can be adapted to any mobile phone” (Hussein & Natterdal, 2015, p. 1). This is best illustrated by the introduction of Google Cardboard (2014) and the consumer version of the Samsung Gear VR headset (2015). Both of these VR HMD’s are powered by a user’s smartphone with low cost or free mobile VR apps, rather than a dedicated built-in computer and display unit. This keeps the cost down and enables a student’s investment in their smartphone to fulfill a wide range of functions beyond being used as a VR headset. The Samsung Gear VR unit is designed to be compatible with the latest Samsung Galaxy smartphones, while Google Cardboard (and third party variants) supports a wide range of Android smartphones, Apple iPhones, and to a more limited extent Windows mobile phones. Simple forms of user-generated VR content include 360 degree or spherical panoramic images, and 360-degree videos. These 360-degree content experiences provide an entry level VR experience. Interactive simulation room environments involve a deeper level of VR production and viewing, but can be relatively cost-effectively designed using 360-degree video cameras, and editing software that splits the 360 video into three or four sections for display by multiple projectors on the walls of a room.

Theoretical foundations:

The project is founded upon networked, ambient/experiential, and student-centred pedagogies that support the development of student reconceptions of being as they prepare for participation within the paramedicine profession. Examples of networked, ambient/experiential and student-centred pedagogies include social constructivism (Vygotsky, 1978), mixed reality learning (Pachler, Bachmair, & Cook, 2010), connectivism (Siemens, 2004), rhizomatic learning (Cormier, 2008), and heutagogy (Hase & Kenyon, 2001). The ability to share geotagged user generated VR content enables connectivist pedagogies, connecting teams of students from various global cohorts. The design of an ecology of resources comprised of a collection of integrated mobile social media platforms such as Google Street View, Google Maps, 360 degree video channels on YouTube and Google Cardboard linked or curated via Google Plus Communities enables a rhizomatic learning environment (Aguayo, Cochrane, & Narayan, 2016; Cochrane, 2016).

Learner generated content in medical education
Luckin et al., (2010) and Pachler et al., (2010) argue that one of the key affordances of mobile learning is the ability to enable learner-generated content and learner-generated contexts. In medical education developing students’ critical clinical analysis skills is highly important. Moving beyond text book information and scenarios to enable students to develop and critique authentic contexts for diagnosis is critical. This is the aim of clinical placement and simulations, however critical analysis and linking theory to practice can be achieved through

designing learning experiences around problem based learning and learner generated content and contexts, leading to the development of student critical analysis skills. Examples of authentic mobile clinical analysis projects in the literature include: (Conradi et al., 2009; Eysenbach, 2008; Ming-Zher, Swenson, & Picard, 2010; Scott, Nerminathan, Alexander, Phelps, & Harrison, 2015; Smordal & Gregory, 2003).

Simulation and VR

The foundation of modern Virtual Reality began in the 1960s with a product called the Sensorama. This apparatus projected images, vibration, sound, smell and wind to provide a series of immersive experiences (Hamit, 1993). Virtual Reality immersive environments in today's world have built on this with a proliferation of available computing-supported visual and auditory experiences. Critical awareness (CA) within paramedicine is an important skill that is very difficult to teach in a classroom. As Norri-Sederholm et al. (2014) argue it is critical within prehospital care for the clinician to have the right information when creating a treatment or management plan at a scene. Guhde (2011) highlights that a simulated experience has its best learning when students are able to role-play, react, and make decisions with as little input from instructors as possible. For many years Paramedicine has used a manikin simulation based strategy for its healthcare education. Not only does this strategy allow a standardised and consistent replication of patient condition but also allows the student to demonstrate procedures, decision making and critical thinking (Jeffries, 2005). It does not however provide a simulation of the environments that the Paramedic may encounter within their daily practice. Currently, a simulation environment within an education setting is often static, non-changeable and to an extent routine. Whilst it is still possible to provide the student with a clinically relevant training, it does not provide the environmental challenge that is unique to Paramedicine. Practice simulation in acute and pre-hospital care settings is a growing area of interest for clinicians and health educationalists, and there is much evidence to support its use (Pike & O'Donnell, 2010).

Design principles

We have identified several design principles throughout the body of mobile learning and educational technology literature that support the key graduate outcomes of the course (Cochrane & Narayan, 2015; A. Herrington, Herrington, & Mantei, 2009; Laurillard, 2012; Leinonen & Durall, 2014). Activity theory is one of the most common theoretical frameworks used to inform mobile learning research and practice, however, Pachler et al., (2010) argue that it is difficult to operationalise and is more suitable as an analytical tool than a pedagogical design tool. Bannan et al., (2015) argue that design based research is an appropriate methodology for grounding mobile learning projects and research. Throughout the design and implementation of over 40 projects, we have found that supporting the development of innovative pedagogies through the integration of educational technology projects via the establishment of a community of practice is key to the success of such projects (Cochrane, 2014). Hase and Kenyon (2007) argue the case for using heutagogy (student-determined learning) as a guiding pedagogical framework to go beyond developing student competency to building student capacity to deal with real world problems. In the messy arena of clinical diagnosis, the ability to think beyond familiar scenarios and to work effectively in teams is critical. Herrington et al., (2009) argue that any educational technology intervention should be designed around the authentic use of the technology. St John-Matthews (2016) argues for the need to integrate collaboration and team-work into student project activities via harnessing social media to network and share research.

Methodology

The project is founded upon a qualitative design-based research methodology (Amiel & Reeves, 2008). The project is supported by: a community of practice that meets weekly face-to-face consisting of a group of like-minded paramedicine lecturers an academic advisor and a research and technology facilitator, an online project discussion forum (Google Plus Community), an online collaborative documentation archive (via Google Docs), a WordPress site that acts as a project social media hub, and a project social media hashtag (#mesh360) for curating the VR panoramas, 360 videos and other mobile social media contents and outputs. Data Collection processes will include: a record of researcher and lecturer collaborative design of new assessment activities and processes via shared Google Docs, collation of researcher and lecturer brainstorming and sharing processes via the public (but participation by invitation only) Google Plus Community, Face-to-face and video conferenced semi-structured interviews, collation of mobile social media via a project hashtag, and online surveys. Participant social media usage will be analysed via visual conversational analysis tools such as TAGSExplorer (Hawksey, 2011) for Twitter. Other social media usage analytics such as Google Street View and YouTube views and peer ratings will provide analysis of the geographic reach and impact of the project artefacts. Stage three of the project will involve student data analysis that will occur after the exam board has finalised all academic grades, with the data analysed by the researchers for themes that indicate the impact upon student learning and the development of professional digital literacies. All participant data will be anonymised.

Research questions

Our research questions focus upon using mobile VR to enable new pedagogies that redefine the role of the teacher, the learner, and of the learning context:

- How can we use our identified design principles to utilise a mash up of mobile social media as a simple framework to design learner-generated authentic learning environments and stimulate student critical awareness of practice risks via VR environments?
- How can we enhance clinical simulation environments using interactive 360 degree videos to more authentically reflect real world scenarios?

Project participants

Within the first phases of the project the project participants include three paramedicine lecturers, an academic advisor as pedagogical and technological support, and a research and VR production facilitator. In the implementation and evaluation stages of the project participants will include the current cohort of paramedicine students.

Guiding design principles

Design principles were identified through the literature on designing authentic learning and scaffolding innovative pedagogies. These include:

- Basing the project within a design-based research methodology
- Supporting the project through the establishment of a community of practice
- Using heutagogy (student-determined learning) as a guiding pedagogical framework
- Designing around the authentic use of mobile devices and VR
- Integrate collaboration and team-work into the project activities

There are four key stages of the project:

1. Establishment of a project community of practice and development of theoretical mobile VR solutions to stimulate critical and analytic problem awareness and analysis
2. Testing of mobile VR solutions in practice through simulations and development of design principles
3. Development of an enhanced VR simulation room environment
4. Design of student-generated mobile VR scenarios

Data collection strategies

A generic mobile VR ecology of resources can consist of a collage of mobile social media tools that facilitate five key elements: (1) a student team hub, (2) a mobile VR content creation workflow, (3) a cloud-based VR content host, (4) VR content publication and sharing via social networks (SNS), and (5) a smartphone-driven head mounted display. The goal of the framework is to enable the explicit design of learning experiences around new pedagogies such as rhizomatic learning, social constructivism, heutagogy, authentic and ambient learning, and connectivism, via participant-active VR. Table 1 illustrates the crossover between educational design research, learning design, design-thinking, and the relationship with theory, practice, and mobile learning across each of the four stages.

Table 1: DBR framework

Methodology: (Educational) Design-Based Research	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**
4 stages of learning design	Informed Exploration	Enactment	Evaluation: Local Impact	Evaluation: Broader Impact
Connecting theory and practice	Theory	Practice	Participant Feedback	Critical Reflection
Intersection with mobile learning	MSM Framework informing curriculum redesign	Rhizomatic Learning: Developing an EOR Designing Triggering Events	Participant Feedback	Peer reviewed feedback via SOTEL
Design Thinking	Observe & Define	Ideate & Prototype	Iterative Testing & improvement	Wider testing

While the data collection stages will be most relevant in the evaluation stages of the project this paper outlines the first two stages of the Mesh360 EDR research project where we co-define the project problem and requirements, and develop prototype solutions based on existing design principles and technological innovation.

Mesh360 Project Implementation

The aim of this project is to utilise the potential of virtual reality by providing a learning environment for novice Paramedicine students to try, fail and learn without real-life consequences. We aim to provide an environment that can develop an understanding and critical analysis of the complexity of pre-hospital paramedic practice. Due to the nature of the wide and dynamic working environment that a Paramedic might encounter it is important to provide an imitation of some real thing, state of affairs, or process for the practice of problem solving, skills and judgement. It is important that all components of a teaching system, especially the teaching methods used and the assessment tasks, are aligned with the learning activities assumed in the intended outcomes. In order to ask this of our paramedic students we are required to provide the correct working environment and the correct medical training. The Mesh360 project consists of three identified elements: (1) pre simulation VR scenarios to develop student critical awareness of real world issues – simulating arriving at a critical care incident and risk evaluation before patient treatment upon entering the simulation room (2) an enhanced 360 degree interactive simulation training room to reflect the impact of a variety of environments on Paramedic performance (3) integration of the use of mobile social media into the curriculum to facilitate student-generated content and authentic simulation contexts as more authentic assessment activities. The portion of the framework for supporting user-generated VR content is illustrated in figure 1.

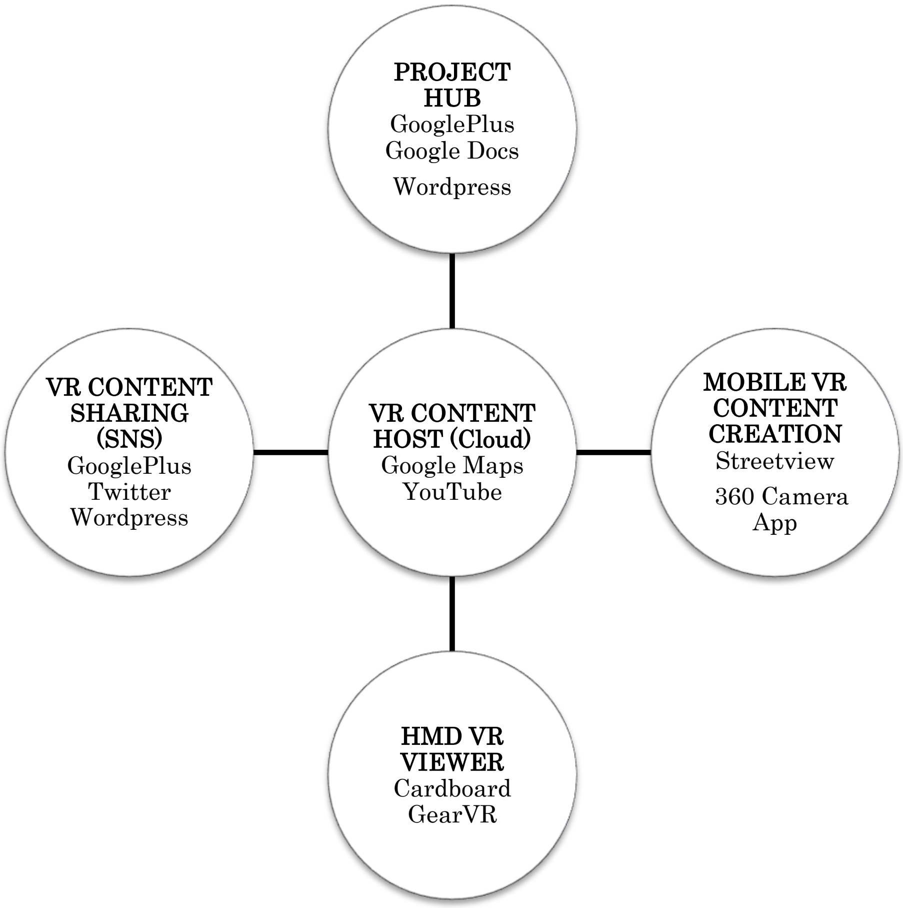

Figure 1: Mobile VR EOR

Figure 1 illustrates the use of a collection of mobile social media and social networks to support the creation and sharing of user-generated mobile VR as part of the overall Mesh360 project. Cormier (2008) refers to the design of a collection of tools to support learning as an ecology of resources (EOR). In our case the ecology of resources utilised to support the mesh360 project include:

- Individual WordPress blogs as project journals
- A team WordPress blog for publicizing project outputs http://mesh360.wordpress.com
- A shared Google Drive folder for project documentation, collaborative research writing, and collaborative curriculum brainstorming and redesign
- A Google Plus Community
- A project YouTube Channel
- A social media hashtag #mesh360

The mobile VR ecology of resources provides both a collage of community building and nurturing tools for the project, and will provide a rich source of participant-generated artefacts and reflections from both lecturers and students. In choosing platforms for each element of the framework we have focused upon selecting cross-platform tools that enable a student BYOD approach and interconnect easily. A simple and flexible delivery platform for student-generated mobile VR content is key – and this is why we have chosen Google Maps and YouTube as suitable mobile VR content hosts that do not require any specialised institutional web server, minimises the project IT infrastructure, and provides the opportunity for either private or global collaboration.

Pre simulation VR scenarios

Typically, when a paramedic is responding to a job there is a period of time in the response to the job where they can start to formulate a plan based on the information at hand. Bringing this into a simulation program is difficult as students are usually in clinical rooms with a manikin and not able to visualise or experience the broader scene. Given that paramedic's work in an ever changing environment and gain information from the environment they are in it is important to give the student the different prompts that one can gain from the environment they are in.

The project aims to give the student a 360-degree immersive view of the scene before the scenario to allow the student a period of time to take prompts from the scene and formulate a plan of action. Therefore, allowing students to gain information from the environment to make informed decisions during the simulation. Typically, when doing manikin-based simulations the instructor will feed information to the student verbally. Although this works, it can interfere with the students' train of thoughts and interrupt their learning. By engaging in a 360-degree VR experience the student has a learning environment they can experience and learn from as they explore the scene for answers as an on road paramedic does. Enabling the student to be able to experience the environment and make decisions or plans without being interrupted, for example see our first attempt at making an ambulance VR experience at https://youtu.be/7bUDlWQX6OQ that can be viewed using a smartphone and a HMD.

It is hoped that as a result of this project students will learn to use the environment they work in as a chance to get information and therefore help with their critical decision making in the treatment of their patient's.

Enhanced 360-degree interactive simulation environment

The project aims to develop authentic interactive simulation environments for student training and assessment. To put this in context, a Paramedic may be called to a car crash with multiple victims, a Fire, a drowning in a pool, building site trauma or an elderly person's home address. The diversity is endless yet our current simulation environment stays the same. The inability to change the environment within current Paramedic programs means that the student Paramedic will not develop an understanding of the importance of context-sensitiveness around critical aspects such as sound, visual clues, and safety. The implications of external stimulus so often found in a real world environment are required to develop a critical awareness and understanding of a real world influence. This project acknowledges that education is about creating the conditions in which people can learn and is looking to enhance this experience by way of technology.

The immersive Virtual world is at the frontier of innovation in medical education and our aim is to utilise a 360 video capture and content production workflow and use an immersive three wall room projector system to replicate a multitude of environments that a student can experience when attempting a medical based scenario. The concept is similar to that developed by Immersive Interactive Ltd (http://immersive.co.uk/) with a screenshot shown in Figure 2, but custom designed specifically for our Paramedicine context.

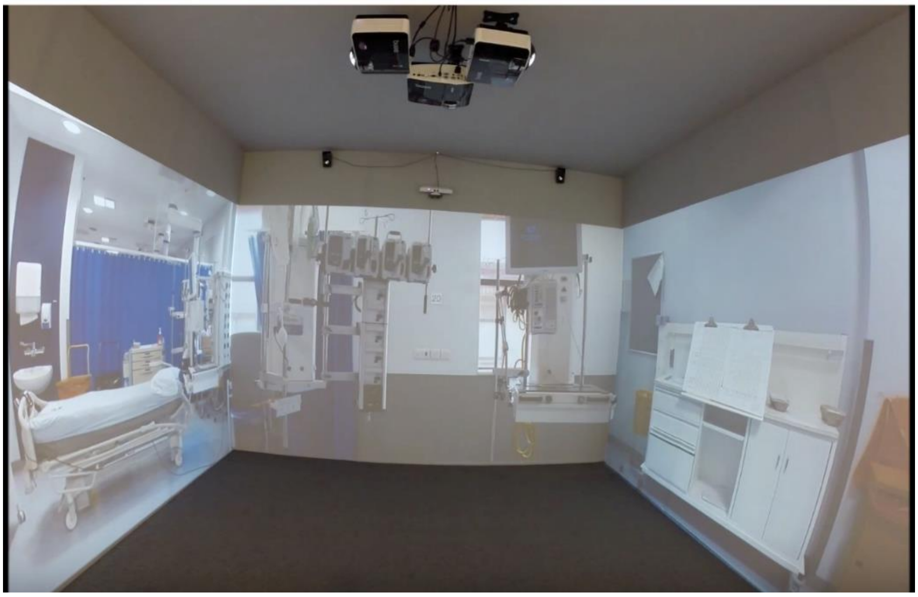

Figure 2. Simulation room concept by Immersive Interactive Ltd (https://youtu.be/Rmb1q-Ckghw?t=26s)

The systems currently being considered utilise infrared technology for interaction with the projected image. The interaction will include additional pertinent information that may enhance decision making strategies and further develop problem solving skills. An example of this will be that the student paramedic will interact with the screen to investigate medical records or medications. This information is often essential in the real world environment to determine risk and medical management of the patient. In addition to the interactive capabilities of this system, sound will complement the projected image and provide additional stimulus to the environment.

Integration of mobile social media within the curriculum

Education traditionally has been delivered face to face, yet in recent years online and mobile learning have allowed more flexibility, for students to study at their own time and pace, as well as in collaboration with their peers. Lecturers can engage a wider class without having students in the physical classroom. Designing effective online learning involves creating an environment that facilitates interaction, collaboration and feedback from their tutors. Poorly designed online learning environments can stifle students' progress and provide limited avenues for interaction.

Classrooms provide the ideal traditional environment to interact and get real time feedback within social dynamics, allowing students to take ownership of their education and learn in a streamlined manner. This project aims to increase students' immersion in their learning environment by creating a blend of digital and face-to-face interaction utilizing virtual reality and mobile social media. Lectures will be redesigned to become more interactive and collaborative experiences, with real world scenarios and demonstrations streamed for remote participants recorded with a 360 video camera in real time and archived for later viewing and critique. Course content will be redesigned to focus upon collaborative student-generated content, shared via the networked connectivity of students' own devices. This will facilitate discussion and collaboration between the on-campus students and remote students, as well as provide opportunities for input from experts around the globe via social network sites (SNS) such as Twitter (see for example #foamed), Google Plus Communities, and live-streamed video conferencing (such as Hangouts on air). This course redesign will allow a refocus upon social learning to occur, facilitating team-work and providing active participation within the global professional network of the critical care community.

This needs to be undertaken in a way that does not incur a considerable cost for the student by utilizing a BYOD approach with a low-cost head-mounted display (HMD) to view any VR content. The aim is to provide interactive learning experiences that students can replay at any time and not have to read through extensive notes to gain a similar level of understanding. Virtual reality in the classroom aims to provide the best of the real world and mobile learning, to obtain an enhanced education experience.

Discussion

One of the goals of this project to provide a facility that offers pre- and post-graduation paramedics the opportunity to experience a range of scenarios in a 'real life' but secure and safe environment. Paramedics' scope of practice, in pre-hospital and out-of-hospital environments, requires a comprehensive understanding and application of a range of clinical procedures. These procedures require paramedics to work autonomously or as part of multidisciplinary teams, and to take a multi system-based approach to managing patients' conditions. This project enables students to apply theory to practice in complex situations, such as managing patients injured in road traffic collisions.

Mesh360 simulation is a practical, 'real life', safe working environment in which student paramedics, and other healthcare students, can experience aspects of pre-hospital care and contextualise their theoretical studies. The Mesh360 facility will be used by student paramedics who are undertaking the undergraduate paramedic science foundation degree programme or the BHSc paramedic science degree programme. The facility enables these students to apply their theoretical knowledge and understanding to the management of patients with multiple conditions or injury. Currently student paramedics attend practical teaching sessions that are based on objective structured clinical examination (OSCE) scenarios that involve patient assessment, patient management and patient extrication. Experienced paramedic lecturers from the Auckland University of Technology (AUT) school of health and environmental science use their wealth of operational knowledge to create multiple scenarios, ranging from single patient encounters to multiple patient encounters following complex accidents, and encourage exploration and learning from each scenario via an immersive experience. Skills training and theoretical developments are redundant if they do not improve patients' prognoses and outcomes. It is hoped that the Mesh360 simulation facility will enhance a student's learning experience and equip them with the knowledge, skill and understanding required to work in complex, sometimes hostile, and uncertain environments.

It is envisaged that the Mesh360 facility will further support student paramedics' education through mutually beneficial collaboration with agencies such as the fire and rescue service, the police and specialist hazardous area response teams. In addition, it is hoped that this facility will be utilised as an inter-school training arena for all health disciplines within the University.

Project Community of Practice and Refinement of the design principles

Throughout the initial stages of the project we have attempted to use our identified design principles to guide the project:

- Basing the project within a design-based research methodology
- Supporting the project through the establishment of a community of practice
- Using heutagogy (student-determined learning) as a guiding pedagogical framework
- Designing around the authentic use of mobile devices and VR
- Integrate collaboration and team-work into the project activities

The design-based research methodology forms the foundational link between the iterative project stages (Table 1). The establishment of the Community of Practice supported by online collaborative platforms and weekly face-to-face meetings has allowed for the facilitated implementation and running of the design-based research methodology agenda in addressing mobile VR in Paramedicine. In particular, the analysis of practical problems and development of design principles through constant testing and refinement of prototype solutions in authentic practice is enhanced by the ongoing collaborative and co-creative structure of the Community of Practice and its associated ecology of resources. This has also permitted the rapid adaptation to the constantly changing nature of available mobile VR technological affordances. As an example, since the start of the Mesh360 project in early 2016 we went from no access to 360 cameras in New Zealand nor online, to access to a range of them and associated creation and production software and sharing platforms. Social media sharing of prototype mobile VR solutions allows for quick and responsive feedback from the Community of Practice, which in turn nurtures itself from the constant drive of technological innovation around emerging and more sophisticated mobile VR content creation platforms, for example from Google Streetview and YouTube #360 to Pano2VR, Seekbeak, WondaVR and Thinglink. Integration of heutagogy as a guiding pedagogical framework has been possible in part due to the practitioners addressing their own needs within their educational contexts through mobile VR technology. By addressing their authentic needs in context the Mesh360 practitioners have led the development of their own prototype solutions and learning environments with the facilitation of the Mesh360 Community of Practice, resulting in the design of a unique solution to the identified pedagogical limitations of prior approaches to paramedicine education.

Project implementation and evaluation stages

The establishment of the Mesh360 Community of Practice and initial development of theoretical VR solutions (stage 1 and 2) have shown positive outcomes allowing for the emergence of a set of prototype solutions currently being tested in practice. These outcomes and prototype set of solutions will inform the next steps in the design-based research project (stage 3 and 4), involving the implementation of prototype VR scenarios and testing of a prototype 360 degree enhanced manikin simulation room. Student feedback on these prototypes will inform further design iterations, and we aim to gather wider peer feedback via conference presentations and peer-reviewed publication of our results. This set of feedback and evaluation instances will permit the development of a final set of design principles for the implementation and use of mobile VR technology and associated affordances in the provision of transformative and enhanced learning experiences in paramedicine education.

The potential of VR in education

Our research questions focus upon using mobile VR to enable new pedagogies that redefine the role of the teacher, the learner, and of the learning context. At this stage of the project we are excited about the possibilities and have defined our objectives and scope of the project. By focusing upon a BYOD approach to learner-generated VR we are keeping the financial investment in the project to the students to a minimum. However, there is a significant cost to the institution in establishing the assessed pre simulation VR scenarios and the enhanced interactive manikin simulation environment. We believe the investment will be worthwhile, in both terms of value for money in the enhanced learning experience, and in terms of the benefits of the professional development of the lecturers. We are also hopeful that our experiences will be useful in other educational contexts and discipline areas, who can design their own VR enhanced learning environments based upon our developing design-based research model supported by a sustained community of practice.

Conclusions

This paper presents a work in progress, reporting on the first two stages of a design-based research project exploring mobile VR and 360-degree video enhanced simulation environments for authentic paramedicine education scenarios. The goal of these enhanced learning environments is the development of student critical thinking and analysis skills in the life-and-death pressure situations a critical care professional must face daily. Preparing our students to have the capability to work within these environments requires a more authentic approach to education than a traditional classroom and clinical simulation environment. Keeping us on track within the project scope and goals is our foundational design-based research methodology and a commitment to heutagogy as a guiding pedagogy. In the next stage of the project we will move beyond ideation and prototyping to the design, implementation, and evaluation of mobile VR and enhanced simulation learning experiences.

References

Aguayo, C., Cochrane, T., & Narayan, V. (2016, 9-12 February). *Mobile learning technologies for sustainability education.* Paper presented at the NZAEE16: Activate, Agitate, Advocate, University of Auckland.

Amiel, T., & Reeves, T. (2008). Design-Based Research and Educational Technology: Rethinking Technology and the Research Agenda. *Educational Technology & Society, 11*(4), 29-40.

Bannan, B., Cook, J., & Pachler, N. (2015). Reconceptualizing design research in the age of mobile learning. *Interactive Learning Environments*, 1-16. doi:10.1080/10494820.2015.1018911

Barnett, R. (2009). Knowing and becoming in the higher education curriculum. *Studies in Higher Education, 34*(4), 429-440. doi:10.1080/03075070902771978

Cochrane, T. (2014). Critical success factors for transforming pedagogy with mobile Web 2.0. *British Journal of Educational Technology, 45*(1), 65-82. doi:10.1111/j.1467-8535.2012.01384.x

Cochrane, T. (2016). Mobile VR in education: From the fringe to the mainstream. *International Journal of Mobile and Blended Learning, 8*(3), In Review.

Cochrane, T., & Narayan, V. (2015). Rethinking Instructional Theory for Mobile Learning. In C. Reigeluth & B. J. Beatty (Eds.), *Instructional-Design Theories and Models*.

Cone, D. C., Serra, J., & Kurland, L. (2011). Comparison of the SALT and Smart triage systems using a virtual reality simulator with paramedic students. *European Journal of Emergency Medicine, 18*(6), 314-321. doi:10.1097/MEJ.0b013e328345d6fd

Conradi, E., Kavia, S., Burden, D., Rice, A., Woodham, L., Beaumont, C., . . . Poulton, T. (2009). Virtual patients in a virtual world: Training paramedic students for practice. *Medical Teacher, 31*(8), 713-720. doi:10.1080/01421590903134160

Cormier, D. (2008). Rhizomatic education: Community as curriculum. *Innovate, 4*(5), np. available http://davecormier.com/edblog/2008/2006/2003/rhizomatic-education-community-as-curriculum/.

Dahlstrom, E., Brooks, C., Grajek, S., & Reeves, J. (2015). *ECAR Study of Undergraduate Students and Information Technology, 2015*. Retrieved from Louisville, Colorado: http://www.educause.edu/library/resources/2015-student-and-faculty-technology-research-studies

Eysenbach, G. (2008). Medicine 2.0: Social Networking, Collaboration, Participation, Apomediation, and Openness. *Journal of Medical Internet Research, 10*(3). doi:10.2196/jmir.1030

FitzGerald, E., Ferguson, R., Adams, A., Gaved, M., Mor, Y., & Thomas, R. (2013). Augmented reality and mobile learning: the state of the art. *International Journal of Mobile and Blended Learning, 5*(4), 43-58. doi:10.4018/ijmbl.2013100103

Hase, S., & Kenyon, C. (2001). From Andragogy to Heutagogy. *ultiBASE Articles,* (December), 1-10. Retrieved from http://www.psy.gla.ac.uk/~steve/pr/Heutagogy.html

Hase, S., & Kenyon, C. (2007). Heutagogy: a child of complexity theory. *Complicity: an International Journal of Complexity and Education, 4*(1), 111-118.

Hawksey, M. (2011). Twitter: How to archive event hashtags and create an interactive visualization of the conversation. Blog Retrieved from http://mashe.hawksey.info/2011/11/twitter-how-to-archive-event-hashtags-and-visualize-conversation/

Herrington, A., Herrington, J., & Mantei, J. (2009). Design principles for mobile learning. In J. Herrington, A. Herrington, J. Mantei, I. Olney, & B. Ferry (Eds.), *New technologies, new pedagogies: Mobile learning in higher education* (pp. 129-138). Wollongong: Faculty of Education, University of Wollongong.

Herrington, J., Reeves, T., & Oliver, R. (2009). *A guide to authentic e-learning*. London and New York: Routledge.

Hsu, E. B., Li, Y., Bayram, J. D., Levinson, D., Yang, S., & Monahan, C. (2013). State of Virtual Reality Based Disaster Preparedness and Response Training. *PLoS Currents, 5*, ecurrents.dis.1ea2b2e71237d75337fa53982a71238b71232aff. doi:10.1371/currents.dis.1ea2b2e71237d5337fa53982a38b2aff

Hussein, M., & Natterdal, C. (2015). *The benefits of virtual reality in education: A comparison study.* (Bachelor of Science Thesis in Software Engineering and Management Student essay), Chlamers University of Technology, University of Gothenburg, Göteborg, Sweden. Retrieved from http://hdl.handle.net/2077/39977

International Telecommunication Union. (2015). The World in 2015: ICT facts and figures*2015*(April). Retrieved from http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf

Laurillard, D. (2012). *Teaching as a design science: Building pedagogical patterns for learning and technology*. New York: Routledge.

Leinonen, T., & Durall, E. (2014). Design Thinking and Collaborative Learning. *Comunicar, 42*(1), 107-115. doi:http://dx.doi.org/10.3916/C42-2014-10

Luckin, R., Clark, W., Garnett, F., Whitworth, A., Akass, J., Cook, J., . . . Robertson, J. (2010). Learner-Generated Contexts: A Framework to Support the Effective Use of Technology for Learning. In M. Lee & C. McLoughlin (Eds.), *Web 2.0-Based E-Learning: Applying Social Informatics for Tertiary Teaching* (pp. 70-84). Hershey, PA: IGI Global.

Lyon, J. (2013). The Effectiveness of Online and Mobile Technologies for Changing Health Behaviours*Evidence Snapshot July 2013*. Retrieved from http://www.ana.org.nz/sites/default/files/Final snapshot on mobile technologies.pdf

Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Computers & Education*, *70*, 29-40. doi:http://dx.doi.org/10.1016/j.compedu.2013.07.033

Ming-Zher, P., Swenson, N. C., & Picard, R. W. (2010). A Wearable Sensor for Unobtrusive, Long-Term Assessment of Electrodermal Activity. *Biomedical Engineering, IEEE Transactions on*, *57*(5), 1243-1252. doi:10.1109/TBME.2009.2038487

Pachler, N., Bachmair, B., & Cook, J. (2010). *Mobile learning: Structures, agency, practices*. London: Springer.

Scott, K. M., Nerminathan, A., Alexander, S., Phelps, M., & Harrison, A. (2015). Using mobile devices for learning in clinical settings: A mixed-methods study of medical student, physician and patient perspectives. *British Journal of Educational Technology*, n/a-n/a. doi:10.1111/bjet.12352

Siemens, G. (2004). Connectivism: A Learning Theory for the Digital Age. *eLearnspace,* (12 December). Retrieved from http://www.elearnspace.org/Articles/connectivism.htm

Smordal, O., & Gregory, J. (2003). Personal Digital Assistants in medical education and practice. *Journal of Computer Assisted Learning*, *19*(3), 320-329.

St John-Matthews, J. (2016). Harnessing social media to network and share research. *Journal of Medical Imaging and Radiation Sciences*, *47*(2), 121-123. doi:10.1016/j.jmir.2016.04.002

Szczerba, R. (2014, 14 December). The Future of HealthTech - Ambulance Drones. *Forbes Tech.* Retrieved from http://onforb.es/1AxEl2w

UNESCO. (2013). *UNESCO Policy guidelines for mobile learning* (978-92-3-001143-7). Retrieved from Paris, France: http://unesdoc.unesco.org/images/0021/002196/219641E.pdf

Vygotsky, L. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.

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Beyond Pokémon Go: Mobile AR & VR in Education

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The new wave of mobile VR and AR are anticipated to become a multi-billion dollar industries in the near future (F. Cook, 2016) – how will this impact higher education? This Symposium will gather the collective experience and expertise of members of the newly established Ascilite Mobile Learning Special Interest Group (Ascilitemlsig) to explore and discuss the potential and issues surrounding the rapidly developing fields of mobile Augmented Reality and mobile Virtual Reality. The SIG seeks to draw develop an international community of mobile learning researchers in the context of mobile VR and AR. Building upon the global popularity of the Pokémon Go app, Google Cardboard, and the Samsung Gear VR, there is now widespread interest in these technologies, but still little expertise in integrating these within authentic educational experiences beyond another form of interactive content delivery. Members of the Ascilitemlsig will discuss the potential of mobile AR and VR for user generated content and contexts, share their recent practice-based research, and invite interaction from the wider Ascilite conference attendees.

Keywords: Mobile Learning, Augmented Reality, Virtual Reality, Authentic and contextual learning

Goal of the Symposium

The Symposium will highlight and create discussion and awareness around the aim of the Ascilitemlsig: "To explore the intersection of mobile learning, new pedagogies, SOTEL, DBR, and authentic learning". In response to Traxler's (2016) lament that the mobile learning dream has ended with the LMS on students' smartphones, the SIG seeks to explore the unique affordances of mobile devices (Bannan, Cook, & Pachler, 2015; J. Cook & Santos, 2016) for student-generated content and experiences via such technologies as collaborative media production and sharing, VR, AR, geolocative and contextual sensors, drones and wearable technologies. The Symposium will highlight the resources being established by the ML SIG, including curated research outputs on the SIG Wordpress site, and the Google Plus discussion forum. Participants will be invited to join the SIG as it establishes an international community of mobile learning researchers interested in VR and AR in education, and to contribute relevant examples of practice based research.

Format

The Symposium will take the form of a discussion panel made up of members of the Ascilite ML SIG and remote participation (either pre-recorded or live via G+ Hangout) from Sarah Jones of Coventry University (UK). Each panel member will describe a mobile AR or VR project in which they have been involved, outlining the impact and challenges of each project implementation. Project contexts will include: Paramedicine education, Journalism education, Design education, teacher education, and others.

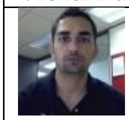
Strategies

Strategies that will be used to engage the audience will include face-to-face discussion, an invitation to participate in the AsciliteMLSIG Google Plus Community, and a moderated back-channel using a second screen for a Todaysmeet discussion and Twitter streams using the #ascilitemlsig hashtag. Attendees will be encouraged to BYOD for back channel interaction, and exploring examples of mobile AR and VR. The panel will also demonstrate the creation and sharing of mobile AR and VR content live during the Symposium, using tools such as Aurasma, Google Streetview, and YouTube 360.

Audience

The Symposium will be relevant to anyone interested in finding out about the rapidly emerging field of mobile AR (FitzGerald et al., 2013; Kidd & Crompton, 2016) and VR (Cochrane, 2016; Hussein & Natterdal, 2015) in education.

Biographies of Panel Members

Thomas Cochrane 	Academic advisor and senior lecturer in educational technology, the Centre for Learning And Teaching, Auckland University of Technology, New Zealand. Thomas is the coordinator of the Ascilite mobile learning special interest group, and a mobile learning researcher/practitioner. http://orcid.org/0000-0002-0192-6118
Sarah Jones 	Deputy Head of School of Media & Performing Arts at Coventry University, UK. Sarah is an Apple Distinguished Educator (Class of 2015), with expertise in mobile AR and VR production. Her approach is based on mobile global collaborative learning. https://www.linkedin.com/in/sarah-jones-830b818
Matthew Kearney 	Associate Professor in education at UTS, Australia. Matthew is widely published in emerging learning technologies with 45 journal articles, a book chapter, and a book. He is a core member of the Ascilite Mobile Learning SIG. http://orcid.org/0000-0002-6396-0418
Helen Farley 	Associate Professor (Digital Futures), Australian Digital Futures Institute, University of Southern Queensland. Helen is currently leading the USQ-led Collaborative Research Network (CRN) project with ANU and UniSA to develop a Mobile Learning Evaluation Framework, and a core member of the Ascilite Mobile Learning SIG. http://orcid.org/0000-0002-9511-4910
Vickel Narayan 	Teaching consultant at the Centre for Learning and Teaching (CfLAT) at AUT University. He has a keen interest in Mobile Web 2.0 technologies and its potential to engage students and teachers in the teaching and learning process. The latter forming the basis for Vickel's PhD study from Murdoch University in Perth. http://orcid.org/0000-0002-6833-706X

References

Bannan, B., Cook, J., & Pachler, N. (2015). Reconceptualizing design research in the age of mobile learning. *Interactive Learning Environments*, 1-16. doi:10.1080/10494820.2015.1018911

Cochrane, T. (2016). Mobile VR in Education: From the Fringe to the Mainstream;. *International Journal of Mobile and Blended Learning (IJMBL), 8*(4), 45-61. doi:10.4018/IJMBL.2016100104

Cook, F. (2016, Friday April 29). Global tech leaders to convene in Auckland. *NZ Herald*. Retrieved from http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11630474

Cook, J., & Santos, P. (2016). Three Phases of Mobile Learning State of the Art and Case of Mobile Help Seeking Tool for the Health Care Sector. In D. Churchill, J. Lu, T. K. F. Chiu, & B. Fox (Eds.), *Mobile Learning Design* (pp. 315-333): Springer Singapore.

FitzGerald, E., Ferguson, R., Adams, A., Gaved, M., Mor, Y., & Thomas, R. (2013). Augmented reality and mobile learning: the state of the art. *International Journal of Mobile and Blended Learning, 5*(4), 43-58. doi:10.4018/ijmbl.2013100103

Hussein, M., & Natterdal, C. (2015). *The benefits of virtual reality in education: A comparison study.* (Bachelor of Science Thesis in Software Engineering and Management Student essay), Chlamers University of Technology, University of Gothenburg, Göteborg, Sweden. Retrieved from http://hdl.handle.net/2077/39977

Kidd, S. H., & Crompton, H. (2016). Augmented Learning with Augmented Reality. In D. Churchill, J. Lu, K. F. T. Chiu, & B. Fox (Eds.), *Mobile Learning Design: Theories and Application* (pp. 97-108). Singapore: Springer Singapore.

Traxler, J. (2016). What killed the mobile learning dream? *Jisc Inform.* Retrieved from https://www.jisc.ac.uk/inform-feature/what-killed-the-mobile-learning-dream-26-feb-2016?

Please cite as: Cochrane, T., Jones, S., Kearney, M., Farley, H. & Narayan, V. (2016). Beyond Pokémon Go: Mobile AR & VR in Education. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 136-138).

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Evaluating a Professional Development cMOOC: Mosomelt

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Abstract: This paper focuses upon the evaluation stages of the design and implementation of a lecturer professional development cMOOC embedded within an educational design-based research methodology. In the design and development stages the first iteration in 2015 of the cMOOC informed the redesign of the second iteration in 2016. In this paper the overall impact of the cMOOC is evaluated via evidence of active participation, a post-survey of the 2016 participants, and evidence of impact through the development of participant eportfolios. Based upon our experiences we propose a transferable and scalable lecturer professional development framework that can be mapped to established teaching and learning accreditation pathways such as CMALT.

Keywords: cMOOC, Design-Based Research, Educational Design Research, Professional development, CMALT.

Introduction

Traditional approaches to university lecturer professional development focus upon either attendance of a series of workshops, or undertaking some form of graduate or post-graduate qualification (certificate, diploma or Masters) in higher education. The goal of these professional development activities is the development of teaching and learning skills and critical engagement with learning theories, ultimately leading to better learning experiences for students. The endemic problem with these approaches is the low rate of uptake of these qualifications by academics who are either swamped with the demands of teaching and research workloads, or see no need of exploring new pedagogies beyond those that they experienced themselves as students. The problem is two-fold: firstly, one of access, and secondly one of scalability. MOOCs have been proposed as solutions to the flexible access and scalability of education. MOOCs come in two main types: xMOOCs and cMOOCs (Bates, 2014). MOOCs began as a form of connectivist learning (hence named cMOOCs or connectivist MOOCs). However, the predominant form of MOOC has become the xMOOC that is typified by access to a series of online course content leading to a paid certificate of completion, with the market leaders in MOOC delivery being hosted by either the Cousera, EDX, or Future Learn platforms. These xMOOC platforms have exhibited large numbers of participants, for example, Future Learn launched their first courses in September 2013 enrolling 4,077,604 participants since then (https://www.futurelearn.com/about).

The Mosomelt (Mobile Social Media Learning Technologies) cMOOC (http://mosomelt.wordpress.com) was designed in 2015 as a supporting framework for a network of predominantly face-to-face departmental communities of practice in a variety of discipline contexts, spanning six national higher education institutions and reaching participants from across the globe. Mosomelt has undergone two iterations, beginning in 2015 with 51 participants, and relaunched in 2016 with a further 23 participants. Over these two iterations Mosomelt has connected 74 participants from 8 countries. Though Mosomelt was not ‘massive’ in participant numbers, it did represent a new approach to facilitating lecturer professional development and collaboration across a wide variety of curriculum contexts and geographic locations.

Literature review

Barnett argues that we live in a rapidly changing world where education must refocus as "learning for an unknown future, in short, for an ontological turn" (Barnett, 2012, p. 65).

> Construing the pedagogical task as the formation of authentic being turns us towards neither knowledge nor skills as central categories but rather to certain kinds of human qualities. They are the qualities that both make authentic being possible and are also, in part, generated by a drive towards authenticity. They are qualities such as carefulness, thoughtfulness, humility, criticality, receptiveness, resilience, courage and stillness. The achievement of qualities such as these calls for a transformatory curriculum and pedagogy which are themselves understood to be and practised as endeavours of high risk; high risk not just for the participants but also for the academic staff in their educational roles. (Barnett, 2012, p. 76)

An ontological turn implies a reconception of one's self or being: for learners this is a shift from passive receptor of knowledge to active participation in new knowledge creation and professional participation, while for teachers this is a shift from gate-keepers of knowledge and assessment to collaborative co-learning and modelers of professional practice. This calls for new models of lecturer professional development (PD) that model active participation within authentic contexts supporting a culture of pedagogical change. These new PD models need to be agile, sustainable, scalable, and authentic.

Examples of new models of Lecturer Professional Development include flexible online courses ranging from certificates of teaching to Masters of higher education, and the development of communities of practice (McDowell, Raistrick, & Merrington, 2013). The default approach has become the provision of an in-house Postgraduate Certificate of Teaching and Learning in Higher Education (PgCert) (Hall, 2010). MOOCs have also begun to emerge as platforms for teacher professional development (Kill & Stroud, 2016; Salmon, Gregory, Lokuge Dona, & Ross, 2015). Laurillard argues that the MOOC format is predominantly suitable for highly self-directed and motivated learners, such as teachers who regularly engage in professional development to hone their teaching skills.

> The demographics of massive open online course (MOOC) analytics show that the great majority of learners are highly qualified professionals, and not, as originally envisaged, the global community of disadvantaged learners who have no access to good higher education. MOOC pedagogy fits well with the combination of instruction and peer community learning found in most professional development. (Laurillard, 2016)

Analysis of MOOC participation data indicates the effectiveness of the MOOC format for professional learners (Kill & Stroud, 2016; Milligan & Littlejohn, 2014). While MOOC completion rates are typically low (Jordan, 2014), they can be powerful experiences for a motivated core group of participants (Mackness & Bell, 2015). Most MOOCs are short in duration, typically spanning six weeks of activity.

Theoretical foundations:

Hall (2010) argues that there has been a lack of theorising around the application of professional standard frameworks to professional development activities. Hall suggests an engagement with new and emergent educational development theories such as rhizomatic learning. The design of the Mosomelt cMOOC was informed by a mashup of learning theories and frameworks including:

- Connectivism (Siemens, 2005)
- Social constructivism (Head & Dakers, 2005; Vygotsky, 1978)
- Rhizomatic learning (Cormier, 2008)
- Conversational framework (Laurillard, 2001)
- Authentic learning (Herrington, Reeves, & Oliver, 2009)
- Constructive alignment (Biggs, 2003)
- Heutagogy – or student-determined learning (Hase & Kenyon, 2007; Luckin et al., 2010)
- Creativity (Kaufman & Sternberg, 2007; Sternberg, Kaufman, & Pretz, 2002)
- Ontological pedagogies (Barnett, 2012)
- Design Based Research (DBR) or Educational Design Research (EDR) (Bannan, Cook, & Pachler, 2015)
- Scholarship Of Technology Enhanced Learning (SOTEL) (Wickens, 2006)

We detailed the choice and implications of these theoretical foundations in our earlier papers on the design of the Mosomelt cMOOC (Cochrane, Narayan, & Burcio-Martin, 2015; Cochrane, Narayan, Burcio-Martin, Lees, & Diesfeld, 2015). What links these theories and frameworks into a cohesive strategy is the focus upon designing learning environments around student-generated content and student-generated contexts to facilitate authentic collaborative learning experiences.

Professional Accreditation Pathways

Kill and Stroud (2016) argue for the importance of certifying or accrediting learning within MOOCs. While xMOOCs are primarily driven by gaining some form of accreditation upon completion, cMOOCs have typically been characterised more by participation and collaboration with like-minded peers and experts. Professional accreditation pathways developed well before the advent of MOOCs as a way of assessing and credentialing lecturer professional development, but some have recently been designed to map to accreditation pathways (University of Leeds, 2016a). Two of the most mature accreditation pathways are through the Higher Education Academy (HEA) and the Certified Member of the Association of Learning Technologists (CMALT), both of which are based upon the UK Professional Standards Framework (https://www.heacademy.ac.uk/recognition-accreditation/uk-professional-standards-framework-ukpsf). HEA has accredited 75000 fellowships since 2003 (https://www.heacademy.ac.uk/recognition-accreditation/hea-fellowships), while CMALT (Deepwell & Slater, 2012) has just over 340 accredited members since 2005 (https://www.alt.ac.uk/certified-membership). HEA has four levels of membership accreditation, two of which require a combination of portfolio and accredited course completion (Associate Fellow and Fellow), with the two higher levels evidenced solely through portfolios (Senior Fellow, and Principle Fellow). CMALT is based around a portfolio mapped to the UK Professional Standards Framework (UKPSF) (Association for Learning Technology (ALT), 2015; Deepwell & Slater, 2012), and requires renewal of the portfolio every three years for continued accreditation. While the goal of professional accreditation pathways is to provide an evidence pathway for good teaching practice, they have been criticised for focusing upon measuring prior experience rather than being an effective vehicle for professional development themselves, and a reflection of a neoliberal regulatory environment (Connell, 2009; Gosling, 2010; Hall, 2010). However, much work has been done on mapping these professional accreditation pathways to various professional development activities, including courses, and MOOCs such as the Blended Learning Essentials xMOOC (University of Leeds, 2016b). Both HEA and CMALT cover four areas of professional teaching practice, with CMALT adding the integration of technology within these four areas of teaching practice to a higher level than HEA. We chose to map the design of the Mosomelt cMOOC to the CMALT accreditation pathway as an appropriate measure of the development of technology enhanced learning practice and reflection, and also build upon the close links between Ascilite and ALT (https://ascilite.org/get-involved/cmalt/) to facilitate a supportive community.

Methodology

The design and implementation of the Mosomelt cMOOC is founded upon a qualitative educational design research (EDR) methodology (Table 1), that is supported by an ecology of social media resources (Figure 1).

Research questions

In evaluating the impact of the Mosomelt cMOOC framework we chose two research questions to focus the evaluation of the first two iterations:

1. How effective is an ecology of resources (EOR) based upon social media for sustaining an authentic professional development cMOOC and providing a participant eportfolio for accreditation pathways?

How can we redesign the cMOOC-triggering events based upon participant feedback?

Participants

The initial 51 participants for the 2015 Mosomelt cMOOC were drawn predominantly from the participants of a national six-institution higher education project #npf14lmd (Frielick et al., 2014). The Mosomelt cMOOC was relaunched in 2016 with 23 participants mainly from Auckland University of Technology (AUT University), however interest and participation from global participants was generated through Twitter and Google searches, leading to sign-ups from as far afield as Canada, and Venezuela. Across 2015 to 2016 Mosomelt has had 74 members from 14 different HE institutions across 8 countries. Many of the participants formed small communities of practice within a department that met weekly face-to-face to support one another as they participated within the wider Mosomelt online network.

Guiding design principles

Design principles were identified through the literature on designing authentic learning and scaffolding innovative pedagogies (Cochrane, Narayan, & Burcio-Martin, 2015; Cochrane, Narayan, Burcio-Martin, et al., 2015). These can be summarised by the following six design principles:

- Creating a supporting ecology of resources
- Nurturing a network of communities of practice
- Design of activities to trigger participant-generated content sharing
- Modelling collaboration and active participation within a global community
- Embedding SOTEL within an EDR framework
- Mapping activities and user-generated content to existing accreditation pathways

These design principles were reified in four key elements of the project:
1. Establishment of an online network of face-to-face communities of practice
Design of a supporting Ecology of Resources (EOR) using mobile social media
Design of weekly activities to trigger participant-generated content sharing
Accreditation of participant social media portfolios via CMALT

The Mosomelt cMOOC scaffolds a network of COPs exploring technology enhanced learning in a variety of higher education contexts, and also provides a platform for developing and nurturing global research collaborations. The cMOOC explicitly integrates SOTEL through preparing participants to submit eportfolios for certified membership of the association for learning technology (CMALT) accreditation, effectively updating Boyer's (1990) fourfold DIAT (Scholarship of Discovery or SOD, Scholarship of Integration or SOI, Scholarship of Application or SOA, and the Scholarship of Teaching and learning or SOTL) model of scholarship for the open social scholarship age. The cMOOC was designed around a series of triggering events intended to facilitate the sharing of participant-generated content, open scholarship, and SOTEL within a foundational EDR methodology (Bannan et al., 2015), connecting theory, practice, and critical reflection (Table 1). Table 1 illustrates the mapping of these guiding concepts within an EDR framework.

Table 1: EDR framework

EDR	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**
4 stages of learning design	Informed Exploration	Enactment	Evaluation: Local Impact	Evaluation: Broader Impact
Boyer's DIAT model	SOD	SOI	SOA	SOTL
Intersection with mobile learning	Mobile social media framework informing curriculum redesign	cMOOC designed upon Rhizomatic Learning: Developing an Ecology of Resources Designing Triggering Events	Participant Feedback & Redesign	Informed by the scholarship of technology enhanced learning (SOTEL), accredited via CMALT
Connecting theory and practice	Theory	Practice	Evaluation & iterative redesign	Critical Reflection

After two iterations of the cMOOC in 2015 and 2016, this paper focuses upon the evaluation stages of the EDR framework. The design and enactment phases of the Mosomelt cMOOC are reported in prior publications (Cochrane, Narayan, & Antonczak, 2015a; Cochrane, Narayan, Antonczak, & Burcio-Martin, 2016; Cochrane, Narayan, & Burcio-Martin, 2015; Cochrane, Narayan, Burcio-Martin, et al., 2015). Figure 1 illustrates the use of a collection of mobile social media and social networks to support the Mosomelt cMOOC.

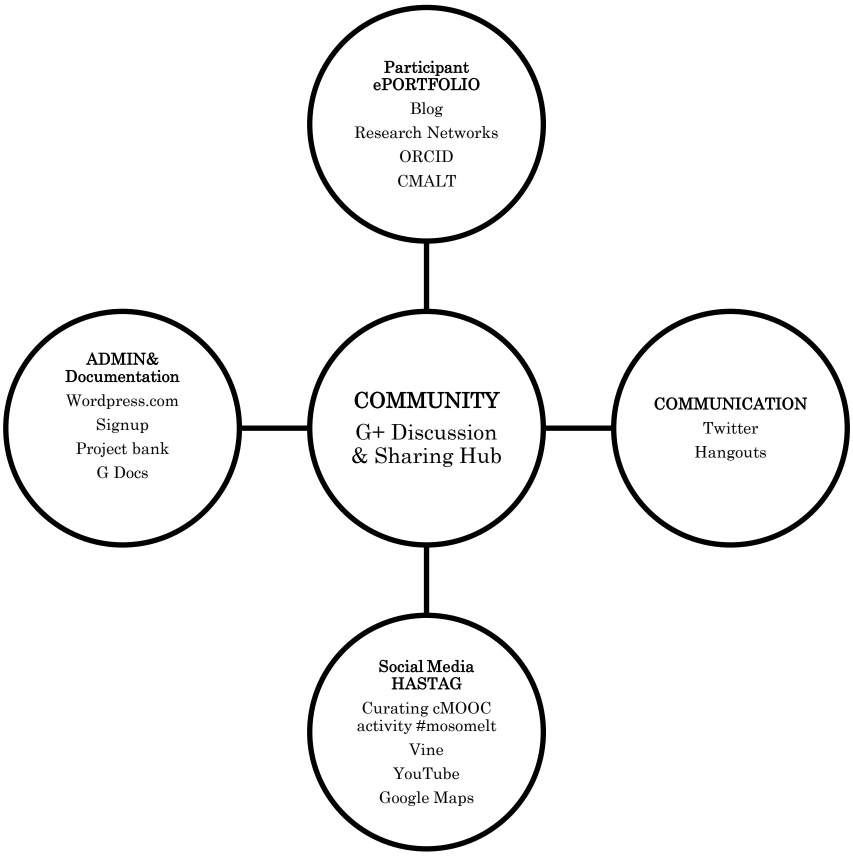

Figure 1: Mosomelt Ecology of Resources (EOR)

Cormier (2008) refers to the design of a collection of tools to support learning as an ecology of resources (EOR). In our case the ecology of resources utilised to support the Mosomelt cMOOC include:

- A WordPress course hub
- Google Plus Community
- A collaborative Participant Map
- A social media hashtag for curation: #mosomelt, with Twitter analysis via TAGSExplorer (Hawksey, 2011)
- A prior teaching practice survey of the participants: Post PowerPoint Survey
- The Project Bank for sharing participant curriculum design ideas
- A blog roll of participant reflective blogs
- An archive of online webinars, reflections, and tutorials via YouTube

The use of social media to support the Mosomelt cMOOC community also provided rich data for evaluation, for which ethics consent was achieved through the AUT ethics committee 13 May 2016, AUTEC Reference number 1669.

Redesign of Mosomelt 2016

As part of the iterative enactment stage of our EDR framework, reflections on the 2015 Mosomelt cMOOC (Cochrane, Narayan, Burcio-Martin, et al., 2015) informed the redesign of the cMOOC in 2016. The first 2015 iteration of the Mosomelt cMOOC was designed to follow the two twelve week academic semesters of the New Zealand academic calendar, with 24 weeks of sustained participation. However, we found that participant activity decreased after the first six weeks, and again after the end of the first twelve weeks. We compared our 2015 experiences with other MOOCs and found most MOOCs follow a 5 to 6 week timeframe for sustained participant engagement. Hence we refocused the second iteration of the Mosomelt cMOOC in 2016 around the first six weeks as community building, with the second six weeks offered as optional for further exploration. The second twelve week activities in 2016 were refocused as a guide for independent CMALT portfolio preparation. We also integrated the links between the various social media sites in a simpler menu structure on the Wordpress.com hub, and created a shared Mosomelt EOR concept diagram (Figure 1) to facilitate participant understanding of the specific use of each social media site within the Mosomelt EOR. The weekly triggering events were updated and previous links checked to make sure they were still active. Finally, we made sure that any social media curation tools and hashtags allowed continuity between 2015 and 2016 to create an expanding database of user-generated content as resources for future participants.

Results and Evaluation

In this section we evaluate the impact of the Mosomelt cMOOC as a professional development strategy via evidence of active participation of both the 2015 and 2016 participants, including: a pre Mosomelt survey, a participant collaborative Google Map, and the Mosomelt social media EOR. We also analyse a post-survey of the 2016 participants, and the development of participant eportfolios for potential CMALT submission.

Data collection and analysis

Ethics consent process
At the end of the second iteration of the Mosomelt cMOOC participants were invited by an independent colleague to view an online consent form, online participant information document, and participate in an anonymous online feedback survey using Google Forms.

Pre Mosomelt survey
In order to gain insights into the prior experiences and teaching strategies of the participants we invited participants to complete a simple SurveyMonkey survey in the first week of each iteration of the cMOOC. The survey indicated that while participants had experience of using a variety of technologies in teaching, the use of a presentation tool such as PowerPoint/Keynote/Prezi as their main teaching tool dominated their in class use of technology (65% 2015, 64% 2016). The prior use of any form of social media in teaching was typically used by less than 20% of respondents. 50% of respondents associated their teaching practice as student-centred (andragogy), with social constructivism and problem based learning being the most popular theoretical frameworks employed (57%). Mosomelt challenged participants to move beyond teacher-centred presentation technologies and their accustomed safe set of interaction tools to explore technologies that enable student-determined learning environments.

Participant Map
In 2015 the Mosomelt participants were invited to locate themselves on a collaborative participant map. In 2016 we created a second layer to the map for 2016 participants, creating a geographical context for the cMOOC that built over the two iterations. Participants linked elements of their social media portfolios into their points of interest on the collaborative map. Initially the map was made private in 2015, generating 71 views from the participants. In 2016 the map was made public, with contributions limited to Mosomelt participants. The map generated 533 views in 2016.

Social Media Activity
Mosomelt participants were required to sign up for the cMOOC participation by creating and sharing several social media profiles via an online form. These included: Twitter, a blog site, and Google Plus. As participants signed-up they were welcomed into the community via a Twitter post and invited to become members of the Mosomelt G+ Community. Their blogs were also curated via RSS feeds into a shared blog roll. These formed the basic communication and community channels for the cMOOC. Participation with these social media channels is summarised in Table 2, comparing the activity of the 2015 and 2016 cohorts.

Table 2: Comparison of 2015 and 2016 Mosomelt cMOOC participant activity

Mobile social media	Activity in 2015 for 51 participants	Activity in 2016 for 23 participants
#mosomelt Tweets (Summarised in a replay)	167 conversations involving 69 users	659 conversations involving 159 users
Google Plus Community activity	150 posts and 244 comments from 51 members	90 posts and 34 comments from 74 members
Introductory video production http://vinebox.co/tag/mosmomelt	31 Vine videos 10 Instagram videos	4 Vine videos 7 MSQRD videos
Collaborative Google Map of participants	29 participants, 71 views	11 participants, 533 views
Curated social media posts using #mosomelt via Twinesocial http://apps.twinesocial.com/mosomelt	390 Posts	241 Posts
Participant blogs	36 WordPress blogs with an average of 4 pages each.	12 WordPress blogs with an average of 7 pages each.

Table 2 indicates that while there were fewer new participants to Mosomelt in 2016 than 2015, external interest and continued participation from the 2015 cohort created a high engagement with the Mosomelt social media

EOR, particularly Twitter and the collaborative Google Map.

Post Mosomelt survey 2016
2016 participants were invited to complete an online evaluation survey at the end of the twelve weeks of the Mosomelt cMOOC. The survey questions are attached in the appendix of this paper. We received replies from 10 of the 23 2016 participants, representing a 44% return rate. 70% of respondents had more than 11 years of teaching experience. 80% of respondents indicated that their Mosomelt experience made a significant difference in their teaching practice - moving beyond teacher centred pedagogies and teaching platforms to learner centred socially collaborative learning spaces. The most helpful aspects of the Mosomelt experience were rated at 80% as:

- Being part of a Community of practice
- Learning new technologies
- The weekly activities

Followed by 70%: Working with a technology steward, noting that not all participants were part of a face-to-face COP. Exploring SOTEL and the option of CMALT accreditation were rated at 50%. Hence participation within a learning community was the most highly valued aspect of Mosomelt by the participants. All respondents stated that the facilitation and use of social media tools in Mosomelt (WordPress, Project Bank, Twitter etc.) helped them learn, share, create and co-create new meaning and understanding of learning and teaching. They indicated that the use of social media tools in their teaching practice after Mosomelt increased to over 60% compared to less than 20% prior to Mosomelt, with 70% integrating the use of Google Plus Communities and Twitter into their courses. General responses to how Mosomelt has impacted participants' teaching practice were of the theme "Inspired and new knowledge to make learning more interactive" (Participant post Mosomelt survey feedback, 2016).

Development of participant eportfolios

For most Mosomelt participants this was their first sustained experience of creating an eportfolio based around a reflective blog and social media. Their blog posts detailed the critical incidents in their Mosomelt journey and also gave insights into the wider impact of Mosomelt into their professional practice and curriculum design processes, as illustrated in the following examples.

> *[I]* Now use WordPress as a professional development tool for personal reflection and sharing of these reflections with the #mosomelt community. While I don't use this tool in the classroom setting I feel it informs my teaching and helps me to be more reflective of my teaching practices. In addition, using WordPress for reflecting on my own experiences learning to use new digital tools has impacted on me being more mindful and aware of how my students approach their learning and helps me to consider their diverse learning styles when introducing them to new tools. I'm now much more open to looking for and considering new digital tools and have started to follow several people on Twitter who discuss their use of such tools. (Participant post Mosomelt survey feedback, 2016)
>
> Thank you for being our fearless leader. Our team has benefitted and digital capability skyrocketed... There have been many surprising benefits:
> The mosomelt process inspired team building and strategic planning.
> And exploration of the pros and cons of MOOCs.
> And articulation of our collective teaching philosophy.
> And views on optimum teaching.
> And our understanding of student priorities and preferences.
> And how we can refresh our content and delivery. (Participant G+ comment, 2016)

CMALT Reflections
To date eight Mosomelt participants have submitted CMALT portfolios for accreditation, three have reached accreditation, with a further seven in process. Participants can use a wide variety of eportfolio formats, but we encouraged the use of WordPress as an eportfolio hub to build upon participants' Mosomelt blog reflections. Participants initially found the prospect of creating a reflective portfolio for CMALT submission daunting, and although it was a time-consuming exercise those that have thus far submitted CMALT portfolios for accreditation found the experience empowering. The following is an example participant reflection on the CMALT portfolio production process.

> First glance at the CMALT accreditation application I thought “cripes, another long-winded essay I can do without” but I am embarrassed to say, that I actually LIKED writing about myself ... The portfolio I was required to produce, forced me to apply my practical teaching resources within a learning and teaching technology context. It made me realise how much I had achieved while on auto-pilot, just getting on with ploughing through the coursework and bringing new ideas to it for 12 years. (Mosomelt participant blog post, 2016)

Example participant CMALT portfolios:
- https://daniellemulrennan.wordpress.com/
- https://mattguinibert.wordpress.com/cmalt-portfolio/
- https://thomcochrane.wordpress.com/cmalt/
- https://atz119.wordpress.com

The variety in the CMALT portfolios illustrates the flexibility and creativity enabled by this approach to professional practice portfolio production.

Discussion

In this section we discuss the key findings regarding the evaluation of the impact of the Mosomelt cMOOC, and plans for the future – proposing a scalable framework for professional development via networks of COPs.

Nurturing a community of practice

None of the 2015 participants unenrolled themselves from the Mosomelt Google Plus Community, with several 2015 participants becoming active more experienced peers within the 2016 iteration of Mosomelt, while the remainder continued in a more peripheral participation mode. Thus although the 2016 cohort was smaller than that of 2015, the 2016 participants felt part of a larger community that was building over time. This was reified in the participant collaborative map, where we created a new layer of points of interest for the 2016 participants to add themselves while keeping the 2015 participants as a separate layer on the map. Key feedback from continuing 2015 participants included the value of the webinar series and the face-to-face Winter Workshop in the 2015 iteration of Mosomelt that we did not include in 2016. The 2015 participants valued the opportunities to virtually and physically meet with COPs in other discipline contexts and institutions. We plan to reintroduce these in the third and subsequent iterations of Mosomelt. In the short term we will begin a webinar series of reflections from the first cohort of CMALT accredited submitters.

Evaluation: local impact
At this stage we have completed two iterations of the mosomelt cMOOC, having just completed the first 12 weeks of triggering events of the 2016 cohort. SOTEL is embedded within the mosomelt cMOOC design explicitly during the second 12 weeks as part of the requirements for CMALT accreditation, and this will be the focus of the remainder of the year for 2016 as we help participants through this process. The Mosomelt cMOOC is now one of the institution’s key strategies for up scaling authentic professional development based around a network of lecturer COPs. A more general PD parallel pathway has also been developed as a unique approach to support the HEA fellowship accreditation scheme pathway named AKO Aronui.

Evaluation: broader impact
Many participants have begun to publish in peer reviewed conference proceedings, book chapters and journal papers based upon their reflective practice journeys for the first time, creating a scholarly base for transferring the impact of mosomelt to the wider global education community. In the meantime, we are beginning to see the wider impact of the mosomelt cMOOC through the analysis of the open mobile social media EOR behind mosomelt as evidenced in Altmetrics (Cochrane, Narayan, & Antonczak, 2015b; Priem, Taraborelli, Goth, & Neylon, 2010). Altmetrics provides an indication of the impact of research publications based upon conversations generated in social network sites such as Twitter, Facebook, Mendeley, and Google+. For example, a TAGSExplorer analysis of the #mosomelt Twitter hashtag shows 159 nodes (users) and 828 edges (conversations/interactions), indicating the growth in peripheral participation in the #mosomelt community beyond the 74 enrolled participants.

Design principles

The two iterations of Mosomelt have reinforced the importance of the design principles behind the design and development of the cMOOC:

- Creating a supporting ecology of resources
- Nurturing a network of communities of practice
- Design of activities to trigger participant-generated content sharing
- Modelling collaboration and active participation within a global community
- Embedding SOTEL within an EDR framework
- Mapping activities and user-generated content to existing accreditation pathways

Of these the least developed so far are the integration of SOTEL and CMALT accreditation, however these will be more explicitly explored in following iterations of the Mosomelt cMOOC concept of a network of professional development COPs through national and international partnerships.

A Scalable Framework for Mapping a PD cMOOC to accreditation pathways

While the specific focus of the Mosomelt cMOOC has been the exploration of mobile social media to enable student-determined pedagogies (Heutagogy) in higher education we believe the concept of a cMOOC as a framework for network of professional development (PD) COPs can be applied to a variety of contexts (Domains of interest). We propose reimagining PD as a network of COPs or cMOOCs designed around domains of interest, with a meta cMOOC equivalent to a PgCert in higher education.
Example domains of interest may be:

- The scholarship of technology enhanced learning (SOTEL)
- Flipped classroom
- Mobile learning
- AR and VR
- BYOD

These cMOOCs can be designed to model practice and provide a transferable framework (Salmon, Gregory, Lokuge Dona, & Ross, 2015) that leverage existing global accreditation via creating evidence for participant portfolios for submission to HEA and CMALT, without the neoliberal connotations of mandating completion of a generic PgCert in higher education.

We propose a reimagined PgCert as a cMOOC facilitating a base level of effective, flexible, agile, and scalable academic PD. Beyond mandating academics complete an accredited PgCert (Hall, 2010) we believe Mosomelt demonstrates the potential of a PD cMOOC that is designed around the following principles:

- Conceptualised as a collaborative Network of COPs
- Webinars facilitating both global expert and local participant input
- Flipped content as triggering events designed to stimulate participant discussion and user-generated content
- Accredited via HEA or CMALT Portfolios
- Integrating SOTL/SOTEL explicitly through brokering collaborative reflective practice publications

We aim to test this concept by collaborating with like-minded individuals/departments/institutions both nationally and internationally in future iterations of Mosomelt.

Conclusions

Although hardly massive in numbers (74 participants over two years) the Mosomelt cMOOC as a concept and model for developing a culture around open scholarship and social media has been effective in scaffolding curriculum redesign, supporting innovative participant practice, and connecting practitioners from a variety of curriculum and geographic contexts. Key to the effectiveness of the Mosomelt cMOOC framework has been the development of a supporting community and collaboration infrastructure based upon an ecology of social media resources. Secondly the design of the cMOOC was explicitly based upon a series of triggering events to stimulate participant collaboration and sharing of their experiences and new pedagogical strategies. These triggering events were redesigned in light of feedback from the first iteration of the cMOOC. An EDR methodology has guided the design and implementation of the cMOOC, and we have identified six potentially transferable design principles. Mosomelt is still a ‘work in progress’, but the exciting element is the unique creative potential unleashed through the diverse participants with the focus of Mosomelt around user-generated content and discussions. You are welcome to join us on this journey by signing up for #mosomelt at http://mosomelt.org/signup/.

References

Association for Learning Technology (ALT). (2015, March 2015). ALT Certified Membership (CMALT), UKPSF and recognition of Fellow of the Higher Education Academy and accreditation of an institution's staff development provision. Retrieved from http://bit.ly/2a9DljX

Bannan, B., Cook, J., & Pachler, N. (2015). Reconceptualizing design research in the age of mobile learning. *Interactive Learning Environments*, 1-16. doi:10.1080/10494820.2015.1018911

Barnett, R. (2012). Learning for an unknown future. *Higher Education Research & Development, 31*(1), 65-77. doi:10.1080/07294360.2012.642841

Bates, T. (2014, October 13). Comparing xMOOCs and cMOOCs: philosophy and practice. Retrieved from http://www.tonybates.ca/2014/10/13/comparing-xmoocs-and-cmoocs-philosophy-and-practice/

Biggs, J. (2003). *Teaching for Quality Learning at University* (Second ed.). Buckingham: The Society for Research into Higher Education.

Boyer, E. (1990). *Scholarship reconsidered: priorities of the professoriate*. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

Cochrane, T., Narayan, V., & Antonczak, L. (2015a, 19 November). *Mobile Learning, Altmetrics, and SOTEL.* Paper presented at the 5th Mobile Creativity and Mobile Innovation Symposium, RMIT University, Melbourne, Australia.

Cochrane, T., Narayan, V., & Antonczak, L. (2015b, 19 November). *Mobile Learning, Altmetrics, and SOTEL.* Paper presented at the 5th Mobile Creativity and Innovation Symposium, RMIT, Melbourne, Australia.

Cochrane, T., Narayan, V., Antonczak, L., & Burcio-Martin, V. (2016, 19-20 April). *Modelling Open Practices in Professional Development: Creating a culture of open social scholarship.* Paper presented at the OER16: Open Culture, University of Edinburgh, UK.

Cochrane, T., Narayan, V., & Burcio-Martin, V. (2015). Designing a cMOOC for Lecturer Professional Development in the 21st Century. In J. Keengwe & G. Onchwari (Eds.), *Handbook of Research on Active Learning and the Flipped Classroom Model in the Digital Age* (pp. 378-396). Hershey, PA, USA: IGI Global.

Cochrane, T., Narayan, V., Burcio-Martin, V., Lees, A., & Diesfeld, K. (2015, 29 November - 2 December). *Designing an authentic professional development cMOOC.* Paper presented at the Globally connected, digitally enabled, Proceedings the 32nd Ascilite Conference, Curtin University, Perth.

Connell, R. (2009). Good teachers on dangerous ground: towards a new view of teacher quality and professionalism. *Critical Studies in Education, 50*(3), 213-229. doi:10.1080/17508480902998421

Cormier, D. (2008). Rhizomatic education: Community as curriculum. *Innovate, 4*(5), np. available http://davecormier.com/edblog/2008/2006/2003/rhizomatic-education-community-as-curriculum/.

Deepwell, M., & Slater, J. (2012). *The changing role of learned bodies and membership organisations: some UK experiences.* Paper presented at the ASCILITE-Australian Society for Computers in Learning in Tertiary Education Annual Conference.

Frielick, S., Cochrane, T., Aguayo, C., Narayan, V., O'Carrol, D., Smith, N., . . . Wyse, P. (2014, 12 April 2015). Learners and mobile devices (#NPF14LMD): A framework for enhanced learning and institutional change. Retrieved from https://akoaotearoa.ac.nz/learner-mobile-devices

Gosling, D. (2010). Professional development for new staff – how mandatory is your Post Graduate Certificate? *Educational Developments: The Magazine of the Staff and Educational Development Association Ltd (SEDA)*, 1-4.

Hall, J. (2010). Theorising resistance to engagement with the Professional Standards Framework. *Professional development for new staff–how mandatory is your Post Graduate Certificate?, 11*, 14-16.

Hase, S., & Kenyon, C. (2007). Heutagogy: a child of complexity theory. *Complicity: an International Journal of Complexity and Education, 4*(1), 111-118.

Hawksey, M. (2011). Twitter: How to archive event hashtags and create an interactive visualization of the conversation. Blog Retrieved from http://mashe.hawksey.info/2011/11/twitter-how-to-archive-event-hashtags-and-visualize-conversation/

Head, G., & Dakers, J. (2005). Verillon's trio and Wenger's community: Learning in technology education. *International Journal of Technology and Design Education, 15*, 33-46.

Herrington, J., Reeves, T., & Oliver, R. (2009). *A guide to authentic e-learning*. London and New York: Routledge.

Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *The International Review of Research in Open and Distributed Learning, 15*(1).

Kaufman, J. C., & Sternberg, R. J. (2007). Creativity. *Change: The Magazine of Higher Learning, 39*(4), 55-60. doi:10.3200/chng.39.4.55-c4

Kill, M., & Stroud, J. (2016, 19-20 April). *Massive Open Online Courses and Professional Development.* Paper presented at the OER16: Open Culture, University of Edinburgh, UK.

Laurillard, D. (2001). *Rethinking University Teaching: a framework for the effective use of educational technology* (Second ed.). London: Routledge.

Laurillard, D. (2016). The educational problem that MOOCs could solve: professional development for teachers of disadvantaged students. *2016, 24*. doi:10.3402/rlt.v24.29369

Luckin, R., Clark, W., Garnett, F., Whitworth, A., Akass, J., Cook, J., . . . Robertson, J. (2010). Learner-Generated Contexts: A Framework to Support the Effective Use of Technology for Learning. In M. Lee & C. McLoughlin (Eds.), *Web 2.0-Based E-Learning: Applying Social Informatics for Tertiary Teaching* (pp. 70-84). Hershey, PA: IGI Global.

Mackness, J., & Bell, F. (2015). Rhizo14: A Rhizomatic Learning cMOOC in Sunlight and in Shade. *Open Praxis, 7*(1), 25-38. doi:http://dx.doi.org/10.5944/openpraxis.7.1.173

McDowell, J., Raistrick, A., & Merrington, J. (2013). *Enhancing institutional practice through CMALT accreditation*. Paper presented at the ALT-C 2013 - Building new cultures of learning, University of Nottingham, UK. http://eprints.hud.ac.uk/19914/

Milligan, C., & Littlejohn, A. (2014). Supporting professional learning in a massive open online course. *2014, 15*(5).

Priem, J., Taraborelli, D., Goth, P., & Neylon, C. (2010, 26 October). Altmetrics: A manifesto. Retrieved from http://altmetrics.org/manifesto/

Salmon, G., Gregory, J., Lokuge Dona, K., & Ross, B. (2015). Experiential online development for educators: The example of the Carpe Diem MOOC. *British Journal of Educational Technology*, n/a-n/a. doi:10.1111/bjet.12256

Siemens, G. (2005). Connectivism: Learning as network-creation. *eLearnspace*, (10 August). Retrieved from http://www.elearnspace.org/Articles/networks.htm

Sternberg, R. J., Kaufman, J. C., & Pretz, J. E. (2002). *The creativity conundrum: A propulsion model of kinds of creative contributions*. Philadelphia: Psychology Press.

University of Leeds. (2016a). Blended Learning Essentials: Accreditation pathways. Retrieved from https://www.alt.ac.uk/sites/alt.ac.uk/files/public/Guide_paths to accreditation_v9.pdf

University of Leeds. (2016b). Blended Learning Essentials: Getting Started. Retrieved from https://www.futurelearn.com/courses/blended-learning-getting-started?utm_source=FL_DB&utm_medium=crm&utm_campaign=11_08_2015_FL_newsletter&utm_content=text

Vygotsky, L. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.

Wickens, R. (2006). SoTEL: Toward a Scholarship of Technology Enhanced Learning. *Canadian Journal of University Continuing Education, 32*(2), 21-41.

Appendix: 2017 Post Survey Questions

1. How many years for teaching experience do you have?
2. Prior to enrolling for Mosomelt, what would you say was your primary teaching style? (1 being teacher-centred - 5 being entirely learner-centre)
3. What part did technology play in your teaching prior to your enrolment in Mosomelt? (1 LMS focused only - 5 being entirely open based on social media and other open learning platforms)
4. How would you rate your professional development experience in Mosomelt?
5. What factors helped or hindered your experience in Mosomelt? (Choose as many apply.)
6. The facilitation and use of social media tools in Mosomelt (WordPress, Project Bank, Twitter etc) helped me learn, share, create and co-create new meaning and understanding of learning and teaching.
7. Briefly outline the changes you have made to your teaching (if any) directly resulting from your journey in Mosomelt.
8. Select the tools you have explored and are now using in teaching your subject. (Select as many apply.)
9. Do you intend submitting a CMALT portfolio? If yes, what have you found valuable about the CMALT process?
10. Do you have any suggestions that will help improve Mosomelt for future iterations?
11. Would you like to participate further in this research by giving us permission to use your portfolio as a source of data for informing the findings?

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Development of a tool to support continuous assessments and improve the feedback cycle on statistical analysis assignments for large classes

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The purpose of this paper is to describe the development of a tool, AGStex (Assignment Generation Software using Latex), that enables educators to generate individual assignments tasks and to provide targeted feedback to students in large classes in a timely manner. In this paper, the initial development of the tool targeted at a statistical data analysis course in the field of biomedical engineering is presented. In addition, the authors illustrate how educators can utilise the feedback generated by the tool to improve student learning in large classes. The paper concludes with an outline of the next steps for the project including suggestions on further work needed to inform the impact on the types feedback generated by AGStex on students' learning outcome.

Keywords: computer-based assessment, feedback, large class, higher education

Introduction

The primary focus of assessment and feedback is to help students reduce the gap between current understanding or performance and a desired goal (Hattie & Timperley, 2007). Despite its importance, particularly for large classes, academics are constantly struggling to provide sufficient opportunities for students to apply their understanding of the concepts learned after face-to-face lessons. Coupled with limited resources, the provision of quality feedback on practice exercises and assignments tends to be compromised. The situations were especially grave for assignments that require open-ended responses which involve complex analytical skills. In such courses, students are often required to do substantial practice that needs to be marked by the educator and returned to students before the next lesson.

The context of this paper is a core data analysis course at the National University of Singapore (BN2102 Bioengineering Data Analysis), where students are introduced to concepts relevant to the interpretation and statistical analysis of experimental results in the biomedical engineering field. These concepts/knowledge require students to perform some of the most commonly used statistical analysis of experiments as well as to interpret the results of typical bioengineering experiments by building a suitably fitted mathematical model. With high enrolments of an average of 100 students each year, it is rather difficult for the instructor to address students' diverse needs due to a great variability in their prior knowledge and skills. To provide students with enough practice, standard exercises and the provision of model answers during the next classroom session are adopted. However, two issues were identified using this approach. First, it was observed that students tend to copy answers from each other, without even attempting to examine the process in solving the given problem. Second, though model answers enable students to verify the accuracy of their solutions against the model or ideal solutions, the usefulness is limited as there could be other methods to approaching the same task. Moreover, it has been reported that students prefer personal over standard feedback as the latter were perceived as having "lack of personal empathy and guidance" (Huxham, 2007, p. 608). In domains with well-structured but complex declarative knowledge, studies have reported the sole usage of model answer is not as effective as combining it with elaborated feedback (Collins, Carnine, and Gersten, 1987; Mory, 2004).

To speed up the provision of assessment and feedback, the use of computer-based solutions for the provision of assessment and feedback is a popular option for educators. For feedback to be effective, students need to be provided with timely and targeted feedback on their work (Butler & Winne, 1995; Corbett & Anderson, 2001). Most importantly, instructors need to make informed decisions on how they can adapt their teaching by making best use of information on their students' progress to better close the feedback loop.

The purpose of this paper is to describe the development of a tool, AGStex (Assignment Generation Software using Latex), which enables academics to generate individual assignments tasks and to provide targeted feedback to students in large classes. We will examine what constitutes an effective feedback and introduce the theoretical underpinnings of the tool. Using a combination of both automated and manual assessment, we will describe how the instructor goes about providing extra feedback to address the learning gap faced by students. Finally, we will discuss the limitations of this conceptual paper and to suggest further work needed to inform the impact on the types feedback generated by AGStex on students' learning outcome.

Literature review

Computer-based assessment for complex cognitive tasks

In recent years, there has been a surge of research demonstrating that the use of computer technology to provide assessment and online feedback produces significant benefits (Timmers & Veldkamp, 2011; Hatziapostolou & Paraskikis, 2010). Other than engaging students to apply the concepts taught in the lectures, automating assessment effectively reduces teachers' grading time by automating the generation of questions, marking of students' work for certain tasks and by speeding up the provision of feedback (Brown, Race, & Bull, 1999, Van der Kleij, Timmers, & Eggen, 2011).

Scalise and Gifford (2006) created a taxonomy of item types in computer-based assessment and discussed the limitations of each of the item types. The item types are namely: (a) fully constrained responses (e.g. multiple-choice items), (b) intermediate constrained responses (e.g. short answer items), and (c) fully constructed responses (e.g. essay questions). They explained that fully constructed responses are better able to diagnose more complex learning processes and promote deep understanding of conceptual knowledge than items with fully constrained responses. In the case of BN2102, students are frequently engaged with problem-solving related tasks that require them to produce fully constructed responses. These problem-solving tasks involve the use of cognitive strategies, such as the selection, application, and evaluation of a cognitive strategy. Although current technology has made it possible for open-ended responses to be done by machine grading with substantial inter-rater reliability with the human scoring (Wiser, Mead, & Pennock, 2016), such technology is not readily available and affordable in most common learning management systems.

Along with the convenience in administering the online quiz, teachers have to deal with plagiarism. Plagiarism is considered a very serious offence in most universities. The detection of plagiarism for large class assignments has always been a difficult task for human graders. In particular, if different teachers are involved in the grading process, the question of reliability comes into play.

Formulation of the written online feedback

Feedback is instrumental for improving quality of student learning performances. Yet, based on a comprehensive review of 87 meta-analyses of studies, Hattie and Timperley (2007) observed that different types of feedback can be differently effective in terms of students' learning performances and levels of attention paid to feedback. They advocate that providing task-related feedback is critical as it will inform students on the correct direction to approach the task, the manner to complete the task, and enhance the effects of self-regulatory behaviour.

Shute (2008) proposed useful insights towards the types of feedback and the design of task-related feedback. Various types of feedback were distinguished by the author, namely: knowledge of results (KR), knowledge of correct response (KCR) and elaborate feedback (EF). In the case of KR, the feedback only informs whether the answer is correct or incorrect. KCR is an extension of KR which aims to revise incorrect answers by providing the correct answer. With EF, students are provided with an explanation for why their response is correct or incorrect, coupled with process related feedback that addresses the method to be followed to complete the task. This cues the learners into a cognitive elaboration process, which enhances deep understanding (Anderson & Reder, 1979). A recent meta-analysis on effects of feedback in a computer-based learning environment by Van der Kleij, Feskens, & Eggen (2015), suggests that EF is most effective as compared with KR and KCR for higher order learning outcomes.

Feedback timing is also an important consideration for auto-generated feedback. Studies were less conclusive about the impact of feedback timing (i.e. immediate vs delayed) on learning outcomes (Shute, 2008; Van der Kleij et al., 2015). Most research is concerned that feedback is timely, where students receive the feedback not before the student is ready to make adjustments in his or her performance or understanding (Corbett & Anderson, 2001). That feedback needs to lead students to revisit the learning activity that led to the feedback is arguably the most important finding regarding the effectiveness of feedback (Butler & Winne, 1995). Given that one of the biggest challenges to computer-based feedback is that students can easily ignore the written feedback (Timmers & Veldkamp, 2011; Van der Kleiji et al., 2015), it is suggested that students will need explicit guidance to benefit from learning opportunities that arises from the feedback.

With the above considerations on what constitutes an effective feedback for higher order learning outcomes and the affordances of an automated assessment tool, a feedback cycle process flow is formulated to guide the educator from the creation of the assignments to the provision of elaborate feedback. The proposed tool, AGStex, is being developed with the following aims:

1. Substitute the one-size-fits-all traditional approach of distributing the same take-home assignment to the entire class with a personalized assignment approach even in large classes
2. Ease the educator's work to provide students with timely, targeted and effective feedback on their work.
3. Try to reduce plagiarism among students

The AGStex application is developed using the C++ programming language and hinges on several open-source software, primarily Latex for the generation of the pdf files.
Figure 1 describes how the feedback is generated to the use with reference to the model of feedback and self-regulated learning, from point A to D, originally published by Butler and Winne (1995). The external feedback responses would have to be interpreted, constructed and internalised by students to have a significant influence on subsequent learning (Ivanic, Clark & Rimmershaw, 2000). This is addressed at Point E where our approach to close the feedback loop is described.

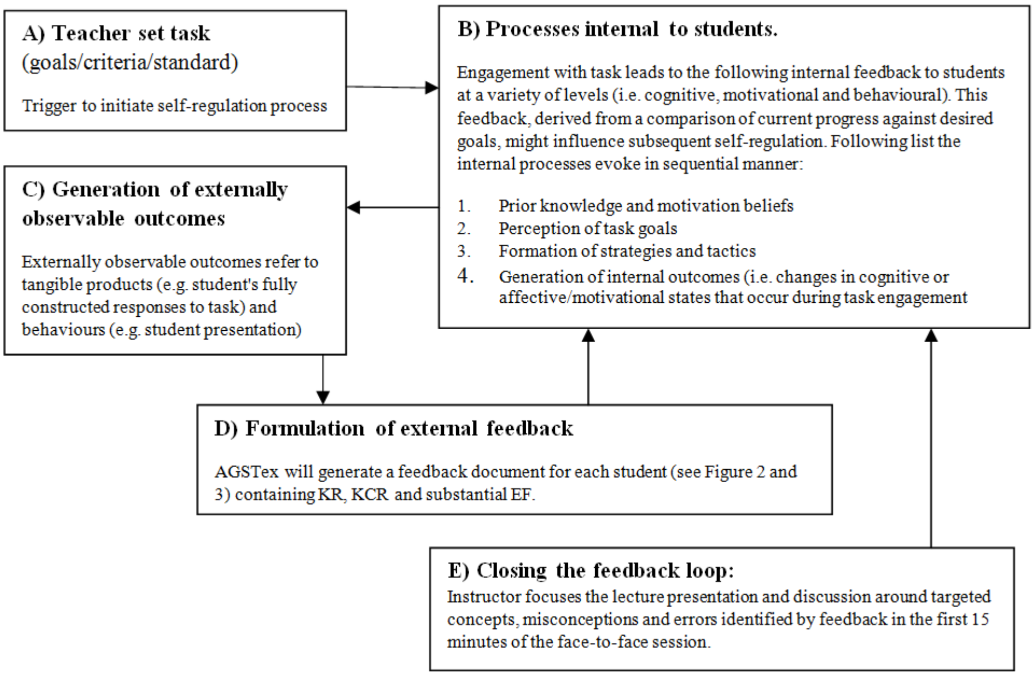

Figure 1: Contribution of AGStex within the model of self-regulated learning and feedback principles proposed by Butler and Winne (1995)

The following section outlines the process of developing the feedback and closing the feedback loop to improve learning using the proposed AGStex tool.

The AGStex tool and design of feedback

The aim of the developing the AGStex tool is to enable the educator to generate a set of individual assignments for topics on data analysis as well as providing personalized feedback distributed students in a timely manner. The objective is to provide each student with individual knowledge of the correct response (KCR) as well as targeted elaborate feedback (EF). Figure 2 shows a schematic representation of how AGStex generates questions and feedback. The educator inputs the following:

1. Textual description of a few contexts used to frame the question
2. Criteria to be used to generate data sets that students will work on, specifying "groups" of data
3. For each context in a), a specific textual feedback
4. For each group of data in b) a targeted feedback and typical mistakes.

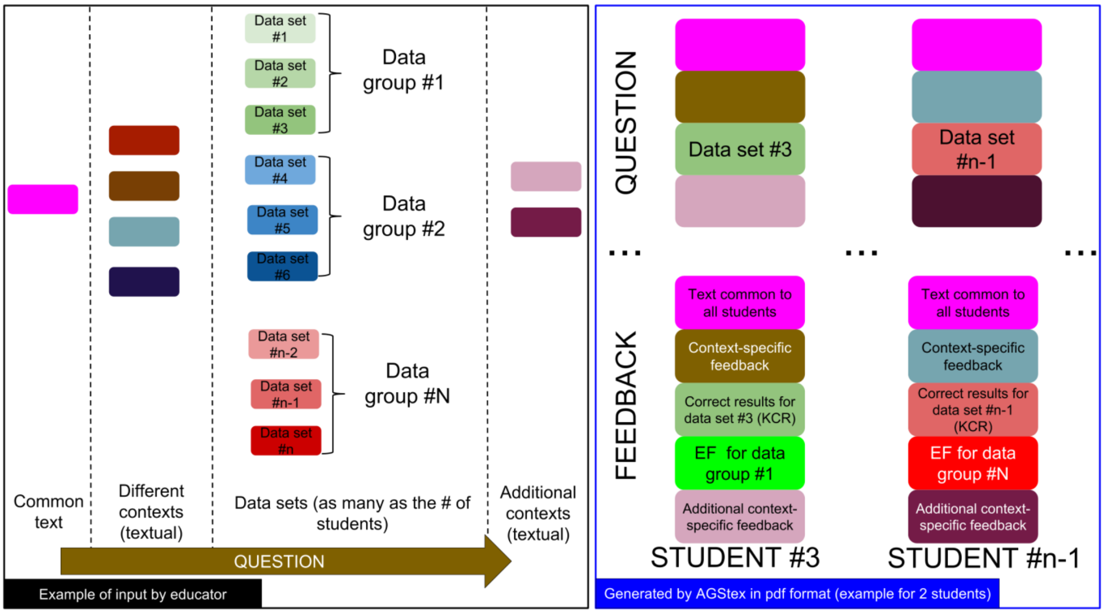

Figure 2. Color-coded schematic representation of educator's input (black box, left) and AGStex output (blue box, right) in the form of unique questions and n feedback documents.

Given these inputs and the required number of students n, AGStex will:

1. Generate n sets of data, keeping track of which "data group" they belong to and perform the required analysis.
2. Generate n unique assignment questions (in pdf format) obtained by randomizing the given set of contexts and assigning one unique data set to each student
3. Generate n unique assignment feedback documents (in pdf format) containing textual context-specific feedback, the correct numerical answers of the data analysis (KCR) as well as the required interpretation and typical mistakes associated with that specific "data group" (EF).

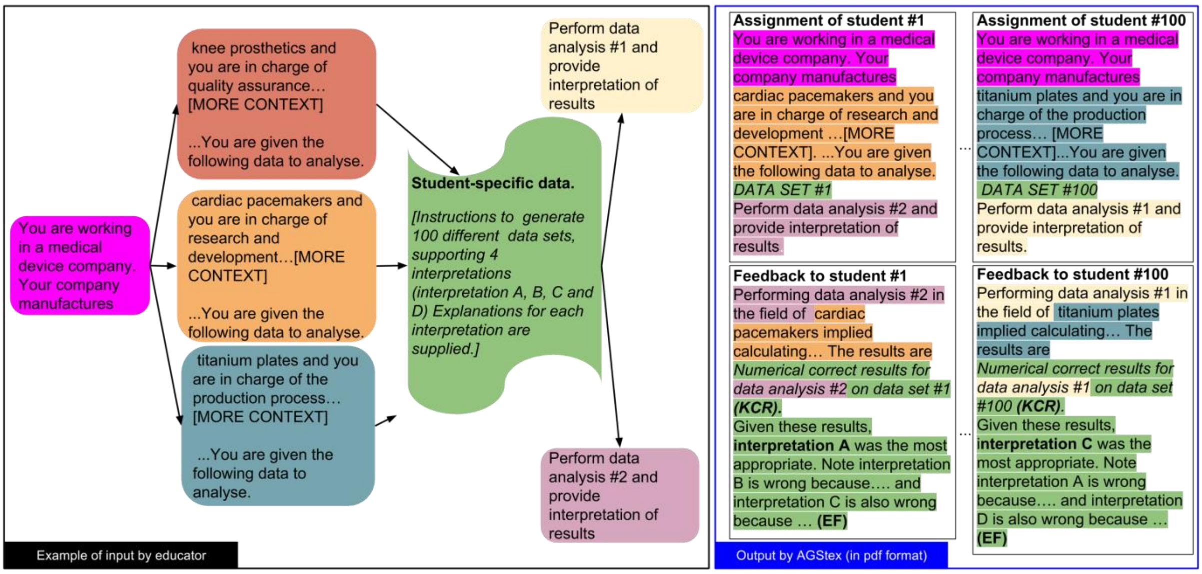

Figure 3. Example of usage of AGStext to generate assignment and feedback for data analysis topics in the biomedical engineering field. In this example, AGStext will randomize the choice of context and the generation of data for each student. It will then generate a feedback document with the correct answer (KCR) and containing specific feedback for the given context and data set (EF).

Taking the BN2102 Bioengineering Data Analysis module as an example (100 students), Figure 3 shows a possible concrete case of assignment and feedback generated for 100 students. Given the inputs, the approach described in Figures 2 and 3 is fully automated. With students receiving different datasets or scenarios, yet maintaining similar complexity level of the test-items, the possibility of students copying the solutions from each other is mitigated.
There are several optional extensions to what is shown in Figure 2 and 3 that AGStex will incorporate to improve the given feedback:

- Given a class roster typically maintained by institutional learning management systems, the feedback document can be automatically generated including the name of the student in the feedback, at any point in the document specified by the instructor, e.g., “Dear John, ”. This is an attempt to address the “lack of personal guidance and empathy” (Huxham, 2007, p. 608) typically associated with online assignments.
- The feedback can include graphical elements in the form of charts which will be specific for each data set and automatically generated
- The automatically generated feedback documents described in Figure 2 and 3 are immediately available to the educator. It will be possible for the educator to tweak it manually during the process of marking and add individual feedback for each student manually, if necessary.
- AGStex has the ability to compute and give the correct numerical answer for a particular problem and data set. Provided a suitable format of students’ submission, it is also possible to auto-mark the numerical part of the answer to ease the educator’s work.

Current progress, limitations and future work

The AGStex tool is being coded by one the authors of this paper. The approach described in Figure 2 and 3 has been preliminary tested for the BN2102 Data Analysis module. The tool is currently functional for certain types of data analysis but lacks a Graphical User Interface (GUI). As such, the only way to use it at the moment is to provide the necessary inputs within the appropriate sections of the source code itself. This is definitely not convenient. Development of a suitable GUI is a fundamental future step as it will allow an educator without knowledge of C++ to use the tool. We also intend to expand the range of numerical analysis that AGStex is able to help the educator with. This would not be limited to the data analysis/statistics field, but can extend to any discipline.
Though we have tested the functionality of the tool for one semester, the research is limited because we did not manage to collect data from students on their perception about the feedback generated. We plan to conduct a formal study by collecting both quantitative and qualitative data to explore students’ perspectives about the type of feedback generated by the AGStex tool and to investigate whether by closing the feedback cycle helps students achieve better learning outcomes.

Conclusion

Providing quality feedback and having a process in place to assure that students engage with it is an important consideration in implementing computer-based assessment. Quality feedback needs to be targeted, timely and personalised. In addition, an effective communication method is needed to ensure that students engage with the feedback content. Given the features built into AGStex, we believe the tool can provide added value over standardised assignment tasks and model answers by presenting individualised assignments and targeted feedback.

References

Anderson, J. R., & Reder, L. M. (1979). An elaborative processing explanation of depth of processing. In. L. S. Cermak & F. I. M. Craik (Eds.), *Levels of processing in human memory* (pp. 385–403). Mahwah, NJ: Erlbaum.

Brown, S., J. Bull, & P. Race. (1999). *Computer-assisted assessment in higher education*. London: Kogan Page.

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of educational researc*h, *65*(3), 245–281.

Corbett, A. T., & Anderson, J. R. (2001). Locus of feedback control in computer-based tutoring: impact of learning rate, achievement and attitudes. *Proceedings of ACM CHI-2001 Conference on Human Factors in Computing Systems*, 245–252.

Collins, M., Carnine, D., & Gersten, R. (1987). Elaborated corrective feedback and the acquisition of reasoning skills: A study of computer-assisted instruction. *Exceptional Children*, *54*(3), 254–262. https://www.researchgate.net/profile/Russell_Gersten/publication/19840015_Elaborated_corrective_feedback_and_the_acquisition_of_reasoning_skills_A_study_of_computer-assisted_instruction/links/00463537261f9205e6000000.pdf

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of educational research*, *77*(1), 81–112. https://insightplatform-public.sharepoint.com/SiteAssets/feedback-and-reporting/characteristics-of-effective-feedback/power_feedback.pdf
Hatziapostolou, T., & Paraskikis, I. (2010). Enhancing the impact of formative feedback on student learning through an online feedback system. *Electronic Journal of eLearning*, *8*(2), 51–90.
Huxham, M. (2007). Fast and effective feedback: are model answers the answer?. *Assessment & Evaluation in Higher Education*, *32*(6), 601–611. https://www.researchgate.net/profile/Mark_Huxham/publication/254220135_Fast_and_effective_feedback_are_model_answers_the_answer/links/5579ab9308aeb6d8c02055ad.pdf
Ivanic, R., Clark, R., & Rimmershaw, R. (2000). What am I supposed to make of this? The messages conveyed to students by tutors' written comments. In M. Lea & B. Street (Eds.), *Student writing in higher education* (pp. 47–65). Buckingham, UK: Open University Press.
Mory, E. H. (2004). Feedback research revisited. *Handbook of research on educational communications and technology*, *2*, 745–783. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.610.3249&rep=rep1&type=pdf
Scalise, K., & Gifford, B. (2006). Computer-based assessment in e-learning: A framework for constructing" intermediate constraint" questions and tasks for technology platforms. *The Journal of Technology, Learning and Assessmen*t, *4*(6).
Shute, V. J. (2008). Focus on formative feedback. *Review of educational research*, *78*(1), 153–189. http://myweb.fsu.edu/vshute/pdf/shute%202008_b.pdf
Timmers, C., & Veldkamp, B. (2011). Attention paid to feedback provided by a computer-based assessment for learning on information literacy. *Computers & Education*, *56*(3), 923–930.
Van der Kleij, F. M., Feskens, R. C., & Eggen, T. J. (2015). Effects of feedback in a computer-based learning environment on students' learning outcomes: A meta-analysis. *Review of educational research*, *85*(4), 475–511. https://www.researchgate.net/profile/Theo_Eggen/publication/272923307_Effects_of_Feedback_in_a_Computer-Based_Learning_Environment_on_Students'_Learning_Outcomes_A_Meta-Analysis/links/5592911e08ae5af2b0eb335f.pdf
Van der Kleij, F. M., Timmers, C. F., & Eggen, T. J. H. M. (2011). The effectiveness of methods for providing written feedback through a computer-based assessment for learning: a systematic review. *CADMO*, *19*(1), 21–39.
Wiser, M. J., Mead, L. S., Smith, J. J., & Pennock, R. T. (2016). Comparing human and automated evaluation of open-ended student responses to questions of evolution. *arXiv preprint arXiv*:1603.07029. http://arxiv.org/pdf/1603.07029.pdf

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Social Media #MOOC Mentions: Lessons for MOOC Research from Analysis of Twitter Data

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There is a relative dearth of research into what is being said about MOOCs by users in social media, particularly through analysis of large datasets. In this paper we contribute to addressing this gap through an exploratory analysis of a Twitter dataset. We present an analysis of a dataset of tweets that contain the hashtag #MOOC. A three month sample of tweets from the global Twitter stream was obtained using the GNIP API. Using techniques for analysis of large microblogging datasets we conducted descriptive analysis and content analysis of the data. Our findings suggest that the set of tweets containing the hashtag #MOOC has some strong characteristics of an information network. Course providers and platforms are prominent in the data but teachers and learners are also evident. We draw lessons for further research based on our findings.

Keywords: HCI, MOOCs, Data Analytics, Twitter, Social Media, Big Data

Introduction

Although MOOCs learners are known to be educated, digitally literature (Jordan, 2104) and, socially networked (McAuley et al, 2010) little research has been undertaken into how MOOCs are portrayed in social media platforms such as Twitter. Studies to date are limited by relatively small datasets or from having taken samples of manually extracted tweets. One study of note in this area looked at users of the Sina Weibo platform, a popular Chinese microblogging website (Zhang et al, 2015). This study screen-scraped 95,015 postings with mentions of MOOC published by 62,074 users on Sina Weibo from a four year period and analyzed the volume of postings according to four time frames: year, month, day of the week, and the time of day. Their work outlined some trends and made an exploratory foray into this topic.

This paper contributes to research into MOOCs by a systematic extraction of a dataset from the global Twitter stream (utilizing the Twitter GNIP API) and interrogating this data via descriptive and content analyses. Our aim was to conduct exploratory analysis of the MOOC discourse on Twitter. We sought to determine, through big data analysis, what conversations are being conducted in the MOOC arena by the range of potential actors such as MOOC platform providers, traditional educational institutions providing MOOCs, MOOC teachers, MOOC leaners and MOOC researchers. Moreover, we sought to probe the use and meaning of the term MOOC itself as negotiated by users of the term on public social media via its hashtag.

Data and Methods

Twitter data for the MOOC dataset was extracted from GNIP API for the period September to December 2015 and augmented with additional data including Klout scores - a social network influencer measure as developed by Rao Spasojevic and Dsouza (2015). The GNIP API produces very large volumes of data and we used cloud computing, data extraction, storage and processing techniques to handle the data. The GNIP Stream API produces more reliable data than more manual techniques such as screen scraping of the public Twitter REST

API (Driscoll & Walker, 2014), and also offers more data protection such as excluding data from deleted accounts. The hashtag '#MOOC' was used as a keyword to extract the required data. In this we followed the work of Zhang et al (2015).

The GNIP Stream API provides a file containing data for each 10 minute interval of a specified period. Complex analytics on the data were performed mainly in R (an open-source statistical tool). This study is in line with current state-of-the-art frameworks (Chae, 2015; Lynn et al. 2015) for descriptive analytics and content analytics on Twitter data. The methodology follows the approach for descriptive and content analytics outlined by Chae (2014) and extended by Lynn et al. (2015).

Findings

The MOOC dataset had 32,309 tweets of which 17,910 were original tweets and 14,399 were retweets. Replies constituted 8 percent (1,434) of the total number of the original tweets. The dataset had 4,980 unique hashtags. Obviously #MOOC features in most of the original tweets (17,263). Other popular co-occurring hashtags included #elearning (1,876), #edtech (1,134), #moocs (822), #highered (637), #coursera (631), and #education (594). The average number of hashtags in original tweets was 2.68.

There were 14,890 unique user screen names in the dataset. This indicates that each user on an average sends 1.2 tweets, 0.9 retweets and 0.1 replies. The most active and visible users were identified (See **Error! Reference source not found.**). Activity was calculated as per Chae (2015) i.e. the activity of a user was calculated as the sum of the number of tweets, retweets and replies which the user has contributed to the network. The visibility of a user was determined by the number of followers for each user as on 31st December 2015. **Error! Reference source not found.** shows a line graph to describe the relationship between active and visible users. It can clearly be observed from the figure that the most active users are not the most visible users and vice versa. For instance, @MOOCs (the most active user) is not the most visible user. Similarly, @edX, the most visible user, is not among the top 30 active users in this network.

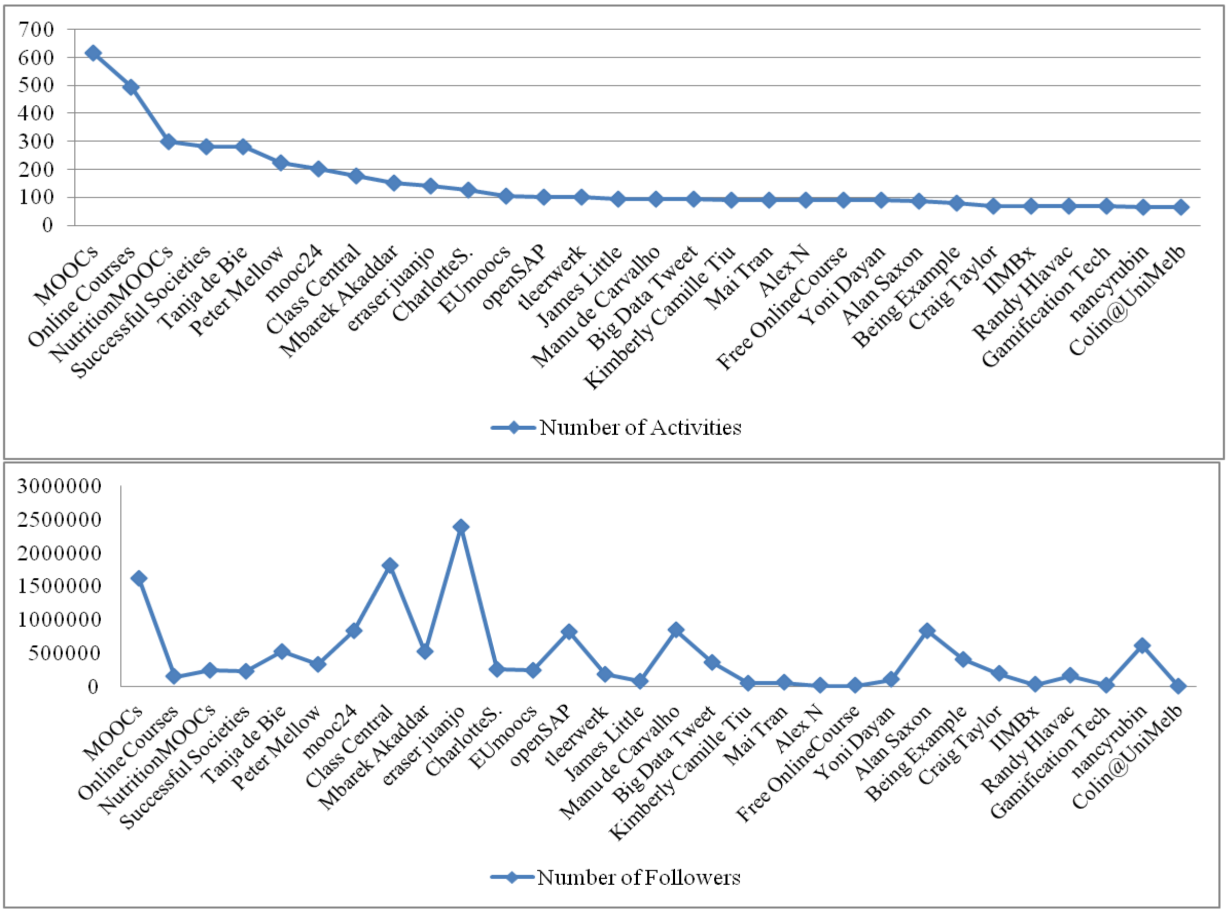

Figure 1: Active Users Vs Visible Users in #MOOC Dataset

Content analytics is primarily concerned with uncovering the patterns hidden inside content. Word analysis, hashtag analysis and sentiment analysis are the analyses which were performed in this category. For performing word analysis, the 'tm' library in R was used. Frequent words appearing in the tweets were discovered in order to identify the most popular words among the users in the network. The most popular words were unsurprising i.e. 'MOOC' (occurring 21,199 times), 'course' (2,733), 'learn' (2,686), 'online' (2,442), 'elearn' (2,079), 'free' (1,911), 'coursera' (1,410), 'edxonline' (1,332) and so on were some of the most popular words. The 'ngram' library in R was used to identify the most frequently co-occuring words in the dataset. The most popular co-occurring words included 'mooc elearn' (1,412 times), 'online course' (1,333), 'edxonline mooc' (869), 'mooc course' (496), 'free mooc' (478) and 'mooc onlinecourse' (467). The dataset had 4,980 unique hashtags. Some of the most popular hashtags were #mooc (17,263), #elearning (1,876), #edtech (1,134), #moocs (822), #highered (637), #coursera (631) and #education (594).

Peak detection algorithms were used to identify events of significance in the dataset. In line with Healy et al. (2015), the peak detection algorithms were those presented by Du et al. (2006), Palshikar (2009) and Lehmann et al. (2012). Due to the relatively small number of true peaks and low volume of tweets per peak, the topics were identified manually. Table 1 summarises the topics identified from the true peaks within the dataset. The table also mentions the originated tweet for the topic.

Table 1: Topics of True Peaks

Timestamp	Topic	Originating Tweet of the Topic
21st September 2015, 1900	Promotion of MOOC on "Cognitive Technology and its growing importance for business" by David Schatsky, course instructor and senior manager Deloitte LLP.	@dschatsky leads Deloitte's #MOOC on #CognitiveTechnology and its growing importance for business: http://t.co/AxNIAePgDL
29th September 2015, 1400	Promotion of Deloitte's MOOC on 3D printing.	Data from @DU_Press' #MOOC paints a picture of the future applications of #3DPrinting. #DeloitteReview http://t.co/PiCnozQ0ed
14th October 2015, 1300	Successful Societies (by Princeton University) promoting MOOC on 'How can Governments Improve Citizen Services and Cabinet Office Coordination.'	@crownagents ISS #MOOC examines how govts improve citizen svcs, cabinet office coordination & more. Starts 10/21/15 http://t.co/LJDCKKXL90
16th October 2015, 1400	Successful Societies promoting MOOC on 'Making Government work in Hard Places'.	@USGLC These leaders made government work in hard places. Learn how. #MOOC: http://t.co/iZveyixK4B http://t.co/7aP0zRShE3
19th October 2015, 1500	Successful Societies promoting MOOC on 'How Leaders Overcome Governance Challenges'.	@USGLC Still time to enroll! Princeton #MOOC on how leaders overcome #governance challenges. Starts 10/21/15. http://t.co/iZveyixK4B
23rd October 2015, 1600	Successful Societies promoting MOOC on 'Writing Science of Delivery Case Studies'	@USGLC Enroll today! ISS #Princeton #MOOC on writing "Science of Delivery" case studies. Starts 10/28. https://t.co/AZuu2qFylP
27th October 2015, 1300	Successful Societies promoting MOOC on 'Writing Science of Delivery Case Studies'	@EU_Commission Starts 10/28! Learn to write case studies on "Science of Delivery" in new free ISS #Princeton #MOOC. https://t.co/AZuu2qFylP
29th October 2015, 1400	Successful Societies promoting MOOC on 'Writing Science of Delivery Case Studies'	@USGLC Just started 10/28! Learn to write case studies on "Science of Delivery" in new free ISS #Princeton #MOOC. https://t.co/AZuu2qFylP
2nd November 2015, 1500	NutritionMOOCs promoting MOOC on 'Nutrition and Health: Micronutrients and Malnutrition'.	@APH008 Please RT: 9 November start #MOOC #NUTR102x "Nutrition and Health: Micronutrients and Malnutrition" https://t.co/q0NBluOac9
13th November 2015, 0900	NutritionMOOCs promoting 2nd part of MOOC on Nutrition and Health from Wageningen University.	@EatNutritious Please RT: Learn more about #nutrition and #health in 2nd part of our #MOOC @UniWageningen now: https://t.co/q0NBluOac9
8th December 2015, 1500	Promotion of Coursera's MOOC on 'Training TESOL Certificate Part 1: Teach English'.	RT NewsNeus More #Coursera #MOOC #Training TESOL Certificate, Part 1: Teach #English Now!
25th December 2015, 1800	Retweet of Quizalizeapp's tweet 'How to say Merry Christmas in 77 Languages'.	How to say Merry Christmas in 77 Languages. #Edtech #GBL #Langchat #MOOC #English https://t.co/5pBv47vjFP

Sentiment analysis is used to examine overall orientation (positive and negative) and intensity (strong or weak) of opinions in text (Pang & Lee, 2008). The 'qdap' library in R was used to perform sentiment analysis on this dataset. The average sentiment was found to be 0.095; suggesting that the tweets are highly neutral. The standard deviation of the sentiments across the tweets was found to be 0.202; indicating that the spread of the sentiments across the tweets was less. Further, a customized algorithm to analyse the distribution of tweets across different sentiment scores was implemented in R. If a tweet has more positive words, it will get a higher positive sentiment score. On the contrary, if a tweet has more words negative words then its sentiment score will be more negative. If a tweet has words which do not belong to either category then it qualifies as 'neutral'. A tweet having a greater proportion of neutral words will have a neutral sentiment; that is a sentiment score of 0. Figure 2 provides a graphical representation for the sentiments distribution in the tweets.

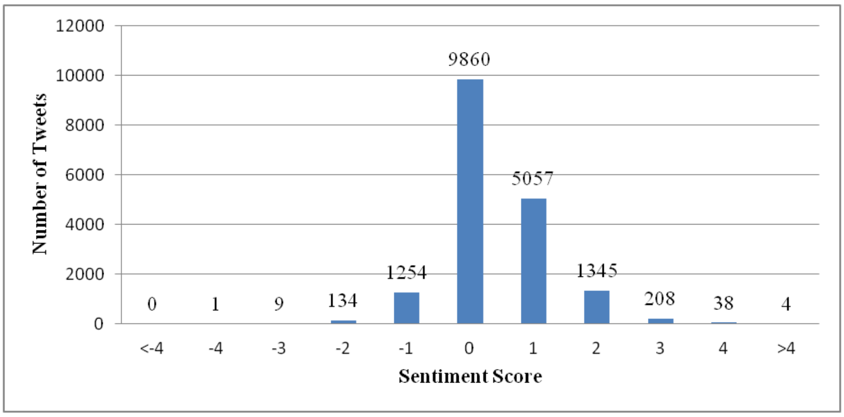

Figure 2: Sentiment Scores in the #MOOC Dataset

As can be easily observed from Figure 2, the MOOC dataset has a substantial amount (55 %) of neutral tweets. Positive tweets make up 38% of the total tweets and the remaining 7% percent constitutes negative tweets. Table 2 lists some exemplar tweets with strong sentiment.

Table 2: Tweets Showing Strong Sentiment

Exemplar Tweet	Sentiment
@thesiswhisperer I think the #MOOC is providing wonderful supportive pillow of trust & honesty- glad I'm taking part- thank u #survivephd15	6
STUNNING #mathed animations from .@robertghrist in his calculus #MOOC. Beautiful and effective. Kudos. http://t.co/GgdN2KHFZf	4
Just discovered a great free #Social Innovation online course, on this cool learning platform - #iVersity #MOOC ~ http://t.co/kGPzmqONFq	4
#ememitalia Teixeira: focusing on dropout as a problem to criticize #MOOC education is a conceptual mistake	-4
CloudComputingApplications - definitely the worst @coursera #MOOC I've ever taken. Irrelevant videos & useless tuts #unenrolled	-3

Finally URL analysis was performed in order to identify the popular URLs (most mentioned) in the network. It was found that URLs were widely used in the network with almost 60 percent of the tweets containing links. A subset of the top URLs are shown in Table 3.

Table 3: Top 15 URLs in the MOOC dataset

URL	Tweets
https://www.edx.org/course/nutrition-health-part-2-micronutrients-wageningenx-nutr102x	327
http://www.owensage.com/2/post/2015/04/how-i-lost-24-pounds-in-12-weeks-amidst-severe-personal-turmoilwithout-dieting-or-going-to-the-gym.html	204
https://www.futurelearn.com/courses/climate-from-space	168
http://www.europeanschoolnetacademy.eu/en/web/developing-digital-skills-in-your-classroom/course	161
http://www.startup365.fr/entrepreneur-courses/	159
https://www.canvas.net/browse/salto/courses/erasmus-funding-opportunities-2	156
https://www.edx.org/course/making-government-work-hard-places-princetonx-mgwx#!	143
https://www.edx.org/course/writing-case-studies-science-delivery-princetonx-casestudies101x	140
http://blog.coursera.org/post/132434298847/introducing-coursera-for-apple-tv-bringing-online	126
https://www.edx.org/xseries/data-science-analytics-context	120
http://www.moocsurvey.org	108
http://www.startup365.fr/the-1-small-business-guide-to-online-marketing/	103
http://Twitter.com/JimKim_WBG/status/661682878393266177/photo/1	96
https://www.youtube.com/watch?v=ahvuPvm-1YU	96
http://www.europeanschoolnetacademy.eu/web/introducing-computing-in-your-classroom	93
https://hbr.org/2015/09/whos-benefiting-from-moocs-and-why	92

Discussion and Conclusion

Peak detection algorithms highlighted tweets of significance in the dataset which largely revolved around the promotion of several MOOCs. The course pages of several MOOCs from the peak detection are referred to in the top URLs. However, the URLs also indicate that the MOOC hashtag may be sometimes appropriated by, or be susceptible, to spam effects e.g. the prominence of weight loss slimming posts. URL 24 points to a book on amazon which contains negative reviews of people who claim to have been duped into following a Twitter link to the page.

The term MOOC may be a problematic one for use in defining networks of MOOC actors. The promotional nature of many tweets suggests this may be more of an informational than a social network (Myers et al., 2014). Beyond the scope of this paper are the findings of our Social Network Analysis (SNA) which confirmed these findings. Moreover, it may be that the term MOOC has particular currency only within particular communities such as the academic one. Some of the top tweets and URLs would appear to bear this out such as a link to a MOOC survey being conducted as part of an MSc. thesis – an item of as much interest to MOOC researchers as students. It is unknown how widely prevalent the term "MOOC" is in popular discourse and hence many MOOC students may go undetected. This may limit the value of using the term MOOC to make inferences about learners. Using other search constructs that would comprise course, platform, provider or some combinations of these might bring more learners into the dataset.

The sample of top tweets from the sentiment analysis does appear to show interesting data from MOOC learners however. All but one of these five tweets are from what we may infer to be a MOOC learner, or in one case prospective learner. The other tweet appears to be from a MOOC commentator/researcher. Of course researchers may also be MOOC students. Research has shown that MOOC learners have disproportionally high levels of educational attainment (Jordan, 2014). This is borne out here in that one of the sample tweets from the sentiment analysis is from well-known academic relating to a MOOC about "surviving" PhDs. Our findings suggest there may be a value in using sentiment analysis to filter a Twitter dataset before performing other types of analyses for researchers. For instance, it can be seen from a visual scan that peak tweets which are informational (and promotional) are relatively lacking in or have weak positive sentiment. This requires further analysis.

This paper has outlined the techniques we used and the theoretical basis by which we adopted these approaches in examining MOOCs in a Twitter dataset. We used descriptive and content analysis techniques to probe a sample of tweets using the hashtag #MOOC. Our results pose perhaps more questions that give definitive answers but we contribute by conducting exploratory analyses in an underexplored area namely research on MOOC actors using large Twitter datasets.

References

Abeywardena, I. S. (2014). Public opinion on OER and MOCC: A sentiment analysis of Twitter data. *Proceedings of the International Conference on Open and Flexible Education* (ICOFE 2014), Hong Kong SAR, China.

Chae, B. K. (2014). A complexity theory approach to IT-enabled services (IESs) and service innovation: Business analytics as an illustration of IES. Decision Support Systems, 57, 1–10.

Chae, B. K. (2015). Insights from hashtag# supplychain and Twitter analytics: Considering Twitter and Twitter data for supply chain practice and research. *International Journal of Production Economics*, *165*, 247-259.

Driscoll, K., & Walker, S. (2014). Big data, big questions| working within a black box: Transparency in the collection and production of big Twitter data. *International Journal of Communication*, *8*, 20.

Du, P., Kibbe, W. A., & Lin, S. M. (2006). Improved peak detection in mass spectrum by incorporating continuous wavelet transform-based pattern matching. *Bioinformatics*, *22*(17), 2059-2065.

Healy, P., Hunt, G., Kilroy, S., Lynn, T., Morrison, J. P., & Venkatagiri, S. (2015, November). Evaluation of peak detection algorithms for social media event detection. In *Semantic and Social Media Adaptation and Personalization (SMAP), 2015 10th International Workshop on* (pp. 1-9). IEEE.

Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *The International Review of Research in Open and Distributed Learning*, *15*(1).

Lehmann, J., Gonçalves, B., Ramasco, J. J., & Cattuto, C. (2012, April). Dynamical classes of collective attention in Twitter. *Proceedings of the 21st international conference on World Wide Web* (pp. 251-260). ACM.

Lynn, T., Healy, P., Kilroy, S., Hunt, G., van der Werff, L., Venkatagiri, S., & Morrison, J. (2015). Towards a general research framework for social media research using big data. *Proceedings of 2015 IEEE International Professional Communication Conference (IPCC)* (pp. 1-8). IEEE.

McAuley, A., Stewart, B., Siemens, G., & Cormier, D. (2010). The MOOC model for digital practice. In *SSHRC Knowledge Synthesis Grant on the Digital Economy.* Retrieved from http://www.edukwest.com/wp-content/uploads/2011/07/MOOC_Final.pdf [viewed 08 July 2106]

Myers, S. A., Sharma, A., Gupta, P., & Lin, J. (2014). Information network or social network?: the structure of the Twitter follow graph. *Proceedings of the 23rd International Conference on World Wide Web* (pp. 493-498). ACM.

Palshikar, G. (2009). Simple algorithms for peak detection in time-series. *Proceedings of 1st International Conference of Advanced Data Analysis, Business Analytics and Intelligence* (pp. 1-13).

Pang, B., & Lee, L. (2008). Opinion mining and sentiment analysis. Foundations and Trends in Information Retrieval, 2(1–2), 1–135.

Rao, A., Spasojevic, N., Li, Z., & Dsouza, T. (2015). Klout score: Measuring influence across multiple social networks. In Big Data (Big Data), 2015 IEEE International Conference on (pp. 2282-2289). IEEE.

Zhang, J., Perris, K., Zheng, Q., & Chen, L. (2015). Public Response to "the MOOC Movement" in China: Examining the Time Series of Microblogging. *The International Review of Research in Open and Distributed Learning*, *16*(5).

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Piloting Mixed Reality in ICT Networking to Visualize Complex Theoretical Multi-Step Problems

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This paper presents insights from the implementation of a mixed reality intervention using 3d printed physical objects and a mobile augmented reality application in an ICT networking classroom. The intervention aims to assist student understanding of complex theoretical multi-step problems without a corresponding real world physical analog model. This is important because these concepts are difficult to conceptualise without a corresponding mental model. The simulation works by using physical models to represent networking equipment and allows learners to build a network that can then be simulated using a mobile app to observe underlying packet traversal and routing theory between the different devices as data travels from the source to the destination. Outcomes from usability testing show great student interest in the intervention and a feeling that it helped with clarity, but also demonstrated the need to scaffold the use of the intervention for students rather than providing a freeform experience in the classroom.

Keywords: mixed reality, visualization, networking, augmented reality, 3d printing, ICT

Introduction

The term 'digital native' is widely considered as having been debunked over recent years (Bennett, 2016). Yet, despite this, it's obvious to those in the research community that the continued use of the term indicates that there is some perceived difference in the way that the 21st century student learns (regardless of their age or generation). Indeed, in recent years, there has been a slate of research into the way that today's generation of students use technology (Corrin, Bennett, & Lockyer, 2013), suggesting that as educators, we are increasingly surrounded by a new breed of individual that tackles problems in new and different ways. As an example, Jones, et al. (2009), points out that students today are more oriented to visual media than previous generations and they prefer to learn visually by doing rather than by telling or reading, through participatory, interactive, sensory rich, experimental activities (either physical or virtual) and opportunities for input.

With this in mind, students studying Information Communication Technology (ICT), and especially those that have chosen to study computer networking, could reasonably be expected to be the epitome of the *Digital Native*. Yet despite this new breed of student with a preference for learning visually, the representation of theoretical concepts without a corresponding real world physical analog model and the simulation of complex mental models in the classroom is still a developing issue. In the teaching and learning of computer networking, this has been investigated with the development of virtual environments for modeling the processes (Dobrilovic, Jevtic & Odadzic 2013; Powell et al., 2007) and simplistic video based visualizations (https://youtu.be/-6UokuM6oY). However, networking models are complex to set up with software and require extensive reworking of existing network facilities. Abstract visualizations also don't capture the complexity of the logical models, specifically the complexity and multi-step nature of the traversal of packets along the layers of the fundamental OSI-TCP/IP packet networking model. There is also evidence to suggest that presenting computer science concepts using a physical analogue can be useful (Bell, 2014).

This paper therefore presents results of a pilot study and qualitative usability testing that examines the use of mixed reality, specifically represented using physical 3d printed models and a mobile augmented reality (AR) application, as a tool to help students with these concepts. The specific aim of the paper is to present a method, supported by usability results, to assist students in theoretical model understanding and applied use.

Pilot Study Rationale

Areas as diverse as architecture, medical anatomy, chemistry, geography, and media/game design all benefit from the use of visualization (Freitas & Neumann, 2009). Work by Mayer (2014) also shows that visualization can be used in education as a positive learning support tool. This work also builds on a previous concise paper by the authors in computer networking looking at network building and the TCP/IP model (Cowling & Birt, 2015) presented at a previous ascilite conference, which studied the application of mixed reality visualization and emerging technologies on a range of teaching and classroom contexts.

Building out from this work, this study looks at how mixed reality, specifically 3d printing and AR, can be used to help students to understand theoretical multi-step complex problems, especially those without a real-world analogue. This in particular looks to provide the scaffolding indicated by Tasker & Dalton (2008), who argue that a mental gap is created for students through the lack of physical model, providing a disconnect between their visual mental model and their understanding of the concepts. It also supports work by Williamson et al. (2012), who argue that visualizations can assist with this gap by providing students with an appropriate mental model that they can use to understand the *hidden* concepts, as well as the work of Paas & Sweller (2014), who argue that *kinesthetic tools can be used to better form mental models*.

In this project, mixed reality, through both an AR app and physical models, will be used to visualise how data travels through various network components, aiming to deliver an improved pedagogy to teach networking concepts to 21st century students from varied cultures.

Experimental Design

Flowing on from the background research, an intervention was developed to help students conceptualise the TCP/IP model through a process of building and simulating packet routing along a computer network. The intervention was developed specifically to be a two-step process for students, with a physical component provided first to allow students to build a network, as per the work by Bell (2014), followed by an app that could be used to simulate network operations over the physical network that was built by students (see Figure 1).

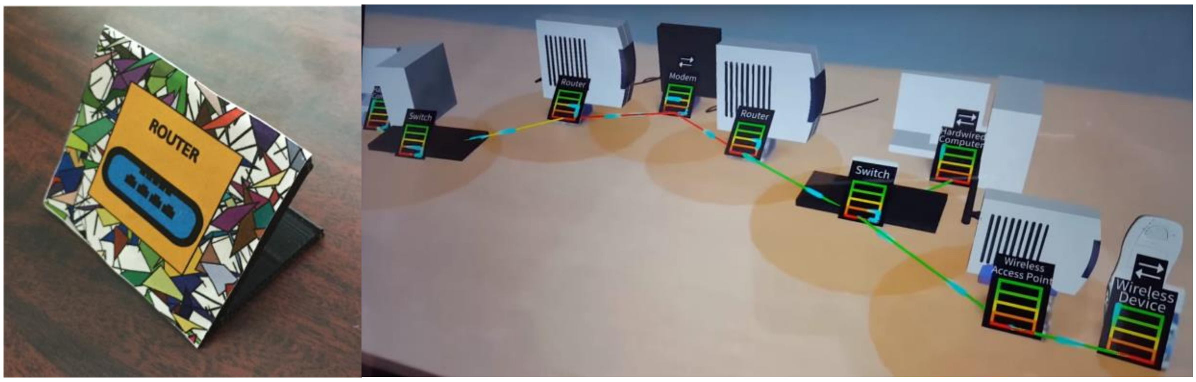

Figure 1: An example 3d printed marker of a router, and augmented simulation view visualizing multiple markers and packet flow (see https://youtu.be/0pHJWjG4-aQ for simulation example)

For the physical component, the intervention uses 3d printed stands overlaid with an image target marker. The use of these stands makes it possible for students to build a network by moving physical pieces around, shuffling them back and forth to create the configuration desired and adding/removing pieces as required for different network designs. This direct linking of object making to computer modeling changes the relationship of the learner to the making of the object and subsequent use, enabling a haptic feedback loop for learners (Paas & Sweller, 2014).

Once the physical network has been built using the physical objects, students can then simulate a working network using the AR app loaded onto a tablet or smartphone. This app allows students to see how packets flow through the network and to simulate packet flow between specific end devices. Specifically, the intervention scans the image target markers via the mobile device camera using the Vuforia AR plug-in (www.vuforia.com) for simulation development in Unity3d (www.unity3d.com).

The overall purpose of the intervention is to provide students with a mixed reality approach to the building of networks, that uses a two-step process to allow students to benefit from having physical representations of the traditionally theoretical TCP/IP model that they can lay out as components of a network. They can then simulate this network using the app in a way that would not be possible using just the physical components. Using the physical components as a tool, the app will allow students to identify each component and use them to construct a custom network on the device based on the placement of the components in the field by students. Most importantly, once the network is in the mobile device, students will be able to simulate network packet routing and visualize the complex multi-step process of the TCP/IP model. Students will also have the ability to rearrange 3d objects to understand how changes in infrastructure affect the performance of the network, providing them with a mental model for this complex process, in line with Tasker & Dalton (2008).

Research Method

The theoretical framework underpinning this work will be action research (Kemmis, 2006), with each *loop* in the research being conducted within a single term and with a different cohort of students. As a paradigm, action research is appropriate because the researchers are also practitioners in the classroom, leading to a situation where the change can be implement in the real classroom whilst simultaneously being researched to determine its effectiveness. The interactive inquiry process involved in action research also suits the objectives of the project in relation to teaching practice, student learning, and visualization of complex multi-step processes.

As the first loop of the action research spiral, it was determined that a usability test should be conducted with students, providing data that would be useful in subsequent trials relating to learning outcomes, as well as allowing the technical aspects of the tool to be tested. With this in mind, an undergraduate class at the lead authors institution was recruited to perform the testing. Specifically, a small class of six students was selected for this initial usability (insight) test in line with common first phase software usability testing practice (Nielsen, 2012), so that it would be possible for a single research assistant to interact with these students in depth and collect rich feedback on their use of the tool. Participants were given a primer on the skills to be covered, and then completed a survey on the applicability of the traditional method of teaching. They were then given access to the tool before being completing a survey on the use of the mixed reality intervention.

To facilitate data collection, categories were developed for both the observation of students as well as the data collection for surveys. Specifically, both the students and the research assistant were asked to assess the tools used for the intervention on measures of usability (Table 1), based on previous work conducted by one of the authors (Birt & Hovorka, 2014). Details of the results of this data collection are included below.

Results

As noted above, the usability testing of the intervention was conducted by an independent research assistant to provide a neutral third party to introduce the intervention to students. The results of the quantitative survey with students are presented in Table 1, with each item ranked on a Likert scale of 0 to 5, where 0 is not relevant and 5 is very relevant. The research assistant also took notes observing the students using the intervention that can be reported on. A summary of this qualitative data in support of the quantitative scores is also presented below.

Table 1: Measures of Usability for the Networking Mixed Reality Intervention

Question	Average		StdDev	
	2D	**AR**	**2D**	**AR**
1. **Accessibility**: Visualisation is readily accessible	3.33	4.67	1.25	0.52
2. **Learnability**: Visualisation is easy to learn	2.67	4.00	1.25	1.26
3. **Efficiency**: Visualisation is efficient to use	3.50	2.83	1.26	1.60
4. **Satisfaction**: Visualisation provides satisfaction (confidence) of the design	4.00	3.83	0.82	1.33
5. **Memorability**: Visualisation is "sticky" and memorable to support the design	3.17	5.00	1.21	0.00
6. **Error Free**: Visualisation is free from visual and design errors	3.33	2.67	1.11	2.07
7. **Manipulability**: Visualisation can be manipulated: rotation, time, lighting etc	3.33	4.17	1.70	0.98
8. **Navigability**: Visualisation allows the user to change their viewpoint	2.00	4.33	1.15	1.21
9. **Visibility**: Visualisation provides clear detail to interpret the design	3.33	4.33	1.25	0.82
10. **Real world**: Visualisation provides a match to the real world	3.17	4.17	1.21	0.98
11. **Communication**: Visualisation aids stakeholder design communication	3.50	2.83	1.26	1.33
12. **Creativity**: Visualisation allows the user to be creative with the design	3.50	4.50	1.26	0.55
13. **Engaging**: Visualisation is meaningful	4.00	4.33	0.82	0.82
14: **Motivating**: Visualisation provides acceptance of the design	3.33	4.00	2.05	1.10

The first significant finding from the data and observations is that students were very interesting in diving in and trying this intervention, with a high score for accessibility and the research assistant reporting that *students asked if they could download [the app] to their own device and whether the markers would work on multiple devices at the same time.* Students were also very interested in the augmented reality aspects of the intervention, with a high score for learnability and the research assistant reporting *students downloaded the app straight away and used it with single markers* rather than using multiple markers to build a network first and then visualising it. This reported result was a surprise to the researchers, with the intervention having been developed as a two stage process for students, with the network building anticipated to be conducted first before the simulation was activated.

The results do show that this urgency created subsequent concern with using the app, with low scores for error free and with the research assistant also reporting that students had difficulty with the simulation once they had it running, *building large networks and then having difficulty visualising these networks using the app*, due to both their complexity and the lack of planning of device placement before the networks were created. This observation is backed up by one of the qualitative comments on the surveys, where a student indicates that they liked the simulation (via their quantitative scores), but that the *technology still needs work*.

In terms of the applicability of the simulation as a tool to teach the TCP/IP model, the data shows good scores for memorability, with the research assistant reporting that after the initial on-boarding reported above, *students were able to successfully use the tool to build networks and to visualise the TCP/IP model*, with students constructing simple networks and then using the focussed mode available in the tool to route packets between a source and destination computer, checking their level on the TCP/IP model as the packet was routed through the network. This observation is again backed by student comments, with students commenting in the qualitative section of the survey that *it was more clarified through this work* and *it's good to work with such networking concepts. It gives user friendly interface, easy to interact and act upon it*. This underlying theme of interactivity was supported by the score for creativity and also noted by the research assistant in their observation notes, with the ability to move items around and construct their own network, rather than being constrained by the set examples provided in the traditional instruction, being one of the main points of commentary noted.

Discussion

The results of this study reveal some useful insights that can be used to facilitate changes to the usability model of the augmented reality application, especially in the context of theoretical literature underpinning this work. Firstly, the work shows that getting students to use the software is not difficult, with many students eager to download the app to their own smartphone and try it out. This is consistent with the reported findings of Jones (2009) in relation to student use of technology, and supports Corrin, Bennett, & Lockyer (2013) in their discussion of how students use technology. It would appear from this work that getting students to use a new technology, especially a novel one placed in front of them in the classroom, is not a significant problem.

It would also appear that students felt that the tool had value and helped with their ability to build a mental model, supported by their comments about the work providing more *clarity* or being *easy to interact with*. This supports the work done by Williamson et al., (2012), who showed that students presented with a visualization could use this to improve their mental model. However, at this stage the evidence for this is anecdotal and further testing, through a larger sample size and the use of pre and post testing, would need to be conducted to see if students mental model was actually improved, and how learning outcomes were affected.

Finally, perhaps the most important takeaway from the results presented so far was that students found it difficult to use the tool in its initial stages due to the freeform nature of the tool. They also found the tool less efficient than the traditional method. This result was surprising to the researchers, but perhaps highlights that whilst the work presented nominally addresses Tasker & Dalton's (2008) thoughts on the need to bridge the mental gap for students, it does not provide enough scaffolding and structure for students to use the tool to really bridge this gap for their mental model and requires the educator *prime the user's perception*.

A possible solution to this problem in the study and *prime the user's perception* is to develop lesson materials and tutorial materials to help students to use the tool correctly when they are first exposed to it. The observations from the classroom show that, once students are familiar with the tool, it can be used effectively to help students interact with the theory and clarify their understanding, so the use of some teaching materials and lesson plans to help with onboarding the students into the simulation would likely help with this dimension, and provide further support in line with the ideals expressed by Tasker & Dalton (2008) in their original work.

Conclusion

This paper has presented preliminary results from a pilot and usability study involving a learning intervention using mixed reality visualization (3d printed physical objects and Augmented Reality simulation) to help teach complex multi-step problems to students studying computer networking in an ICT degree. Results showed that students found the intervention useful, and comments from students and from the research assistant observer supported the ability of the visualization to help students clarify concepts and interact with the model. However, they also showed the importance of scaffolding and structuring to help students with their initial experience as highlighted by the usability results. Hence, despite the small sample size, this work has proved useful as a first loop of the study to gather usability data that will be used to modify the tool in the future.

With this in mind, future work will report on further results from this study gathered after the tool has been updated to include chunked and scaffolded tutorial materials, and provide correlations of various factors related to student performance, showing whether the use of these interventions have improved learning and whether the tools were accepted by the student cohort (as the second loop of the action research approach). The use of the simulation in other disciplines will also be investigated (the third loop of the action research approach). Through this work, a greater understanding of the use of innovate technology tools and simulation in education will be obtained, providing foundations for future research.

References

Bell, T. (2014). Ubiquity Symposium: The science in computer science: unplugging computer science to find the science. *Ubiquity* 2014(Mar): 1-6.

Bennett, S. (2016). The digital revolution in higher education. *Routledge Handbook of the Sociology of Higher Education*, 1956.

Birt, J, Hovorka, D (2014). Effect of mixed media visualization on learner perceptions. *Proceedings of the 25th Australasian Conference on Information Systems.*

Corrin, L., Bennett, S., & Lockyer, L. (2013). Digital natives: Exploring the diversity of young people's experience with technology. In *Reshaping learning* (pp. 113-138). Springer Berlin Heidelberg.

Cowling, M. A., Birt, J. R. (2015). Teaching Theoretical Complex Multi-Step Problems in ICT Networking through 3D Printing and Augmented Reality, *Proceedings of ASCILITE 2015,* ASCILITE, Perth, Western Australia, Nov 30 – Dec 2, 2015

Dobrilovic, D. M., Jevtic, V. Z., & Odadzic, B. (2013). Expanding usability of virtual network laboratory in IT engineering education. *International Journal of Online Engineering (iJOE)*, *9*(1), pp-26.

Freitas, S. d., and Neumann, T. (2009). The use of 'exploratory learning' for supporting immersive learning in virtual environments, *Computers & Education*, *52(2)*, pp 343-352.

Jones, C, Ramanau, R, Cross, S & Healing, G. (2010). Net generation or Digital Natives: Is there a distinct new generation entering university?, *Journal* of *Computers and Education*, vol.54, pp.722-732

Kemmis, S. (2006). *Exploring the relevance of critical theory for action research: Emancipatory action research in the footsteps of Jurgen Habermas*. in P. Reason and H. Bradbury (eds.), Handbook of action research (pp. 94 - 105). SAGE Publications, London.

Mayer, R. E. (2014). Cognitive theory of multimedia learning. *The Cambridge handbook of multimedia learning*, *43*.

Nielsen, J. (2012). How many test users in a usability study? *Nielsen Norman Group, 4* Retrieved from https://www.nngroup.com/articles/how-many-test-users/.

Paas, F., & Sweller, J. (2014). 2 Implications of Cognitive Load Theory for Multimedia Learning. *The Cambridge Handbook of Multimedia Learning*, 27.

Powell, V. J., Turcheck, J., Wu, P. Y., Franzi, L. C., Johnson, R. S. & Parker, I. W. Vlabnet. (2007). A virtual laboratory environment for teaching networking and data communications. *Proceedings of ISECON*, 1-9.

Tasker, R., & Dalton, R. (2008). Visualizing the molecular world–design, evaluation, and use of animations. In *Visualization: Theory and practice in science education* (pp. 103-131). Springer Netherlands.

Williamson, V. M., Lane, S. M., Gilbreath, T., Tasker, R., Ashkenazi, G., Williamson, K. C., & Macfarlane, R. D. (2012). The effect of viewing order of macroscopic and particulate visualizations on students' particulate explanations. *Journal of Chemical Education*, *89*(8), 979-987.

Please cite as: Cowling, M. & Birt, J. (2016). Piloting mixed reality in ICT networking to visualize complex theoretical multi-step problems. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 163-168).

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Blended learning in first year curriculum – Melding pedagogies to support student engagement and empowerment

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Blended learning involves a careful and considered approach to the identification and combination of different modes, times, places and purposes of learning, with emphasis on judicious integration of fit-for-purpose educational technologies in order to enhance student learning experience and outcomes. Students commence their first year of university with a vastly diverse set of personal, social and cultural characteristics that can shape their tertiary experience and engagement with learning. This can present a challenge to first year curriculum design, delivery and evaluation.

This presentation will explore how blended learning pedagogy, transition pedagogy and transparent pedagogies were melded within a first year Allied Health unit at Australian Catholic University in an aim to enhance student engagement with and empowerment within the program. Processes of decision making regarding design, delivery and evaluation of first year curriculum will be shared and supported with case examples and data from the discipline of Speech Pathology.

Keywords: Blended learning, Transition Pedagogy, Transparent Pedagogy, first year experience, curriculum

Background

It is often assumed that students today are technologically savvy and digitally literate individuals who are familiar with the use of technology in learning and for learning and are eager to embrace flexible, multimodal strategies to manage their learning (Department of Education, Employment and Workplace Relations, 2009). Certainly, this is the case with many students. However, the experience of teaching staff within the discipline of Speech Pathology at Australian Catholic University is that there are also many students who require scaffolded and supported introduction to the educational technologies used within the university setting and the pedagogical underpinnings for their use. To this end, explicit, incremental and reflexive approaches to introduction of technologies and expectations of independent, self-directed learning are often required within first year units.

This observation is consistent with what is known about first year cohorts of students within universities across the country, in so far as students commence their first year of university with a vastly diverse set of personal, social and cultural characteristics that can shape their tertiary experience and engagement with learning. Factors such as age, gender, culture, linguistic background, socio economic status, family situation, past education experiences, paid work and other life commitments can all contribute to a student's academic success at university. Therefore, it falls upon universities to provide the "conditions, opportunities and expectations" for effective student engagement in the first year, with the goal of enhancing student success and retention (Coates, 2005. p. 26).

Australian Catholic University embraces a blended learning approach to teaching and learning, within a framework of study modes than encompass a continuum from fully face to face physical attendance through to exclusively online delivery. Integration of pedagogically sound blended learning is therefore an area of focus across the university. Speech Pathology is a new program within the School of Allied Health, Faculty of Health Sciences and is committed to enhancing first year experience through the integration of educational technologies within a blended learning framework, melded with best practice principles of Transition Pedagogy encompassing: Transition, Diversity, Design, Engagement, Assessment and Evaluation/Monitoring (Kift, 2009), and Transparent Pedagogies i.e. strategies that are active, engaging, innovative, democratic, student centred and foster critical thinking and multimodal learning (Fullen & Langworthy, 2014).

The focus of this poster presentation will be on showcasing strategies for constructing a first year experience that enables *engagement* with learning, that is, the attitudes and commitment to study demonstrated by an individual student, as well as *empowerment* or self-regulation of learning, which involves equipping students with the skills to take responsibility for their learning and exercise control over the way in which learning is approached (Nicol, 2009).

What will be presented?

Context

In 2015, several units in the first year of the Bachelor of Speech Pathology at Australian Catholic University underwent a process of curriculum redesign to integrate a blended learning approach. The strategies were implemented nationally across three campuses and 200 students. The unit that will be the focus of this poster is a first year, first semester unit called *Introduction to Speech Pathology Practice* delivered over a 12 week semester.

Details of the Initiative

The presentation will outline how the six principles of Transition Pedagogy: Transition, Diversity, Design, Engagement, Assessment and Evaluation and Monitoring (Kift, Nelson, & Clarke, 2010), have been utilised as a framework to integrate blended learning into a first year unit. Specifically, the following components of the initiative will be addressed:

- Audit of curriculum against First Year Curriculum Principles (FYCP) – Transition Pedagogy
- Design of blended learning strategy including a Flipped Classroom approach
- Integration of educational technologies in Flipped Classroom, video conferenced lectures and tutorial based learning activities
- Examples of transparent pedagogies, rationales for selection and processes for implementation (Including 'Classroom Community Building', 'Expert Jigsaw', 'World Café' and 'Collaborative Learning techniques')

Evaluation

Qualitative student evaluation feedback and data analytics from 2 years of delivery of *Introduction to Speech Pathology Practice* (2015, 2016) will be presented, demonstrating impact of a melded pedagogical approach on student engagement, empowerment and discipline specific knowledge and skill. Feedback themes will address: Access and engagement with educational technologies, engagement with lecturers and tutors, orientation to the chosen profession, building relationships with peers and developing a professional identity.

Conclusion

When designing first year units, there are multiple pedagogies that support the aim of engaging and empowering students, and facilitating the development of successful lifelong learning attitudes and strategies. Reflection on relevant literature and our experience of redesigning a first year unit in light of blended, transition and transparent pedagogies has led to the following key learnings. Student success can be facilitated by:

- Explicit presentation of *behavioural,* skill based learning outcomes, teaching and assessment
- *Learner*-centred curriculum design
- Engagement of existing knowledge and past *experiences* of students
- *Naturalistic* and authentic resources; real clients, real clinicians, real settings and scenarios
- *Embedding* blended learning into unit level assessment tasks
- *Diversity* of learning modes, times, places and purposes to encourage competency with self-directed and multimodal learning strategies.

References

Coates, H. (2005). The value of student engagement for higher education quality assurance. *Quality in Higher Education, 11(1)*, 25-36.

Department of Education, Employment and Workplace Relations (2009). Listening to students' and educators' voices. Accessed (10th October, 2016) [Online] available at: http://www.deewr.gov.au and http://www.aictec.edu.au

Fullen, M., & Langworthy, M. (2014). *A rich seam: How new pedagogies find deep learning.* Pearson. Retrieved from: http://www.michaelfullan.ca/wp-content/uploads/2014/01/3897.Rich_Seam_web.pdf

Kift, S., Nelson, K. & Clarke, J. (2010). Transition Pedagogy: A third generation approach to FYE –A case study of policy and practice for the higher education sector. *The International Journal of the First Year in Higher Education, 1(1)*, 1-20.

Kift, S. (2009). Articulating a transition pedagogy to scaffold and to enhance the first year student learning experience in Australian higher education: Australian Learning and Teaching Council. Retrieved from http://www.olt.gov.au/resource-first-year-learning-experience-kift-2009

Nicol, D. (2009). Quality Enhancement Themes: Enhancing integration and empowerment in the first year. The Quality Assurance Agency for Higher Education. Retrieved from http://dera.ioe.ac.uk/11605/1/First_Year_Transforming_Assess.pdf

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Content strategy: a lesson from the industry for university learning analytics

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This paper proposes an industry paradigm, called content strategy, for identifying data that has yet to be explored in learning analytics: student engagement data with individual online learning resources in a particular week of a course. Industry examples (including nine.com.au and Buzzfeed) suggest that adopting a content strategy approach to course design could increase student engagement with learning resources, making them more likely to achieve learning outcomes. Furthermore, this paper argues that there is no time left for blindness to content strategy data. Given the online context of curriculum, universities need content strategy to better align themselves with the student of today's user-centred internet. Finally, this paper draws on a university case study to identify existing challenges with implementing content strategy at university, including the limited capabilities of university learning management systems, limited instructor knowledge and copyright issues.

Keywords: learning analytics, LA, online learning, Blackboard, content strategy, LMS

Introduction

The aim of this paper is to explain content strategy as a valuable—yet missing—component of learning analytics (LA) for improving online university curriculum design. 'Content strategy' involves implementing metrics and analysing data in order to align content with organisational goals and user needs. My intention is to begin discussion about strategies, and strengthen feedback loops to learning management system designers, in order to make this approach more possible and achievable for university curriculum designers—or what are often still called (rather inaccurately), 'unit coordinators.'

This paper is organised as follows. First, I briefly recap the background on LA, Then I argue that because of the 'online' part of online learning, student 'engagement' with content is now a significant consideration, making testing and optimising online content unavoidable. Furthermore, the increased competitiveness of higher education institutions makes engagement even more crucial. Next, I will draw a comparison between what universities need to do and what the digital content industry has been doing for almost ten years: I argue that content strategy is a strategy for university curriculum design that could increase engagement. Following this argument is my discussion of the challenges facing the implementation of content strategies in higher education (HE). Finally, I discuss a recent case study from an attempt to measure engagement with content at Western Sydney University (WSU). This case study illustrates the potential of content strategy as an important part of LA, as well as some of the challenges and opportunities for further research and development.

Learning analytics: background

Learning analytics (LA) involves studying student data for the purpose of optimising learning and its environments (Daniel 2014). It is an area only recently receiving attention (Dawson 2015). In simple terms, LA involves looking at students' data traces, called a 'breadcrumb trail,' in order to understand more about them:

> It relies on 'digital breadcrumbs' students leave as they interact within information systems on and off campus. Such breadcrumbs involve records of student logins and logouts, maps of student clickstreams, time stamps of activities and resource access, and any text inputs (e.g., discussion forum posts) students provide within information systems. (Rubel & Jones 2016, p. 144)

Given that a key strategic focus of many universities is reducing student attrition, it makes sense for LA to focus on bigger-picture data representing student engagement with the university as a whole (Buckingham Shum et. al. 2012) and at the course level, to see if a student is 'on track' (Arnold & Pistill 2012; de Freitas et. al. 2015)—for example, tools that provide users with an overview of class or group learning activities (Martinez-Maldonado et. al. 2015); and dashboards that predict learning outcomes based on multiple data sources, including a student's grades in the course so far, time on tasks, and past performance (Verbert et. al. 2014). But this broader focus does not mean it is not valuable to drill down to a micro level and consider data gathered from students' use of particular resources in an LMS in order to identify 'relevancy of resources' as well as 'time spent' on each resource (Verbert et. al 2014).

LA is still coming to terms with concerns regarding what constitutes relevant data—and this has been identified as an important area of future research (Verbert et. al. 2014). A grey area in current research is what the 'resources' are that are being clicked and the specifics of the data available. In today's online and blended context of HE, students access a range of resources, often created on or curated by third-party websites (i.e. websites outside the university's password-protected LMS); for example, in a first year core communications unit I teach, approximately fifty percent of resources are content on third-party websites (e.g. *The Conversation*, *Mammamia*, *Vice*, *ABC News*). Alongside the value of students' use of resources in an LMS, it would also be valuable to gather data about engagement with third-party resources specifically (for example, web content, such as online features, journalism, blogs, videos, webinars, podcasts etc.). Both data sets would sit beneath a content strategy approach—discussed in the next section.

Following this logic, it would be beneficial to analyse the effect of the organisation of information in an LMS, in terms of a student's pathway through the course and its materials. Research acknowledges the importance of the big-picture view of a student's progress in a course in general, and LMS dashboards exist that use a traffic light system to identify students at risk (Verbert et. al. 2014), but there is an opportunity for analysis and evaluation of the organisation of resources at a topic level and a weekly level. Relevant is Prieto's (2011) comprehensive review of the concept 'orchestration' in learning environments, defining it in terms of the planning and coordination of learning activities, the management of learning activities, changing and adapting the learning plan, and the use of 'awareness mechanisms' in order to enhance orchestration. Opportunity exists in LA to analyse orchestration in a digital context, drilling down, for example, to a weekly topic of a course in Blackboard, using what commercial software analytics refers to as user 'flow' between 'events' (see Google Analytics for example). This analysis, in order to enhance what Prieto (2011) refers to as 'adaptation/flexibility/intervention' would also benefit from testing the combinations of resources, based on the user data, in the manner of multivariate tests conducted in digital marketing, i.e. 'when a number of elements on a page are tested to determine which combination gives the best results' (Stokes 2013, p. 532).

Naturally, ethics is an important concern as LA raises issues regarding data protection and confidentiality and consent (Kay et. al. 2012). Commercial organisations have been collecting user data and analysing users' digital shadows for many years, but it has been suggested that education is ethically more sensitive than other sectors (Kay et. al. 2012) and also, given a lack of 'legal "maturity"' regarding the application of the law in the digital environment (Kay et. al. 2012), universities may be more cautious and conservative in their decisions about ethics. Clarity is required regarding the information that may be 'justifiably' collected 'in the name of learning analytics' (Rubel & Jones 2016, p. 144) but there is agreement that if student data collected is 'identifiable' then student consent is required.

There is a misconception, however, that LA data is only useful when linked to students (see Rubel & Jones 2016). When this approach is prioritised, the trepidation of HE ethics departments is reasonable and ethics approval for LA projects naturally becomes a hurdle. But placing the importance on data's unique identifiers overlooks the value of de-identified data, including click-rate on resources, time on page data, scroll depth and bounce and exit rate data—all metrics that industry organisations have been using to successfully increase user engagement for many years. Placing greater importance on de-identified data, and increasing awareness about the ethical appropriateness of de-identified data, could clear the path for further LA experiments, making them easier and faster to develop and implement.

Online learning: the state of play and the need for a game-changer

The rise of online learning makes the testing and optimisation of online university curriculum crucial. In this context, testing and optimisation of curriculum needs to be a focus of LA and 'curriculum' becomes 'content' because of the characteristics of the context of its consumption and the patterns of how it is accessed by students. *Going* are the days of academics providing students with curriculum based exclusively on what they think is best. In those days anyway, anecdotal evidence suggests that many students simply 'don't do the readings' and whether or not it is because of the readings themselves is hard to say. In any case, I am arguing in this paper for the value of including in LA *testing content* and *gathering data* as a strategy for deciding on what content to provide students. This process is what content strategy and digital marketing call 'optimisation.'

Evidence suggest that testing and optimising content will likely lead to a decrease in the number of students who 'don't do the readings,' but as I will explain below, it is part of a more fundamental approach for getting students' attention today anyway.

In this paper 'online learning' includes both fully online learning and 'blended' mode. In fully online learning, all content is offered digitally and typically via an LMS such as Blackboard or Moodle—two of the most widely used in Australia. Students interact with course material, fellow students and teaching staff online only, either synchronously in online tutorials (using software such as Zoom), or asynchronously (using email and, often, social networking sites such as Facebook), and often a combination of both—which is the case at WSU. Blended mode is another form of online learning; in fact, for example, it is the only way the Bachelor of Communication at WSU is offered. In blended mode, unit content, which includes lectures, readings, quizzes and tutorial activities, are all provided online via a LMS. Readings are sometimes from a printed textbook, but often they are electronic, from a university's library database, or from third-party publishers. For example, in a first year core unit I teach, 100 percent of readings are electronic and a significant amount are from third-party publishers; and in a second year core unit, textbook readings (print) are supported each week by one or two electronic readings. In blended mode, like fully online mode, students can prepare for class from anywhere they have an internet connection; but, in blended mode students must attend weekly face to face (F2F) classes in order to discuss the material.

Online learning is on the rise. For example, MOOCS, or 'massively open online courses,' are exploding in popularity. *The Economist* (2014) estimated that MOOCs have provided courses to over 12m students in the United States, Europe and India predominantly. One MOOC aggregator estimated in 2015 that there are 4,200 MOOCs offered by more than 500 universities around the world with 35m enrolments (Carter 2016). Closer to home, a simple search on SEEK Learning returns a list of approximately 285 'online courses' in Australia, and tertiary institutions include Swinburne and Deakin. At WSU, I already mentioned that the Bachelor of Communication is offered in blended mode and year one and two are fully online, and by 2017 year three will also be fully online. Furthermore, the model of the Bachelor of Communication is currently being adopted by other schools at the University.

Online learning is on the rise for good reason. Currently, enrolments of new students at university in Australia have plateaued (Moodie 2016)—and have even declined for some universities, and so online learning is likely an attractive option for institutions looking to boost their numbers. Online learning suits students with work and family commitments, and this is in so far as content, and tutorials, are more conveniently accessed. Online learning is more flexible generally, allowing students more potential opportunity when it comes to paid work, and so it is likely to keep growing in popularity, especially given high numbers of students (in Australia) who combine study with work (Parr 2015). Yet enrolments are set to rise in the future given the population growth of 18–24 year-olds (Parr 2015) and online education could be seen as a cost-effective way for universities to accommodate more enrolments or attract a greater percentage of enrolments through the appeal of the flexible learning opportunities offered by online learning.

Online learning is part of a paradigm shift in information consumption and media use today. 'The latest Digital Australia report from professional services firm Ernst & Young has found Australians spend on average 10 hours and 24 minutes engaging with their internet-connected devices every day' (Carmody 2016). Statistics also show an increase in user-preference for on-demand services, reflected in a shift away from commercial TV viewing, or 'linear' free-to-air television, coinciding with the rise of internet-based entertainment: 'Streaming and downloading provided a whole new outlook on media consumption: content on-demand. Now, Commercial TV faces an even more direct competitor, in the form of Subscription Video on Demand (SVOD) including Netflix, Stan, Presto, Quickflix and Foxtel Play' (Roy Morgan 2016). This also coincides with an increase in smartphone usage (Smith 2015). In one report, twenty-five percent of people surveyed said 'they spent more time on their smartphone than they did talking to their partner or friends' (Carmody 2016). Taken together this data paints the picture of today's media user being surrounded by information, all the time, and who is increasingly used to having it that way. But the data also identifies a big challenge for content producers and publishers in this sea of information: getting users to notice their content in the first place and, ultimately, read it.

Given the growing use of electronic resources in HE, many of which require students to leave their LMS and visit third-party publisher's websites, it is often the case that university curriculum is vying for students' attention in the sea of information that is always flowing, 'always on' for today's media user. Furthermore, this is the user used to controlling their access to information themselves, and so the onus is on the institution to choose learning resources that suit their online context. In other words, university learning resources need to become 'content.'

Of course, 'content' refers to everything online, but we can be more specific and define content as all of the following: responsive, engaging and optimised. Since content needs to be accessed any time from any device, it is responsive to different screen sizes and how users read online. Content is also engaging in so far as it achieves a desired user outcome, and these outcomes are measurable, they are 'metrics'; for example, click rate, session duration and page depth—or the 'count of pages that a visitor visits on your site beyond the page they landed on' (Patel 2016). In HE, content is engaging when it is opened and read—in full. Finally, optimised content is better aligned with organisational goals and user needs. It results from the analysis of data collected from metrics. Typically, insights from the data gathered are used to modify content as part of an iterative optimisation and testing process. For a content producer, modification may involve changes to the content itself; for an organisation that provides content, such as a university (a re-publisher, or a curator), modification simply involves choosing different content.

Ensuring content is responsive, engaging and optimised are the broad objectives of 'content strategy.' Content strategy involves looking at a combination of engagement metrics (such as click-rate and session duration) and comparing the data gathered to benchmarks, set by the industry, and goals, set by the content strategist on behalf the organisation's business objectives, in order to decide if and how the content needs to be optimised. In sum, this discipline is concerned with deciding on content based on 'a deep understanding of the intentions of the content creators [and/or curators] as well as the needs of the content consumers' (Lovinger 2007; see also Kissane 2011). Related is content marketing, which involves using content strategy to drive a profitable action (Rose 2013).

There are many examples of different organisations undertaking content strategy. One of the most extravagant attempts recently was by an Australian news team. Hal Crawford, Andrew Hunter and Domagoj Filipovic (2015) built a tracking tool called The Likeable Engine to analyse in real time the news headlines from media organisations around the world that are most shared on social media. Crawford et. al. then used the data gathered to deduce characteristics of news stories that would most likely result in engagement, which in this case is a user sharing the content to the connections in their network. Despite there being many factors influencing user engagement, as a result of the insights from the data gathered from The Likeable Engine, Hunter and Crawford's news teams at MSN and Nine (as they are now known after the end of ninemsn joint venture in 2014) can prove an increase in their ability to predict a shareable story based on headline (A. Hunter, personal communication, July 11, 2016). This is a case, then, of journalists using data to work out what stories to tell and how to tell them.

Buzzfeed is another publisher well-known for testing and optimising its headlines in an attempt to boost engagement with their content, and based on their success generally (see Alexa.com for example), it is reasonable to say their strategy is effective. It has been reported that Buzzfeed test several headlines for each piece of content they publish, as Walgrove (2015) explains: 'For the first couple of hours after [the content is] published, visitors to the homepage or the article page will randomly get one of those variations. Then, editors test the performances against each other, taking into account click-through rates and share rates.' Typically, one or two versions perform better, which are the ones the editorial team use going forward. Given that an optimal headline can be 'the difference between 1,000 or 1,000,000 people reading your story' the time taken in the testing and analysis process is well worth it (Walgrove 2015).

As I have suggested, content strategy is not only relevant for content producers (i.e. organisations who write and publish original content) but content curators also. Content curation, according to the Content Marketing Institute (CMI), 'assembles, selects, categorises, comments on, and presents the most relevant, highest quality information to meet your audience's needs on a specific subject' (Cohen 2014). Curation, then, involves gathering and republishing someone else's content, but crucial is that content curation adds commentary. This commentary is often in the form of a headline and an introductory blurb based on the curator's own 'input or insight' (Souza 2012). *The Huffington Post*, an acknowledged 'master' of content curation (Ristic, quoted in Cohen 2014) is also known for testing different headlines in real time: '*The Huffington Post* applies A/B testing to some of its headlines. Readers are randomly shown one of two headlines for the same story. After five minutes, which is enough time for such a high-traffic site, the version with the most clicks becomes the wood [sic] that everyone sees' (Seward 2009). It is fair to assume that *The Huffington Post* are testing headlines of curated content as well as original content—and in any case insights about how to optimise a headline for original content apply equally to the kind of content to curate.

In these examples, data from testing—or other forms of analysis (e.g. 'scraping,' performed by The Likeable Engine)—is used as part of a user-centred strategy for aligning content with organisational goals and user needs, and although the examples noted are 'success stories' it is nevertheless reasonable to say at the most basic and general level, that testing and optimisation is better than relying on intuition. Crawford et. al. emphasise this point, even in the context of journalism— once the stronghold of intuition-based insight: 'The addiction to the "tummy compass" is one of the bindweeds of old media. The cult of the alpha male editor with its attendant blindness to data now represents a dark side that will work against any organisation still subscribing to it' (14). On the one hand, content strategy is a paradigm necessary for organisations to increase their competitiveness online, but also—as Crawford et. al. make clear, *not* taking advantage of the fact that 'almost every action on the web can be tracked, captured, measured and analysed' (Stokes 2013, p. 9) is dangerously ignorant.

In higher education it appears that the tummy compass still rules when deciding what learning resources to include in courses. Of course, I am not suggesting that readings and other texts are not chosen based on criteria of credibility and expertise, but I am saying that the planning aspects of managing content are not as user-centred as they could be. Optimisation, occurring dynamically and responsively, needs become an approach to online curriculum design in HE and needs to be a part of LA. This is in order to increase the number of students reading content and better prepare them for class and, ultimately, enable them to achieve course learning outcomes. In today's mobile media environment, the onus is on university teaching staff to get to know their students better and align content with their needs, or else they will click somewhere else. The expectation that students are already engaged users, in so far as they have agreed to take the course and are theoretically motivated (i.e. they are not what the marketing industry refers to as 'cold leads'), is not reasonable today. It is necessary to use analytics gathered from data to make the content as engaging as possible.

A practical content strategy for online learning at university needs to include the following processes and data. When analysing content embedded in an LMS page, unit coordinators (who, in this context, are really curriculum *designers*) need easy access to click rate data as well as 'reading' data, including when people scroll and when they reach the end of an article (this is what Google Analytics calls event tracking data—see Cutroni 2012). This data needs to be readily available, as a dashboard, in real-time; and, there needs to be scope built into the course design process, and workload allocation, for implementing the findings. Useful too would be heat map data displaying the areas of an LMS page with the most (and least) activity. At a more sophisticated level, curriculum designers would benefit from the ability to test two or more variations of heading—in exactly the same way *The Huffington Post* and *Buzzfeed* A/B test their content headlines. And worthwhile too would be an aggregation of the most clicked content assets for a given period. Finally, 'time on page' data of content on third-party websites outside an LMS, is essential, and it comes on good advice from senior developers that Facebook already has this capability with the browser software used in its mobile application (P. Steele, personal communication, July 19, 2016; D. Teahan, personal communication, July 16, 2016). All the data gathered would help curriculum designers make informed decisions about the kind of content to include in future weeks, and it would also provide insights useful for optimising content headlines and blurbs.

Content strategy at university: challenges

There is no doubt that optimising content to align with students is a valuable addition to university curriculum design. Optimised content can increase the number of students reading content and better prepare them for class and, ultimately, enable them to achieve course learning outcomes. Optimised content can potentially decrease the fail rate, decrease attrition and make a course (and university) more competitive. Analysing data and using the findings to optimise content is a practice that comes under the umbrella of content strategy. Industry examples prove that 'better' content can increase user engagement, and industry examples also demonstrate the usefulness of testing and analysis to this end. As was mentioned above, for example, a good headline can (sometimes) be all it takes to increase readers tenfold. But, while content strategy is an untapped area of LA and potential in curriculum design, there are several challenges surrounding its implementation. These include research-based, technological, and equity-based challenges.

The first challenge facing the implementation of content strategy at university is research-based. The first rule of writing, and by extension: the first rule of content, is know your audience. But how much does academic teaching staff really know about their audience? Not as much as the industry knows about theirs; for example, Crawford et. al. have spent more than four years gathering and studying data from 'The Likeable Engine' and can only now say, with confidence, that social media users are more likely to share content that is newsworthy, inspirational and 'teaming' (for the specific details see Hunter 2016a). In an academic context, what is needed is data and insights about the kinds of content students are most likely to click, and this goes far beyond content format (e.g. video vs. text—see Pagram & Cooper 2011). For example, useful data includes information about whether students are more likely to read recent content, or journal content, or third-party publisher content, or third-party content aimed at their demographic. Data, over time, could also identify particular themes that students respond to better than others, or switch-off to completely. These insights could be equally applied to content examples used in a weekly topic; for example, perhaps students feel saturated with discussions about

WikiLeaks. Moreover, useful data could tell about the balance of content in an LMS—in other words, are students likely to read an academic essay from a peer-reviewed journal if, that same week, it is 'balanced' with a more light-weight piece—but how light-weight is too light-weight (*The Conversation*; *Vice*?). LA would do well to revisit 'orchestration' (Prieto et. al. 2011), but from the perspective of data insights produced through multivariate tests. And, similar to the tests conducted by *Buzzfeed* and *Huffington*, are students more likely to read content if it is introduced by a blurb, a carefully crafted headline, even a call to action (CTA)? Curriculum designers need this data to begin optimising content, and to get this data they need to begin optimising content.

Another challenge, related to the first, is technological. A majority of participants in a recent LA survey of HE institutions stated that they felt that their university was not providing easy access to LA data and the data provided was not easy to interpret (Buckingham Shum 2015). Clearly there is an issue here with technology and access. A more straightforward technological issue is the limited capabilities of learning management systems. A focus on Blackboard reveals that Blackboard does not have the capacity to track unique clicks on a third-party content link embedded in a content item. Moodle provides more potential for tracking clicks on individual URLs, but the content needs to be content uploaded to Moodle—in other words, clicks on links to content *outside* the LMS cannot be tracked. But, that is not entirely true either, as Google Analytics can be integrated with Moodle, which means that there is the potential to plug-in what Google calls 'event tracking,' which would allow Moodle users to track clicks on third-party links. But the fact that absolute clarity on this application of Moodle for a potential Moodle user, a university course designer (me)—not an IT expert or learning designer—is not readily available is telling enough of the murky complexity surrounding this issue and the technological limitations of learning management systems more generally. (Of course, YouTube analytics include data about numbers of views and average view duration—but this is only available for staff who are account holders of university YouTube channels). Related are two final technological issues challenging content optimisation in HE. First is the limited technological expertise of most academic teaching staff using LMS; second is the huge cost (financial as well as time needed) required for an institution to change an LMS in order to benefit from other features.

Ideally, content optimisation should happen in real-time, or at least content could be optimised on a daily schedule. This, however, poses challenges unique to an education environment. In order to optimise effectively, a course designer needs to have, on hand, a range of content that deals with the same concepts and themes each week, and add/remove appropriately depending on the engagement data gathered. But this could pose an equity issue as students ideally need to access the same content in order to prepare for assessment tasks.

Regularly optimising content would also mean an overall change in the way a curriculum designer plans and implements a course. It is safe to say that in most HE institutions, courses are planned well in advance, and this is for marketing, enrolment and other logistical and administrative purposes. Typically, a course's learning outcomes and assessments are unable to be changed at short notice. While this is the case, some flexibility likely exists for curriculum designers to update reading lists—but common practice is to allow students at least five days to access and read content for a weekly topic. In order to optimise content on a daily basis (or even hourly) curriculum designers would need to quite radically rethink their process for designing courses, and this is in terms of the content they include, and following on from this, the activities and discussion they plan about the content in class (online or F2F). Course design, and teaching, would need to become much more dynamic and agile. The 'front-loading' approach of designing a whole unit before the unit begins, which includes mapping out content and activities with assessment and learning activities, would no longer work. And students would also need to be re-educated about expectations to do with the regularity of their access to content. Really, students would need to be in touch, asynchronously, around the clock. But doesn't technology today lend itself to asynchronous learning, and aren't students 'always on' anyhow?

Finally, related to the last point about the changing nature of course design, is the changing role of HE teachers—which I have been calling 'curriculum designers.' I am identifying an imminent shift in skills and expertise not unlike the shift in skills and expertise Cindy Royal (2014) identifies in journalism, and teaching journalism. 'If you are a journalism educator or media professional,' she writes, 'I have news for you: We work in tech.' In order to keep up with today's data-driven tech environment, a university teacher needs to be a course designer with some of the following skills and expertise: basic coding, in order to avoid problems with LMS editing interfaces and have greater flexibility re. layout and design ('orchestration'); digital copywriting skills—or what is sometimes referred to as 'web writing' skills (Halvorson 2010, p. 128), in order to craft engaging and useful headlines, blurbs for copy (and keep crafting them) and CTAs; usability (UX) skills, in order to implement optimised user pathways in an LMS, or 'event funnels'—as well as some information architecture knowledge; A/B testing skills, in order to implement and evaluate content experiments; analytics skills, in order to know what data to collect and how to interpret it; and market-research/audience analysis skills, in order to get to know their audience. Of course, it is not reasonable to expect an HE teacher to possess all these skills, but realistically, a skill-set that touches on many of these areas is becoming more and more unavoidable with the trend towards blended and online learning.

Case study

A content strategy experiment was undertaken at Western Sydney University in 2015, designed to provide insights into student engagement with weekly content using the LMS Blackboard. This brief case study illustrates the technological requirements of such an experiment, opportunities for technological development in Blackboard, and complications regarding copyright that arise for content strategy in an HE context.

The aim of the experiment was to gather data on student engagement with reading resources ('content') in a weekly topic. More specifically, the aim was to track the number of unique clicks on content.[9] This data would provide insight into student preferences for content; and potentially, this data could provide insight into student preference for content in relation to the progression of the unit (i.e. content in a weekly topic at the beginning, middle or end of the course) and orchestration of resources in the LMS. It is already the case at some institutions that certain engagement data can be obtained from university reading lists—and there is specific software available to track engagement metrics with resources on reading lists—but it is important the curriculum designers have the flexibility to orchestrate where and how content is embedded. For that reason, reading list data was not considered an option.

I was advised at the planning stage of the experiment that Blackboard did not possess the analytics capacity to track user clicks on links embedded in the page of a weekly topic, called in Blackboard a 'content item.' These links are referred to as 'in-item' links. Blackboard could only provide data on views of the weekly content item itself, and/or clicks on 'web links'—which, although valuable, are not useful for determining student preference for individual content resources contained in the content item. I was advised, however, that data on file downloads could be obtained from the University server and also that analytics could be added to pages on the University server outside the Blackboard LMS.

As a result, the following workaround solution was implemented. Outside the Blackboard LMS an HTML page was created with a link to the PDF and the following anchor text: 'Download the PDF (xMB).' For a student, after logging in to Blackboard, they would 1. Open that week's content item; 2. Click on a link to access content; 3. Get redirected to the HTML page; and, 4. Click on the PDF link. Tracking this process would provide data from two metrics: page views of the HTML page and downloads of the PDF. Comparing data would provide an idea of student engagement with content and show the drop-off between arriving on the HTML page and downloading the document. The test was to be conducted for two separate weeks and using two PDFs. The results are below in Table 1:

Table 1: Western Sydney University content strategy experiment—results

Week	Total Students	Page Views (Goal 1)	Conversion[1]	PDF Download (Goal 2)	Conversion[2]	Drop-Off	Engagement
7	342	201	59%	187	93%	7%	54%
10		83	24%	78	94%	6%	23%

A conversion refers to any goal a marketer/researcher may have (Burstein 2012). In this experiment, 'Conversion[1]' is the percentage of the total number of students enroled in the unit who completed the first goal, which was clicking on the link in Blackboard and arriving on the HTML page. 'PDF Download' is the number of students who downloaded the PDF (Goal 2), and 'Conversion[2]' is the percentage of students who completed 'Conversion[1]' that downloaded the PDF. 'Drop-Off' is the percentage of students who completed Goal 1 but did not complete Goal 2. And 'Engagement' is the percentage of total students enroled in the unit who downloaded the PDF—that is, the percentage of total students who completed both goals. The results show that Engagement, when considered in the context of the number of students enroled in the course and expected to read compulsory university reading material, appears low. Engagement also drops as the course progresses, and this is understandable. The conversion rate for Goal 2 is also higher than Goal 1, which is to be expected as a student who completes Goal 1 is what marketing would call a 'hot lead.' The drop-off rate for both weeks was comparable, which suggests that a certain amount of 'hot leads' not downloading the content despite getting as far as the 'Download the reading now' link is to be expected.

[9] Since the data collected was de-identified, ethics approval was not necessary (see Kay et. al. 2012)

Several issues come to light as a result of this experiment and the data gathered. Primary is the difficulty experienced collecting this kind of data from Blackboard and undertaking LA focused on content optimisation. Granted, a solution was developed, but considerable technical assistance was required in order to implement the solution. In addition, the solution required that a two-step process be implemented (step 1: student clicks on link; step 2: student clicks on link to download PDF), and it is a fact in the context of digital marketing that there is a drop-off rate with every additional step in a conversion funnel. Also, it is typical for there to be a drop-off rate at Goal 2, or what is more accurately termed 'abandonment'—since this is the final conversion, and the reason is a general user concern with downloading PDFs, and this could be to do with file size and/or concern about potential viruses. Both of these issues, the two-step process and the final conversion being a PDF download, would likely have negatively affected engagement overall.

Another issue is the absence of comparative benchmarks for conversion goals. It is a fact that students are required to read certain learning resources, and that was the case for the two PDFs in this experiment. But what percentage of students typically read the course material in a given week? Benchmarks exist for industry conversions; for example, a 'typical' conversion rate for 'media and publishing' is ten percent and for 'education or healthcare' is eight percent (Burstein 2012). In terms of these conversions, the rates achieved by this experiment are healthy—even good. But until there are benchmarks for these specific conversion goals in HE, an accurate evaluation will not be possible and informed optimisation of course content can only be guesswork.

Copyright was also a significant area of concern during this experiment—and this is from a university administration perspective. Since it was decided that the most accurate data would be the comparative result of page views and download data, the content needed to be a PDF. A PDF is less user-friendly than a responsive web page (which is especially relevant if students are reading content on their smart-phones), and usability of the content is certainly an important issue, and it is reasonable to assume this could have affected the Conversion^2 rate since the anchor text was: 'Download the PDF (1.4MB)'—assuming a student would have chosen *not* to download the content upon finding out it was a PDF. But, the data does not support this theory since the drop-off rate was minimal. The issue with the PDF, and all PDFs, is to do with copyright. University library staff advised that it was preferable for PDFs reproduced under the University's copyright agreement *not* to be stored outside the University's password protected LMS. The PDF to be used in the experiment had to be freely available PDFs—that is, PDFs the authors are licenced to distribute without copyright restrictions. This is of course understandable, but it nevertheless places limitations on the resources that could be potentially used for experiments such as this.

This case study reveals that opportunities exist for further research on content engagement and conversion data benchmarks. In thinking about this case study we become aware of possible problems with the data collected, and that has to do with the accuracy of the insights developed; for example, a high number of clicks on a link or extended time on page do not necessarily equate with engagement as readers may, in the first case, be clicking links without reading, and in the second, visiting pages or opening browser tabs/windows and leaving their computers unattended. It is crucial that learning designers are aware of the limitations of metrics; for example, selecting course content based on the 'click worthiness' of headlines is a misguided motivation as it may signal temporary interest but not sustained engagement (Chang 2013).

Curriculum designers do not know what to expect regarding student engagement and what to aim for, and until the answers to these questions are known curriculum designers will not be able to optimise content. Further research would benefit from sustained testing over the duration of a course, and this could involve A/B testing headings and blurbs introducing content. Further research also needs to track engagement with content published on third-party websites. This means tracking clicks on in-item links in the LMS to the third-party content (this would allay the effect of a two-step process involved in accessing a PDF; and also, tracking clicks on links embedded in-item would prevent the need for students to access a reading list elsewhere in the LMS). In terms of concerns about the accuracy of metrics and the danger of misguided motivations, further research needs to follow the industry content strategy advice of Chang (2013) and, through testing, decide on the metrics most accurately reflective of engagement with content in HE, which will most likely involve a combination of metrics. For example, in order to accurately track engagement with third-party content, time on page data *and* scroll data would be useful—in the manner, for example, Facebook likely collects data on user engagement with third-party content accessed while using the Facebook mobile application. Content strategy at university would also benefit from the analysis of a user's movement between learning resources in a single topic. This is different to analysing user pathways throughout an entire course, as the focus in this case is what Google Analytics refers to as user 'flow' between 'events' on a page. Finally, discussion about the suitability of existing university copyright agreements for today's online learning environment is also necessary.

Conclusion

There is no doubt that efforts to test and optimise university course content could improve student engagement with content. Industry examples show, in simple terms, that optimised content could likely increase the number of students reading learning resources, which will better prepare them for class, better enable them to achieve learning outcomes, make them happier and (potentially) decrease issues such as attrition. But, as the case study demonstrates, the technology isn't readily available and accessible to curriculum designers; and curriculum designers aren't quite curriculum designers (yet). University teachers need new skills and a different perspective on course content and unit coordination more broadly. Realistically, however, these technological requirements and teaching skills are unavoidable, or at least becoming unavoidable, as they are characteristics of the online space into which HE is charting a new course. This is a space where content, whether it is university content or advertising content, is competitive and students access it whenever they want—because they can. Moreover, in an environment where the student determines the 'content flow,' it is to be expected that a 'take it or leave it' attitude is the norm. The result is that content needs to be optimised.

HE content strategy has a way to go. The importance of small-scale experimentation in LA is crucial. As recent research from the Australian Office for Learning and Teaching notes, 'Benefit can be gleaned from implementing small-scale LA initiatives, and growing the scope and scale of these programs, rather than aspiring to the generation and development of an 'at-scale' initiative in the first instance' (2015, p. 38). A critical follow on from experimentation, and the results of experimentation, would be strengthening feedback loops between institutions and LMS designers, as this would provide opportunities to develop the analytics capabilities of an LMS.

References

Arnold, K. E., & Pistilli, M. D. (2012). Course signals at Purdue: Using learning analytics to increase student success. *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge* (LAK '12), 267–270. http://dx.doi.org/10.1145/2330601.2330666

Biggs, J. B. & Tang, C. (2011). *Teaching for quality learning at university*. Maidenhead, McGraw-Hill Education.

Buckingham Shum, S., Aberer, K., Schmidt, K., Bishop, S., Lukowicz, P., Anderson, S. et al (2012). Towards a global participatory platform: democratising open data, complexity science and collective intelligence. *The European Physical Journal Special Topics*, 214, 1, 109–152.

Burstein, D, (2012, October 23). Marketing Research Chart: Average website conversion rates, by industry. *Marketing Sherpa*. Available: http://www.marketingsherpa.com/article/chart/average-website-conversion-rates-industry#

Carmody, B. (2016). Australians spend 10 hours a day on internet connected devices: The digital trends your SME needs to know. *Smartcompany*. Available: http://www.smartcompany.com.au/technology/62659-australians-spend-10-hours-a-day-on-internet-connected-devices-the-digital-trends-your-sme-needs-to-know/

Chang, S. (2013, December 9). The future of content: Upcoming trends in 2014. *Moz*. Available: https://moz.com/blog/future-of-content-upcoming-trends-in-2014

Crawford, H., Hunter, A. & Filipovic, D. (2015). *All your friends like this: How social media took over the news*. Sydney, Australia: Harper Collins.

Cutroni, J. (2012, February 21). Advanced content tracking with Google Analytics: Part 1. *Analytics Talk*. Available: http://cutroni.com/blog/2012/02/21/advanced-content-tracking-with-google-analytics-part-1/

Daniel, B. (2014). Big Data and analytics in higher education: Opportunities and challenges. *British Journal of Educational Technology*. doi:10.1111/bjet.12230

de Freitas, S., Gibson, D., Du Plessis, C., Halloran, P., Williams, E., Ambrose, M., Dunwell, I., Arnab, S. (2015). Foundations of dynamic learning analytics: Using university student data to increase retention. *British Journal of Educational Technology*. Vol 46 No 6. 1175–1188

Halvorson, K. (2010). *Content Strategy for the Web*. Berkeley, CA: New Riders.

Hunter, A. (2016a, July 7). What Facebook's timeline changes really mean for Australia's publishers. *Mumbrella*. Available: https://mumbrella.com.au/facebooks-timeline-changes-really-mean-australias-publishers-378993

Kay, D., Korn, N. & Oppenheim, C. (2012). Legal, risk and ethical aspects of analytics in higher education. Centre for Education, Technology and Interoperability Standards. Available: http://publications.cetis.org.uk/wp-content/uploads/2012/11/Legal-Risk-and-Ethical-Aspects-of-Analytics-in-Higher-Education-Vol1-No6.pdf

Kissane, Erin. (2011). *The Elements of Content Strategy*. NY: A Book Apart.

Lovinger, R. (2007, March 27). Content strategy: The philosophy of data. *Boxes and Arrows*. Available: http://boxesandarrows.com/content-strategy-the-philosophy-of-data/

Martinez-Maldonado, R., Pardo, A., Mirriahi, N., Yacef, K., Kay, J., & Clayphan, A. (2015). The LATUX workflow: Designing and deploying awareness tools in technology-enabled learning settings. Proceedings of

the 5th International Conference on Learning Analytics and Knowledge (LAK ’15), 1–10. http://dx.doi.org/10.1145/2723576.2723583
Moodie, G. (2016, January 29). FactCheck: has growth in new university enrolments flat-lined? *The Conversation*. Available: https://theconversation.com/factcheck-has-growth-in-new-university-enrolments-flat-lined-53737
Office for Learning and Teaching. (2015). Student retention and learning analytics: A snapshot of Australian Practices and a framework for further advancement. Retrieved from http://he-analytics.com/wp-content/uploads/SP13-3249_-Master17Aug2015-web.pdf
Ourania P., Katerina K., Ioannis D., & Symeon R. (2014). LAe-R: A new learning analytics tool in Moodle for assessing students’ performance. *Bulletin of the IEEE Technical Committee on Learning Technology*, 16(1).
Pagram, J. & Cooper, M. (2011). E-yearning: An examination of the use and preferences of students using online learning materials. In T. Hirashima (eds) *Proceedings of the 19th International Conference on Computers in Education*. Chiang Mai, Thailand, 712-716.
Parr, N. (2015, May 25). Who goes to university? The changing profile of our students. *The Conversation*. Available: https://theconversation.com/who-goes-to-university-the-changing-profile-of-our-students-40373
Patel, N. (2016, May 18). How to measure reader engagement and loyalty using Google Analytics. Neilpatel.com. Available: http://neilpatel.com/2016/05/18/how-to-measure-reader-engagement-and-loyalty-using-google-analytics/
Rose, R. (2013, October 16). How content marketing and content strategy are separate but connected. *Content Marketing Institute* (CMI). Available: http://contentmarketinginstitute.com/2013/10/content-strategy-content-marketing-separate-connected/
Roy Morgan Research (2016, February 1). 1 in 7 Australians now watch no Commercial TV, nearly half of all broadcasting reaches people 50+, and those with SVOD watch 30 minutes less a day. Available: http://www.roymorgan.com/findings/6646-decline-and-change-commercial-television-viewing-audiences-december-2015-201601290251
Royal, C. (2014, April 28). Are journalism schools teaching their students the right skills? *NiemanLab*. Available: http://www.niemanlab.org/2014/04/cindy-royal-are-journalism-schools-teaching-their-students-the-right-skills/
Seward, Z. (2009, October 14). How The Huffington Post uses real-time testing to write better headlines. *NiemanLab*. Available: http://www.niemanlab.org/2009/10/how-the-huffington-post-uses-real-time-testing-to-write-better-headlines/
Smith, A. (2015, October 31). Mobile mania! Australians spend on average more than an hour a day on their smartphones. *Nielsen*. Available: http://www.nielsen.com/au/en/insights/news/2015/mobile-mania-australians-spend-on-average-more-than-an-hour-a-day-on-their-smartphones.html
Stewart, M. (2012). Understanding learning: Theories and Critique. In *University Teaching in Focus: A Learning Centred Approach* (pp. 3-20). London: Routledge.
Stokes, R. (2013). *eMarketing: The essential guide to marketing in a digital world* (5th ed.). Quirk education. Available: www.quirk.biz/emarketingtextbook
The Economist. (2014, June 28). The digital degree. Available: http://econ.st/2cVE5tl
Verbert, K., Govaerts, S., Duval, E., Santos, J.L, Van Assche, F, Parra, G., Klerkx, J. (2014). Learning dashboards: an overview and future research opportunities. *Personal and Ubiquitous Computing*. 18(6), 1499–1514.
Walgrove, A. (2015, February 4). How BuzzFeed, R29, and other top publishers optimize their headlines and images. *The Content Strategist*. Available: https://contently.com/strategist/2015/02/04/how-buzzfeed-r29-and-other-top-publishers-optimize-their-headlines-and-images/

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Determining the requirements for geographically extended learning (gxLearning): A multiple case study approach

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Blended learning, where face to face delivery is augmented with online components is used widely in Tertiary Education Institutions. With emerging and maturing technology solutions there is an opportunity to leverage them to provide alternative ways to facilitate pedagogically sound student learning. In particular, students may not be able to physically attend the class. The research presented in this paper considers how web conferencing technology, with appropriate hardware and software can be used to integrate face-to-face and geographically separate students (gxLearning), and describes three case studies in a variety of scenarios. The findings suggest the technology needed, and describes some notable advantages such as the ability to record the classes, as well as some significant issues, and will provide guidance to others considering using this delivery mode.

Keywords: blended learning, gxLearning, web conferencing, pedagogies, experiential learning, mobile, field trips, HyFlex

Introduction

As the paradigms of blended learning continue to develop alongside technology adoption and innovation, educators look at ways to leverage the benefits while integrating appropriate pedagogical approaches that support student centered learning. Students are becoming increasingly diverse; educational globalization means they may be in a different location to the institution in which they are enrolled, have a variable number of life commitments and responsibilities, and require the flexibility to be able to learn at a time and place suitable to them. This diversity puts pressure on institutions to provide learning in ways that not only meets these students' demands but also meets the needs of those students who prefer or require face-to-face delivery modes.

Over the last 5 years one lecturer at the Eastern Institute of Technology (EIT) in New Zealand, has provided a flexible learning option where web technologies have supported remote students to participate synchronously in the face-to-face class. Coined "gxLearning" by Verhaart and Hagen-Hall (2012), this method of teaching to "a geographically distributed class, consists of students in a face-to- face mode plus students in a remote location" (p. 111). The gxLearning environment extends the blended learning approach by encouraging the integration of web based infrastructures, communication technologies, tools and software to synchronously engage students both in and out of class. This paper focusses on this gxLearning journey and reports on the successes and challenges as a range of pedagogical and technological approaches have been trialed and either adopted, discarded or adapted over that time. This is presented by case studies highlighting how the gxLearning environment enabled remote students' synchronous participation in face-to-face (f2f) classes and on a field trip.

Outcomes from each case study are analysed as a whole, and suggested requirements consolidating the technologies, pedagogical and theoretical approaches are presented. This addresses the research question, "What are the requirements for effective learning in a geographically extended learning (gxLearning) environment". The requirements provide guidance for educators considering extending f2f or blended course offerings into the gxLearning paradigm.

GxLearning

In allowing flexibility and convenience with attendance modality, the gxLearning environment (Verhaart & Hagen-Hall, 2012) primarily promotes an 'enabling blended environment' and encourages pedagogical transformation where students may experience dynamic interactions (Bonk & Graham, 2006) with both the technology and their peers. Development of reliable web conferencing systems requiring little infrastructure to implement, has further supported these blends by enabling remote student participation as part of a normal f2f classes. Adobe Connect, as an example of these technologies, provides a variety of synchronous communication channels and activity enabling features; video, audio, chat, shared whiteboard, presentation (Adobe, 2016) and web 2.0 technology integration. Variations of Verhaart and Hagen-Hall's (2012) gxLearning paradigm has alternatively been described as Hyflex course design by Beatty (2007), blended synchronous learning (Bower, Kenney, Dalgarno, Lee & Kennedy, 2013) synchronous hybrid delivery (Butz, Stupnisky, Petersen & Maherus, 2014) and synchromodal classes, synchromodal hybrid, synchromodal learning (Bell, Sawaya & Cain, 2014).

Beatty (2007) developed the Hyflex model to specifically include online students in on-campus classes. Both f2f and online students use the same course within a LMS, engage in activities and occasionally use web conferencing tools to engage in topical discussions. Students could cross from one participation mode to another confident they would have an equivalent learning opportunity. Miller, Risser and Griffiths (2013) used the Hyflex approach to provide a large class with attendance options. Using Adobe Connect and other synchronous web technologies, the lecture slides and audio feed was streamed to the remote students from the classroom and also recorded for later viewing. While students' reported increased participation in class and appreciation of the recordings, technology issues often disrupted the lecture flow. Both Beatty (2007) and White, Ramirez, Smith and Plonowski (2010) discovered the multimodal delivery method placed an increased load on a normal class teaching demands and used a second instructor to manage the remote student chat and technology requirements. Bell, Cain and Sawaya (2013) observed a similar phenomenon and introduced the "Technology Navigator" in that role as they too explored ways to teach courses where not all the students were physically able to attend class. Like Verhaart and Hagen-Hall (2012), the idea of both video conferencing and web conferencing was considered as solutions to link classrooms and people in various configurations. Bell et al. (2014) trialed three scenarios; classroom to classroom, classroom to online with a shared in-class communication portal, and classroom to online with students having personal portals to the online environment. In each case, web conferencing tools were trialed and the best solution chosen for the given number of students and scenario. Key challenges to both gxLearning and the synchromodal solutions were stated as the variable quality of the internet connection and being able to provide an optimal audio and video solution (Verhaart & Hagen-Hall, 2012; Bell, Sawaya & Cain, 2014; Day & Verhaart, 2015).

In a different approach, Butz et al. (2014) explored the relationships, self-determination and motivation of students in a class where both online and on-campus students were taught synchronously using audiovisual technology. As a result of this study, it was found that the students generally reported similar experiences with their satisfaction, motivation and perceived success, however the online students did feel less relatedness and belonging than their in-class peers. As a further extension to the solutions described by Verhaart and Hagen-Hall (2012), Beatty (2007) and Bell, Sawaya and Cain (2014), Day and Verhaart (2015, 2016) used the gxLearning environment to enable field trip experiences where face-to-face and remote students used mobile devices to participate and communicate while in the field. In all cases, the importance of high quality audio and video feeds was highlighted as essential for a good student experience.

Case Studies

This research presents three case studies demonstrating gxLearning across a variety of scenarios. Each case study is unique in that either the technologies used, the pedagogical approach taken or the underpinning theories applied to the case differed. While being cognizant of the need to provide students with an authentic learning experience and to continually improve teaching and learning within the gxLearning modality, these changes were informed by the learning from each case over the duration of the study. The cases are reported in order of occurrence, from 2012 - 2016. The participants in these case studies were students studying papers within the Bachelor of Computing Systems (BCS) degree at the Eastern Institute of Technology. In each case, students could participate in the scheduled face-to-face class, or attend synchronously but remotely, using the Adobe Connect web conferencing technology as the gxLearning enabling environment.

Case 1: 2012 - 2016 enabling remote participation

GxLearning using the Adobe Connect web conferencing system was first used at EIT 2012, allowing a student located at the distant Gisborne campus to attend. This course was offered in a blended mode where f2f was supplemented with online content and activities, but required a few hours per week of f2f time. Although video conferencing (VC) facilities between campuses was available, it was considered “over-kill' to dedicate a full VC suite for one student (Verhaart & Hagen-Hall, 2012). Benefits of cross campus training using a web conferencing system had previously been identified by Fletcher (2008). Although several challenges were identified; time constraints, technical issues and less interactivity, web conferencing was seen as the solution to a student enrolment/attendance issue when there was no alternative option. From this initial offering of gxLearning, several classes over 5 years have used this scenario allowing remote participation by students unable to attend class. The configuration of software and hardware has remained largely unchanged; Adobe Connect as the gxLearning environment, a webcam and microphone for video and audio and the remote students access the online class on their PC's, laptops, tablets or smartphones. Students in class are encouraged to login to Adobe Connect, and each class is recorded for later viewing and revision.

Adobe Connect provides a number of features enabling the class lecturer to share lecture notes, screen demonstrations, web links and white board notes as well as providing the communication stream between the class and the remote students. The remote students are able to use their own webcams and microphones or the text chat feature of Adobe Connect to communicate in return with the class lecturer and other in class students. The gxLearning environment has also enabled international guest speakers the ability to interact with both the face-to-face and remote students providing a global perspective in the context of their studies.

Case 2: 2015 field trip

EIT's Digital Learning Technologies (DLT) course aims to provide students with practical experience of implementing digital technologies in an education or training environment (EIT, 2015). It also introduces students to related pedagogical approaches and learning theories, and is an ideal course to experiment with technology/pedagogy relationships while meeting the learning requirements. In 2015 students participated in a field trip, visiting EIT's School of Music to experience how digital learning technology is utilized in a classroom setting. Field trips are recognised as providing an opportunity to increase student engagement, knowledge and motivation (Behrendt & Franklin, 2014) while also providing a learning experience that connects class based learning to the real world (Wu, 2009). Based in Kolb's (1984) experiential learning theory the field trip encouraged students to experience, reflect and review, and finally apply their learning to a new scenario (in this case, the production of their own digital learning artefact). Students who were unable to attend the field trip f2f, participated virtually by logging in to the class Adobe Connect session. This session was managed using two mobile devices controlled by the class lecturer and attending education adviser. An iPad streamed the audio and video and a laptop was used to facilitate chat based discussion and questioning with the remote students.

Students who attended the field trip were encouraged to use mobile devices to capture evidence of their visit, make notes and upload their photos or videos to a shared class blog. As an assessed item, the students were asked to share in the blog:

Reflections on the issues surrounding the use of digital technologies during the field trip,

List the strengths, weaknesses, opportunities and threats when using these technologies, and

Reflections on some of the considerations when designing learning for remote participation (Day & Verhaart, 2015).

The remote students also completed the assessed activity, and offered a unique perspective on the experience. Eighteen students attended the field trip face-to-face and ten students attended remotely.

Case 3: 2016 field trip

In the early part of 2016, the DLT students were again taken on a field trip, this time to a sustainable house project located near campus. While the project was of interest, it was the use of technology while in the field that was the primary focus. The students were to use mobile technologies not only to record field based evidence, but also to experience the capabilities of current mobile technologies to enable remote student inclusion within an Adobe Connect supported gxLearning environment. As an extension of the 2015 field trip, this trip was not supported by the campus Wi-Fi infrastructure. Two cycles of Kolbs (1984) experiential learning cycle (see Figure 1) was used as the theoretical foundation when planning this field trip. The first cycle was the learning undertaken by the session planners (course lecturer and the education adviser) during the field trip planning visit and the second is that of the students during the actual field trip (Day & Verhaart, 2016).

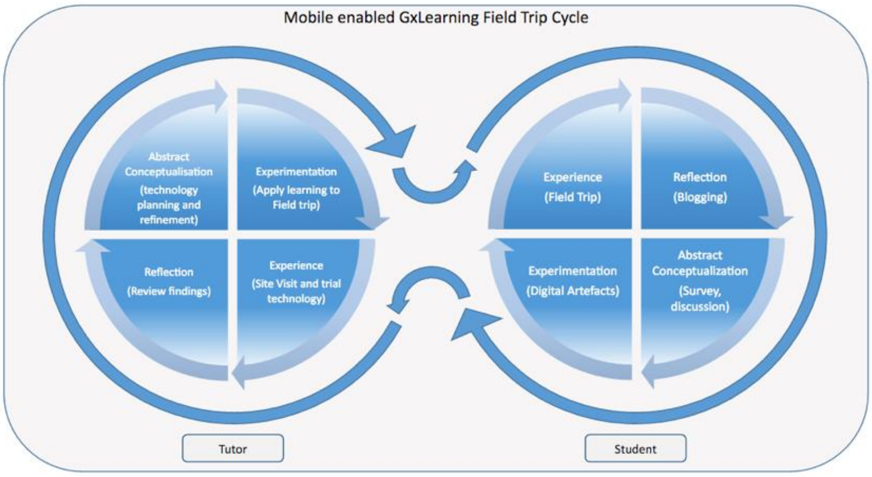

Figure 1. Two cycles of experiential learning used in this case study (Day & Verhaart, 2016)

As the field trip was planned outside the institutes Wi-Fi coverage area, a pre-site field visit by the course lecturer and education adviser was done. This tested the technologies required, allowed a "dry-run", and helped to decide on the strategies needed. The visit was also attended by the project manager (a PhD student) who would host the students during the actual field trip. As stated by Scarce (1997), "good field trips are made possible by instructors' attention to detail" (p. 3). The pre-field trip visit revealed varying 3G/4G data connection strengths and speeds with a high degree of latency. This resulted in a proposed field configuration of one mobile device to deliver the gxLearning video stream and the other to manage the audio and chat capabilities (Day & Verhaart, 2016).

On the day of the actual field trip, outcomes and expectations for the trip were explained to students in a short class session. Mobile devices running the Adobe Connect app provided the communication link to remote students while in the classroom, during the short walk to the field site, and the field visit itself. As planned, one smartphone was dedicated to managing the audio and chat streams with the remote students and another the video feed. However, students tested the limitations of their own mobile devices by communicating with their remote peers using the Adobe Connect app chat feature, and photographing and videoing their observations. Due to a miscommunication between the field trip organisers and the project manager, it was left to the class lecturer to introduce and explain the project. This was achieved without difficulty due to the earlier site visit and discussions. Following the field trip, students completed an individual reflective blog post detailing their technology experiences, reflections on the gxLearning environment as a remote field trip enabler and to offer recommendations for improvement. To complete the learning cycle, students engaged in discussion on how mobile and gxLearning may be used in the context of developing their own learning objects.

Research Methodology

Purpose

The purpose of this research was to determine the requirements needed for effective learning in a gxLearning environment. Over the past five years, a variety of technological, theoretical and pedagogical approaches have been taken to deliver several courses in this way. The delivery of these courses form the foundation of the multiple case study approach taken here. Due to the complexities of implementing the gxLearning environment, and the large number of variables that needed to be considered, case studies provide a methodology by which the phenomenon can be studied in both a longitudinal and holistic manner. Yin (2014) describes the use of a multiple case study approach as suitable when 'replication logic' reveals similar results. These results can then form the basis of a theoretical framework where conditions and outcomes can be constructed. This research was approved in 2012 by EIT's Research and Ethics Approvals Committee under the umbrella of approval granted for gxLearning and the #npf14lmd mobile project research. An updated ethics approval was submitted and approved in 2016.

Method and data collection

Multiple sources of evidence form the empirical evidence within each case study, and includes a longitudinal survey capturing student feedback, a focus group, student reflective blogging, lecturer and education advisor reflections and direct observations. Together the findings offer multiple perspectives for analysis, interpretation and consolidation into a model for effective gxLearning. For this study, responses that specifically mention technology, teaching approaches, communication, benefits or challenges to learning have been extracted.

Longitudinal survey
A small online survey has been gathering feedback from students that have participated in classes using the gxLearning environment; DLT (2012-16), Advanced DLT (2015-16), and Advanced Internet and Web (2012-16). The survey captured use, benefits, disadvantages, and level of engagement and enjoyment when using Adobe Connect for remote participation. Likert items that articulated a variety of usage scenarios, with 1-5 scaling (1 indicating an awful experience and 5 a great experience) and an unstructured answer area was included, as was a selection of demographic questions, such as gender, age range and perceived computer ability. The anonymous survey was distributed electronically to students through the learning management system course pages. Since it was first distributed, 83 valid survey responses have been collected. From those responses, most (63) indicated they have had a good or great overall experience, 17 indicated a neutral experience and 3 indicated a bad or awful experience. Most indicated they have been engaged, or very engaged in the course they took, 59 indicating that the technology used in the course positively influenced their engagement. Previous research resulting from this survey indicate that students appreciate gxLearning because of its flexibility, access and convenience (Verhaart & Hagen-Hall, 2012; Day & Verhaart, 2015).

Class and student blogs
Students participating in the 2015 (Case 2) and 2016 (Case 3) DLT classes were asked to post reflective comments about their experiences into a joint class blog or individual blogs respectively. The reflective feedback and comments have been extracted and added to the collection of evidence for analysis. Combined, this represents evidence gathered from 53 students who blogged over a two-year period.

Focus group
In 2015, the DLT students (Case 2) also participated in a focus group that took place in normal class time. Questions were displayed in a shared Google Doc, allowing students working remotely an opportunity to add their answers and feedback to the document. The focus group questions asked the students to further describe their experiences of attending (either f2f or virtually) the field trip. Comments were transcribed from the Adobe Connect video recording of the class, from the Google doc and from the chat stream within Adobe Connect. The focus group discussion included 28 students, 12 of whom were in the face-to-face class and 16 who attended virtually. The transcribed comments have been considered as part of the overall evidence.

Lecturer and Education Advisor reflections and observations
Over the course of these case studies, one lecturer has been the primary facilitator of all classes. Comments, observations and reflections from the teaching perspective have been collected since 2012 and record the changes, challenges and successes. An education advisor in learning technologies has also been involved in one course in the role of guest lecturer and offers alternative perspectives to the events described in the case studies.

Case Findings and Analysis

To develop an understanding of the requirements to successfully implement gxLearning, student responses that specifically mention technologies, teaching approaches, interaction, communication, and benefits or challenges to learning were extracted from the survey, focus group transcriptions and blogs. These were consolidated into representative themes which are supplemented by lecturer and education advisor observations and reflection.

Technologies

Adobe Connect
While students appreciate the flexibility and convenience offered by the gxLearning environment, their experiences as remote students joining in a f2f class offer valuable insight into overall effectiveness of Adobe Connect as the enabling technology. Students in the DLT class appreciated being able to explore a digital technology directly in the context of their studies, “I came to know about new technologies and how to use them” and “I got a chance to explore modern learning technologies”. Students also showed an appreciation of the technical requirements when using this modality, “The more complex and more useful technologies go often hand in hand with higher requirements in terms of hardware and technical understanding” and noted that it is “important that the technology is easy for people to understand and use, such as Adobe Connect”. Negative feedback over the last 3 years has focused consistently on the poor audio quality “sometimes the audio is not very clear” and this is particularly problematic for international students “The sound quality is really poor. Especially for non-native speakers it is even harder to understand the lecturer when recorded in a poor sound quality”. Despite the ongoing audio issues, one student noted that Adobe Connect was “excellent for video conferencing online”. At the simplest level Adobe Connect allows some collaboration tools such as a white board and break out rooms for discussion. The text chat mode is very useful, however this becomes hidden during screen sharing making it difficult for one lecturer to manage both the classroom and online during these times. Adobe Connect works best with uploaded presentations but screen sharing of applications, browser based content and video provides the greatest versatility when teaching. Although the text chat is difficult for the lecturer to manage, it does allow students both online and

f2f to interact and back channel discussions do happen.

Classroom

The f2f students often had opportunity to interact with their remote peers using their own technologies in class, or, if the class was held in a computer lab, to use the technologies there. Although a small number of classrooms with VC facilities are available, the demand on these rooms are heavy, was considered not a good use of resource for limited student numbers, and was restricted to other campus VC rooms. Although experience showed students had the best interactive experience if they had their own devices, some did provide their thoughts about the classroom technologies. A few noted the time it took to set up the technologies, one student commented that it, “always takes some time so set everything up” and made reference to the limitation of hardware “if you do not have the appropriate hardware, the software's potential cannot be fully used”.

Setting up the classroom in order to use Adobe Connect in the gxLearning environment requires many layers. A typical sequence to get the technology ready is as follows;

1. Lecturer’s computer (the meeting host), webcam, projector and smartboard (where available) configured
2. Zoomit (screen zoom and annotation tool) installed (if no smartboard is attached)
3. Adobe Connect run in Internet Explorer, and setup process completed; recording feature configured, started and paused; microphone and webcam enabled and screen shared
4. Check remote students can hear the audio, see the screen share and check if they have a microphone and want it enabled (rarely in large classes)
5. Start web browser and load teaching material
6. Start recording when ready.

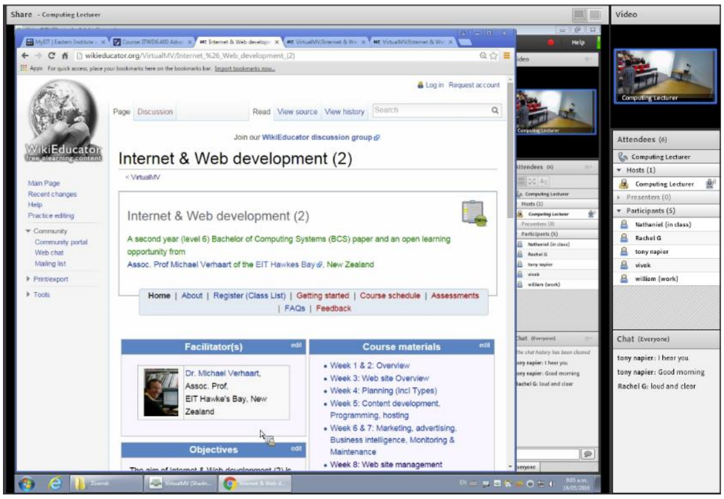

Figure 2. Screenshot of completed Adobe Connect setup

In order for a single class lecturer to manage both the class presentation, screen sharing and remote student chat and video feeds, all needed to be displayed on the primary screen to allow for easy monitoring. To achieve this, the full screen was shared within Adobe Connect, giving a view within a view to the remote students and in the recording (see Figure 2). This can be avoided if each class has the luxury of Bell, Cain and Sawaya’s (2013) “Technology Navigator” to manage the remote cohort on a separate device.

In an attempt to improve the audio and video feed the class lecturer has experimented with various webcam, microphone combinations and solutions. A small USB powered web-cam was initially used and was placed facing the lecturer. Sound quality from the lecturer was acceptable, however due to the angle, questions from the class were inaudible to the remote students. This was mitigated by the lecturer repeating the class questions as they arose. However, in order to try and capture the student questions in the moment, a USB extender cable was used to position the webcam further back into the classroom. Unfortunately, the audio degraded too much to be useful. Next a conference camera/microphone solution was trialed. This required a lengthier set-up process, and still the audio quality was at an unacceptable level. In all cases, the narrow fields of view from the different cameras limited the remote students’ view of the class.

The next equipment trial consisted of a wide angle webcam (90degree) with a magnetic mount attached to the whiteboard positioned at the front of the class. This allowed a side view of the lecturer and some of the class to be visible to the remote students. As long as the lecturer stood facing the microphone this was an improved solution. A USB 3 extension cable was needed to connect this setup to the lecturer computer and provide the extended reach needed without degrading the audio. In the student observations, one noted “ok if the audio can be improved, maybe if the tutor has a separate microphone that is attached to him/her”. A dual microphone (lapel and handheld) solution is currently being trialed, and daisy chained microphones are being considered.

While proving effective, an issue is that the battery life of the roving microphones is limited. The use of USB power banks with battery life indicators is being explored as a solution.

A separate issue is the ability of remote students to talk back to the class. While it would be desirable to have rooms set up with quality speakers this is not often the case. After much experimentation a wired USB powered speaker of at least 20 watts was found to be suitable for a computer room holding 30 students. It should be noted that remote students are reluctant to talk to the class, and to maintain audio quality one participant only should have the microphone enabled. The variety of technologies trialed are shown in Figure 3 and listed in Table 1.

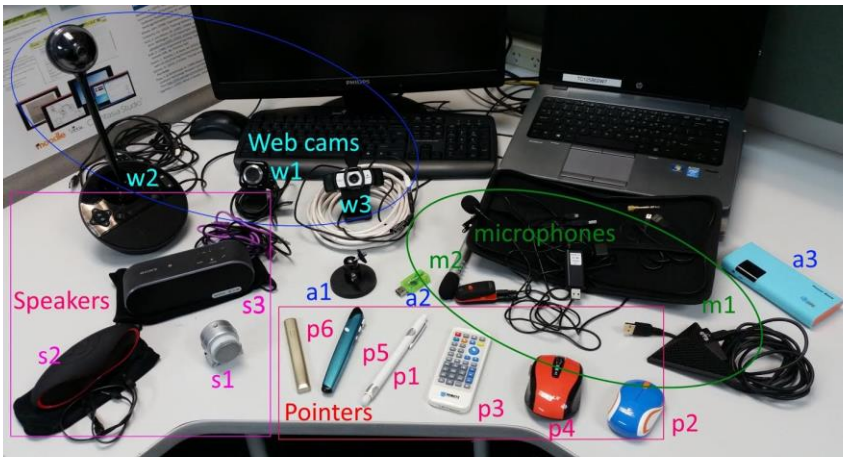

Figure 3. Technologies used

Table 1. List of equipment trialed and used

Speakers	Webcams	Microphones	Pointers	Accessories
s1 Microspeaker 2W *s2* Bluetooth/wired speaker 4W *s3* Sony Bluetooth/wired speaker (20W)	*w*1 Microsoft *w2* Logitech Conference Camera (ET) *w3* Logitech C930e 90deg	*m1* Multidirectional triangle (conferencing mic) *m2* dual lapel and portable	*p1* Smartboard pen *p2* Wireless Mouse *p3* multifunction remote (include mouse paddle) *p4* Bluetooth mouse *p5* Pen mouse *p6* Air mouse	*a1* Magnetic GoPro mount for webcam *a2* USB audio dongle *a3* USB power bank

Remote

Remote students reported using a variety of technologies to access the gxLearning environment. Notable was their use of mobile technologies, indicating the ease at which they could access class from anywhere, "So I could always attend the class through my cellphone at my work easily", "Even without a computer, I can still use a smartphone to attend class. I can also bring a laptop with me on a trip and watch on there or borrow someone else's machine". Students also experienced the odd technological issue, "I couldn't get my microphone to work but will endeavour to rectify this for next time" and at times struggled with poor internet connection "If you have a slow bad internet nothing can be done at a feasible level". Adobe continue to improve Connect giving better experiences on student devices. Once relying on Flash technology, Adobe Connect is moving towards a fully featured HTML5/Web Real Time Communication (WebRTC) application, and ongoing improvements in this area should see more students using the gxLearning environment while on the move.

Mobile

The field trip case studies highlighted a number of issues when using mobile for gxLearning. Firstly, any issues experienced are exacerbated when using mobile devices with either Wi-Fi or 3G/4G connectivity. Sound quality degrades due to network latency and hardware restrictions and the Adobe Connect mobile app is not as developed as the desktop version. However, mobile does enable remote student participation. Mobiles can serve multiple purposes; connecting cohorts of students, enabling communication and for capturing multimedia for reflective purposes. Mobile technology capability is evolving, data speeds increasing and therefore the use of mobile is seen as a way to continue supporting field based learning for diverse student cohorts.

Communication and cloud tool integration

The gxLearning environment acts as a communication channel, facilitating discourse between classroom and remote students. To this end, the ability of the environment to support effective communication across a number of channels is paramount. Students had mixed views on this ability. Some considered it a lesser experience, "The inherent remoteness of presence and sound making for a lesser quality learning experience..." and with reduced interaction, "Student lose interaction with other classmates and tutor". Although voice and/or text features were available to students, some implicated the technology more as a barrier than an enabler; "chat is a bit labored" and "Asking questions was tricky. First the microphone had to be turned on (It's off to reduce interference), then you had to wait for a pause in the lecturers speaking to pop your question in, or wait until they had finished speaking". Other students reported on the communication aspects positively, "you can talk to other people privately if you so wish" and "Questions seemed easier to ask and be answered". Some appreciated the diversity offered, "It was cool having some people in different cities being in the class and talking" and "using this technology enables you to connect with students from other institutions and provides a great Q & A forum".

Although research reveals that web conferencing can increase engagement, particularly with online classes (Gurell, Kuo & Walker, 2010), the challenge is to address the issues reported by students within the mixed mode gxLearning environment. It has been observed over the course of these case studies that remote students are often reluctant to talk back to the class. To enable their participation, particularly in discussion activities, such as brainstorming, contributing to written discussion and communicating progress, additional technologies, such as Google Docs, have been introduced as part of the wider ecosystem. This provides alternative, active and collaborative workspaces for both the f2f and online students.

Other engagement strategies included: students' blogging to encourage reflective practice and as part of the course assessment; social media streams to encourage sharing of ideas and resources and the use of wikis (e.g. wikiEducator) to enable collaborative authoring; and actively using cloud tools as part of their investigation into learning technologies.

Pedagogical approaches

The gxLearning environment supports multiple teaching and learning approaches. Lectures provide an instructivist approach; group activity with Google Docs, discussion and collaboration fulfil the needs of a constructivist approach and interaction within social networks support the connectivist approach. The environment also enabled experiential learning in the form of the field trips, and supported a variety of student learning preferences with Adobe Connects multi-modal communication channels. All these approaches have been trialed and successfully implemented during the course of these case studies.

Student participants reflected on the pedagogical implications of the gxLearning environment comparing their f2f experiences with that of attending remotely. One student was particularly insightful about the necessary teaching skills, "The teacher must be skilled (and preferably at expert level) across all domains: pedagogy, instructional design, the subject material to be presented, the technology used for delivery and managing two audiences before, during and after delivery". As expected, some students naturally preferred f2f learning, particularly the immediacy of the interactions and the perception of a greater personal atmosphere, "Being physically present enables you to interact more fully with lecturers and the class and be aware of more", "Face-to-face meeting is much more better because you get to see the whole room, get to see clear writings on the board and not just the one the tutor is sharing on the screen and be able to raise a question which the tutor can address right away". Others found gxLearning equally effective, "Brilliant, just as effective and suits my way of learning" and appreciated the sharing opportunities offered, "Collaboration capabilities, sharing work in one easy to manage place". One student offered thought on how to enhance the gxLearning process, "Solutions to manage the workload include teaching assistance with the audience(s), technical assistance to set-up and troubleshoot the technology; administration assistance (or automation) to complete class attendance records and assistance with instructional design and implementation".

Recordings

Adobe Connect also comes with a recording feature where the activity within the environment can be saved as a video file and made available for viewing at a later time. The benefits of this was also appreciated by participants, "I could review the session more than once later at home. This ensured that I understood the lesson objectives, activities and was able listen to any questions or feedback from the students and lecturer who were in attendance", "I like being able to catch up on a recorded session if there was a particular topic that the tutor covered that I just wasn't grasping the concept of. Apa referencing for example. or the methodology for project proposal. it was beneficial because I was able to go back and review the guest lecturer that spoke about this topic". Consistently comments included the words "review", "revise" and "repeat".

Conclusion, requirements and recommendations for gxLearning

This research, while ongoing has highlighted a number of requirements needed to ensure successful learning and teaching in the gxLearning environment. In all cases, the quality of the hardware and infrastructure had an impact on the student experience, whether it be lesser computing power, slow internet connection, or under spec'd audio or video equipment. A poor audiovisual experience and other technological difficulties are major contributors to noise, those disruptions that interfere with communication and the learning process. In some cases, international students experienced additional noise, where the time taken to understand and comprehend as part of their learning process was lengthened due to English being their second language. Notable was the importance of the class recordings as a tool to allow these students a way of going back over the class session in their own time and at their own pace.

Several key dependencies to providing students with a valuable gxLearning experience were revealed during the study. Paramount to students learning was the provision of clear audio, however, students' participation and reflections indicated that even with poor audio there were many advantages in providing the gxLearning option. Also important was their ability to participate 'on the go' and independent of location. Some remote students felt the isolating effects of not being in class, however the class lecturer has integrated a variety of web based activities that allow multiple opportunities for both cohorts of students to engage and interact. Recordings proved invaluable, with students repeatedly indicating their appreciation of these for revision, catching up on missed sessions and preparing for assessment.

The gxLearning environment supports multiple pedagogies approaches. However, a degree of creativity and confidence, and a pragmatic approach by the educator is needed to cope with both the technologies used, and the varying technological abilities of the students, both in and out of the classroom.

Limitations

These case studies are limited by the small sample size and the unique contexts in which they occurred. The students participating in learning using the gxLearning environment are primarily second and third year undergraduate IT students. As such, they have the technological skills and digital literacy capability to understand, use and troubleshoot the technologies used.

Future work

As these case studies show, the quality of the student experience has largely depended on the quality of the devices used for audio and video communication. Over time, newer technologies will be tested and integrated into the gxLearning environment as they become available. Furthermore, it is intended to produce a model of learning that reflects the theoretical and pedagogical approaches, the technologies used, and the practicalities of learning and teaching in this way. It is envisaged that this model be used as a guide by educators who wish to extend their classroom teaching and synchronously inclusive of remotely located students.

References

Adobe. (2016). Why Adobe. Retrieved from http://www.adobe.com/products/adobeconnect/enterprise.html

Beatty, B.J. (2007). Hybrid classes with flexible participation options – If you build it, how will the come? Retrieved from http://www.aect.org/pdf/proceedings07/2007/07_3.pdf

Behrendt, M., & Franklin, T. (2014). A Review of Research on School Field Trips and Their Value in Education. *International Journal of Environmental & Science Education*, 9, 235-245. Doi: 10.12973/ijese.2014.213a

Bell, J., Cain, W. & Sawaya, S. (2013). Introducing the Role of a Technology Navigator in a Synchromodal Learning Environment. In J. Herrington, A. Couros & V. Irvine (Eds.), *Proceedings of EdMedia: World Conference on Educational Media and Technology 2013* (pp. 1629-1634). Association for the Advancement of Computing in Education (AACE).

Bell, J., Sawaya, S., & Cain, W. (2014). Synchromodal Classes: Designing for Shared Learning Experiences between Face-to-face and Online Students. *International Journal of Designs for learning*, 5(1). 68-82. Retrieved from http://www.researchgate.net/profile/William_Cain3/public ation/264220501_SYNCHROMODAL_CLASSES_DESI GNING_FOR_SHARED_LEARNING_EXPERIENCES_BETWEEN_FACE-TOFACE_AND_ONLINE_STUDENTS/links/53d257240cf2 20632f3c9155.pdf

Bonk, C., & Graham, C. (2006). *The Handbook of Blended Learning. Global Perspectives, Local Designs*. California, USA: John Wiley & Sons.

Bower, M., Kenney, J., Dalgarno, B., Lee, M.J.W. & Kennedy, G.E. (2013). Blended synchronous learning: Patterns and principles for simultaneously engaging co-located and distributed learners. In H. Carter, M.

Gosper and J. Hedberg (Eds.), *Proceedings of the 30th ASCILITE Conference.* Sydney, Australia, 1st-4th December 2013. Available at: http://www.ascilite.org.au/conferences/sydney13/program/papers/Bower.pdf
Butz, N. T., Stupnisky, R. H., Peterson, E. S., & Majerus, M. M. (2014). Motivation in synchronous hybrid graduate business programs: a self-determination approach to contrasting online and on-campus students. *MERLOT Journal of Online Learning and Teaching*, 10(2). Retrieved from http://jolt.merlot.org
Day, S., & Verhaart, M. (2015). Integrating cloud and mobile technologies in experiential learning: From reality to reflection. In M. Verhaart, A. Sarkar, E. Erturk & R. Tomlinson (Eds.), *Proceedings of the 6th Annual Conference of Computing and Information Technology Education and Research in New Zealand incorporating the 28th Annual Conference of the NACCQ, Queenstown, New Zealand*, 6th-9th October 2015 (pp. 38-44). Retrieved from http://www.citrenz.ac.nz/conferences/2015/pdf/2015CITRENZ_1_Day_GxLearning_v5.pdf
Day, S., & Verhaart, M. (2016). Beyond Wi-Fi: Using Mobile devices for gxLearning in the field. In M. Verhaart, A. Sarkar, E. Erturk & R. Tomlinson (Eds.), *Proceedings of the 7th Annual Conference of Computing and Information Technology Education and Research in New Zealand incorporating the 29th Annual Conference of the NACCQ, Wellington, New Zealand*, 11th-13th July 2016 (pp. 27-33). Retrieved from http://www.citrenz.ac.nz/conferences/2016/pdf/2016CITRENZ_1_Day_gxLearning_16-3.pdf
Eastern Institute of Technology (2015). *Digital Learning Technologies*. In EIT Staffnet, Central Program Repository, Current
Fletcher, K. (2008). Blazing training trails with Wimba classroom to avoid travelling 'round the mountain. In *Proceedings of the 36th annual ACM SIGUCCS fall conference: moving mountains, blazing trails (SIGUCCS '08)*. ACM, New York, NY, USA, 181-186. DOI=10.1145/1449956.1450011 http://doi.acm.org/10.1145/1449956.1450011
Gurell, S., Kuo Y. C., & Walker A. (2010). The pedagogical enhancement of open education: An examination of problem-based learning. *The International Review of Research in Open and Distance Learning*. 11(3), 95-105
Kolb, D.A. (1984). *Experiential learning: experience as the source of learning and development*. Retrieved from http://academic.regis.edu/ed205/kolb.pdf
Miller, B. M., Risser, M. D., & Griffiths, R. P. (2013). Student choice, instructor flexibility: Moving beyond the blended instructional model. *Issues and Trends in Educational Technology, 1(1).*
Scarce, R. (1997). Field trips as short-term experiential education. *Teaching Sociology*, 25(3), 219.
Verhaart, M. & Hagen-Hall, K. (2012). gxLearning, teaching to geographically extended classes. In M. Lopez, M. Verhaart (Eds.) *Proceedings of the 3rd Annual Conference of the Computing and Information Technology Research and Education of New Zealand Conference (Incorporating the 25th NACCQ Conference)*, Christchurch, New Zealand. October 7 – 10. pp 75-81.
White, C.P., Ramirez, R., Smith, J.G. & Plonowski, L. (2010). Simultaneous delivery of a face-to-face course to on-campus and remote off-campus students. *TechTrends*, 54(4), 34-40.
Wu, H-J. (2009). *Using field trips to enhance student learning in operations management: Literature Review and Field Observations*. Retrieved from http://www.csupom.org/publications/2009/2009-17.pdf
Yin, R. (2014). *Case Study Research: Design and Methods [Kindle edition]*. Thousand Oaks, CA: Sage.

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Digital learning: an important ingredient in equity of access to university

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Many countries have policies to improve the equality of opportunities afforded by higher education; to enable people from a wider range of backgrounds to benefit. In recent decades, Ireland has experienced a dramatic expansion in higher education (HE) participation. However, research indicates that certain groups continue to be under-represented; namely those from lower socio-economic backgrounds. Additionally, when working class students do participate in higher education they don't necessarily complete honours degree programmes. The possibility of economic mobility provided by lower level courses is often slight as they tend to have a low value in the labour market. Furthermore, costs associated with travelling, or having to live away from home while studying, present a significant barrier to accessing full-time HE for many working class students. Based on a case study of 268 distance graduates from Dublin City University (DCU) Ireland, this paper argues that without digital higher education provision, significant progress in widening participation is improbable.

Keywords: Graduates; university; distance; access; online.

Introduction

Many countries have policies to improve the equality of opportunities afforded by higher education; to enable people from a wider range of backgrounds to benefit (Thomas & Quinn, 2007 p.1). In recent decades, Ireland has experienced a dramatic expansion in higher education (HE) participation. The progression rate, currently at 52% (HEA 2014) is set to increase to 72% by 2020 (EGFSN 2007 p. 92). However, research indicates that certain groups continue to be under-represented; namely those from lower socio-economic backgrounds and adults over 23 years of age (Harmon & Foubert, 2011). These groups are unlikely to be mutually exclusive as adults often delay their participation in higher education for reasons related to social class (Croxford & Raffe 2014). Social class[10] remains one of the most significant determinants of whether or not an individual will participate in higher education in England, Ireland, Scotland and the United States (Chowdry et al. 2013, Harmon & Foubert, 2011, Ianelli 2011, Piketty, 2014).

When working class students do participate in higher education they often choose less elite[11] institutions (Furlong & Cartmel 2005; Gallacher 2009; Ianelli 2011; Smyth & McCoy 2009; Sutton Trust 2010). Various reasons are proposed for this in the literature. In Ireland middle class families invest heavily in second level education resulting in young people from higher socio-economic groups performing better than those from working class backgrounds in the competition for university places (Denny 2010). The costs associated with travelling, or having to live away from home while studying, also present a significant barrier to attendance (Cullinan et al. 2013). This can result in working-class students selecting institutions on the basis of proximity to where they live, rather than institutional status (Cullinan et al. 2013; Furlong and Cartmel 2005; Greenbank & Hepworth 2008), a factor which may later impact on their employability. Financial concerns also result in students applying for institutions where courses will be shorter; almost inevitably less elite courses (Furlong & Cartmel 2005). Where the increase in higher education participation is for qualifications below honours degree level (level 8) this can be problematic, as it is felt that the normal arguments relating to the benefits of higher education are 'usually based on more traditional undergraduate degree courses' (Gorard, 2008 p.427). Those with honours degree qualifications, or higher, find it easiest to obtain employment (OECD 2012). The possibility of economic mobility therefore, provided by lower level courses, is often slight as they tend to have a low value in the labour market.

[10] While there is no widely agreed definition of social class, occupation and education attainment remain the most widely used indicators.
[11] The term *elite* is commonly used in the literature in association with *institutions* which are ranked highly in national and international league tables; *employment* where graduates are fast tracked to well-paid positions of authority and *courses* which lead to elite employment.

The Research Context

The context for this research is Dublin City University (DCU). DCU is primarily a university for full-time on campus students, and has approximately 15,000 students in that cohort. DCU has also been providing distance education since 1982 and currently has approximately 1,000 distance students on undergraduate and postgraduate programmes. DCU's distance students are primarily located off-campus and have minimal attendance requirements. It is this which distinguishes them from part-time students. The undergraduate distance degrees have a blended delivery format with mostly optional attendance and mostly digital/online delivery.

Method

Participants in this DCU study are those who have graduated with an honours primary degree, which in Ireland is classified as a level 8 degree and is a Bologna first cycle qualification, through distance education. The concept of access is understood 'to encompass not only entry to higher education, but also retention and successful completion' (EAN 2015; HEA 2008 p.14). For this reason the focus of this paper is on graduates. All those who graduated between 2012 and 2015 (n=268) are included in this study. This paper reports on findings from institutional records (n=268) and a web-based survey (n=126 respondents, representing a 47% response rate). Ethical approval was obtained from DCU's Research Ethics Committee for this research. The main research questions are:

- Who are distance graduates? Are they new to, or from groups underrepresented in, university education?
- Why did they choose to study by distance education rather than full-time or part-time?

Findings

Who are distance graduates?
Institutional records tell us that the majority of distance graduates were male (57% n=140) and in the 30-49 age group (72% n=193). A large percentage had never been in HE before (34% n=92). A similarly large percentage (40% n=106) had participated in previous further (25%) or higher (15%) education but at a level lower than the degree they subsequently completed by distance education. Sixty-eight per cent had completed this prior learning on a part-time basis.

It was possible to establish the employment group of the majority of graduates (66% n=178) at commencement of their studies. The largest single group belonged to the non-manual group at entry (43% n=77). The Irish government targets those from this group for increased participation in full-time HE (HEA 2015, p 4) as they are significantly underrepresented compared to their numbers in the wider national population (HEA 2015 p.35). The non-manual group includes 'occupations such as clerical workers…, sales assistants and secretaries' (CSO 2011, p.24). Both European and Irish policy stress the importance of higher education being reflective of the diversity of civil society (DES 2014 p. 5). Based on their prior education and occupation a large number of the graduates in this study were characteristically working class on entry to the distance degree programme.

The survey sought information on the socio-economic background of the graduates together with the reasons why they had chosen distance education. Parental economic status at the time students' complete compulsory education influences whether and how they participate in HE (Bourdieu & Passeron 1977). Survey findings (table 1) indicate that 41% of graduates in this DCU study (N=52) came from a background where their father belonged a lower socio-economic group. A further 13% (N=16) of graduates' fathers had not been contributing to the family income at the time when the graduate was leaving compulsory education. (The socio-economic categories specified in Table 1 are mutually exclusive; individuals are classified into one group only.) In contrast, 26% of *new entrants* to full-time university came from a similar background. Thirty nine per cent (N=49) of respondents categorised their mother to 'home duties', a category of unpaid work.

Parental education is a significant factor when deciding to proceed to higher education (Flannery & O' Donoghue, 2009). In Ireland, young people with neither parent educated beyond primary school level are very unlikely to attend full time higher education (CSO, 2011 p.22). It is interesting therefore that the largest single group (30% N=37) of distance graduate respondents were from backgrounds in which the full time education of their father had stopped at primary level or included no formal education (see Table 1).

Table 1: Socio-economic status and educational attainment of respondents and their parents together with socio-economic background of new entrants to full-time Irish university

Socio-economic status	**Respondent**		**Respondent's father**		**Respondents' mother**		**Full-time University New entrants* (for comparison purposes)**
	%	N	%	N	%	N	%
Employer/manager	6%	8	12%	15	4%	5	18.8%
Professional	55%	69	24%	30	18%	23	23.8%
Non-manual	16%	19	6%	8	14%	18	9.9%
Skilled manual	3%	4	25%	31	3%	4	8.2%
Semi or unskilled manual	7%	9	10%	13	17%	21	7.8%
Farmer (200 acres or more)							7.1% (farming-general)
Farmer (less than 200 acres)			9%	12	2%	2	
Home duties	10%	13			39%	49	6.9% (own account)
Unemployed	3%	4	1%	1			
Retired			5%	6			
Deceased			6%	8	2%	3	
Absent from home			1%	1			
Missing data/unknown			1%	1	1%	1	17.6%
Total	100%	126	100%	126	100%	126	
Educational attainment							
Primary (incl. no formal)			30%	37	24%	30	
Lower secondary		1	20%	25	26%	32	
Upper secondary	39%	49	17%	21	24%	30	
Level 6	22%	27	7%	9	9%	11	
Level 7	18%	23	10%	13	5%	7	
Level 8 or higher	17%	21	9%	11	6%	8	
Missing	4%	5	7%	10	6%	8	
Total	100%	126	100%	126	100%	126	

*Base number =22,904, response rate = 74%. These figures are for new entrants to full-time Irish university, not graduates. Source HEA (2015): Key Facts and Figures 2014/15 p. 21

Additionally, recent survey data from the HEA states that just 19% of full-time higher education students' parents' highest qualification is low secondary level or below (Harmon & Foubert, 2011, p. 21). For survey respondents in this DCU study, fifty per cent (50% N=62) of their parents (both father and mother) fell into this category. While we must be mindful that this is self-reported data, if we measure social class by occupation (Ianelli 2011) the indication is that graduates' current social class is regularly higher than their social class of origin as represented by parental occupation.

While absolute numbers of distance graduates are small, the evidence from this case at least suggests that distance education has an important role to play in broadening participation in university education by the targeted socio-economic groups. The numbers of working class students who *graduate* from full-time HE may be no higher; this figure is unknown as socio-economic background data on university graduates is not published. What we do know however, is that in Ireland there is a clear link between non-progression in fulltime HE and being from a non-manual or manual social background (HEA 2016, p.15)

Why choose distance education?

Most graduates had work and caring responsibilities; their choice of delivery mode was constrained by this. The majority of graduates (67% n=85) were in full-time (f/t) employment and their requirement to work, or be available for work, was the primary reason 71% of respondents gave for studying by distance rather than fulltime.

Thirty four per cent of graduates lived close to DCU, with a further 24% living close to another university. However, the flexibility afforded by distance education was the main reason why graduates preferred distance education to part-time study. Flexibility relating to attendance requirements was important to 69% of graduates.

> I knew that I would not consistently attend college lectures after a full day at work. (Female age 40-49 f/t employment)

Sometimes, however, the flexibility related to location:

> I looked at doing a degree in (named Institute of Technology) which required attendance at college up to 3 nights per week. This was impractical, especially since I live in Dundalk. (BSc Male age 30-39 f/t employment)

> My job at the time involved my working in Limerick, Dublin and Cork and therefore (DCU) provided the only option for me. (BA male 30-39 f/t employment)

> …flexibility. I didn't have to commit to living in one place for 4 plus years. With distance learning, if I needed to move it didn't affect my studies. (BA F Y f/t employment)

Thirty seven per cent of graduates lived in a region (county) of Ireland which did not have a local University. Digitally enhanced delivery has enormous potential to widen access to HE and support lifelong learning and continuing professional development.

Conclusion

Despite the overall increase in higher education participation levels, class differences in educational attainment persist. Distance education would appear to be addressing this imbalance and providing an opportunity to those from lower socio-economic backgrounds to broaden and deepen their access to Irish university education. Currently funding to broaden access to Irish university education is exclusively funnelled into full-time course provision. Yet we know from the literature that older students are more likely to study part-time (European Commission 2015) and that being an older student is, in turn, often related to socio-economic background (Croxford & Raffe 2014). The existing funding mechanism means that part-time flexible HE provision is hopelessly underdeveloped in Ireland. Yet it would seem that working class students want to work and study at the same time and require flexible options regarding attendance. Without flexible, digitally enhanced, part-time higher education provision, significant progress in widening participation appears improbable.

References

Bourdieu, P. and Passeron, J.C. (1977): *Reproduction in Education, Society and Culture*. (R. Nice, Trans.) London: Sage Publications.

CSO (Central Statistics Office) (2011): Levels of educational attainment at each award level: Accessed online on 21st December 2014 at: http://www.cso.ie/en/media/csoie/releasespublications/documents/education/2011/educationalattainment2011.pd f

Chowdry, H., Crawford, C., Dearden, L., Goodman, A. and Vignoles, A. (2013): Widening participation in higher education: analysis using linked administrative data. *Journal of the Royal Statistical Society:* Series A (Statistics in Society) Volume 176 Issue 2 pp. 431-457 February 2013.

Croxford, L., & Raffe, D. (2014) Social class, ethnicity and access to higher education in the four countries of the UK: 1996-2010, *International Journal of Lifelong Education*, 33(1), pp. 77-95

Cullinan, J., Flannery, D., Walsh, S. and McCoy, S. (2013) Distance Effects, Social Class and the Decision to Participate in Higher Education in Ireland; *Economic and Social Review*, Vol. 44, No 1, Spring 2013, pp.19–51

Denny, K. (2010): *What did abolishing university fees in Ireland do?* University College Dublin: Geary Institute, Discussion Paper Series, School of Economics & Geary Institute. Accessed September 2013 online at: *http://www.ucd.ie/geary/static/publications/workingpapers/gearywp201026.pdf*

EAN-European Access Network (2015): Constitution: Accessed online 20th Dec. 2014 at: http://www.eanedu.org/about-us.html

EGFSN (2007): *Tomorrow's skills: Towards a National Skills Strategy: fifth Report*. Dublin: Expert Group on Future Skills Needs.

European Commission/EACEA/Eurydice (2015): The European Higher Education Area in 2015: Bologna Process Implementation Report. Luxembourg: Publications Office of the European Union. Available online at:
http://eacea.ec.europa.eu/education/eurydice/documents/thematic_reports/182EN.pdf

Furlong, A. & Cartmel, F. (2005): *Graduates from disadvantaged families: Early labour market experiences.* York: Joseph Rowntree Foundation. Accessed online 2nd Feb 2015 at: http://www.jrf.org.uk/sites/files/jrf/1861347820.pdf

Gorard, S. (2008): Who is missing from higher education? *Cambridge Journal of Education* Vol. 38, No. 3, September 2008 421-437.

Greenbank, P., and Hepworth, S. (2008): Working class students and the career decision-making process: A qualitative stud. A PROP report for HECSU: http://www.hecsu.ac.uk/assets/assets/documents/Working_class.pdf

Harmon, D. & Foubert, O. (2011): *Eurostudent Survey IV Report on the Social and Living Conditions of Higher Education Students in Ireland 2009/2010.* Dublin: Higher Education Authority and Insight Statistical Consulting

HEA (Higher Education Authority) (2008): *National Plan for Equity of Access to Higher Education 2008-2013*. Available online at: http://www.hea.ie/content/2008-0

HEA (2016): A Study of Progression in Irish Higher Education 2012/13 to 2013/14. Dublin: Higher Education Authority. Accessed online 4th Jan 2016 at: http://www.hea.ie/sites/default/files/hea-progression-irish-highereducation_final.pdf

HEA (2015): Key Facts and Figures: Higher Education 2014/15. Dublin: Higher Education Authority. Accessed online 2nd February 2016 at: http://www.hea.ie/sites/default/files/hea-key-factsfigures-2014-15.pdf

Ianelli, C. (2011): Educational expansion and social mobility: the Scottish case. *Social Policy and Society*, 10 (2), 251-64 Cambridge: Cambridge University Press.

OECD (2012): *Education at a Glance: 2012 OECD Indicators, OECD Publishing Highlights.* Accessed online 7th Nov. 2014 at http://dx.doi.org/10.1787/eag-2012-en

Piketty, T. (2014): *Capital in the Twenty-First Century.* Cambridge: The Belknap Press of Harvard University Press.

Smyth, E. and McCoy, S. (2009) *Investing in Education: Combating Educational Disadvantage*, Research Series No. 6, May, Dublin: Economic and Social Research Institute

Sutton Trust, The (2010): *Responding to the new landscape for university access*. Accessed online Jan 2013 at: http://www.suttontrust.com/researcharchive/responding-new-landscape-university-access/

Thomas, L. & Quinn, J. (2007): *First generation entry into higher education: An international study*. New York: McGraw Hill.

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Voice-to-Text Transcription of Lecture Recordings

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Educational institutions are increasingly recognising the potential value for students that same-language-subtitles can bring to lecture recordings and other digital content. During 2016 the University of South Australia's Teaching Innovation Unit and School of Information Technology and Mathematical Sciences collaborated on a project which aimed to test our ability transcribe every piece of digital video content hosted by the University in to same-language subtitles in a cost effective way. We believe this augmentation to our existing media content would have various benefits for our students. This paper discusses the benefits of same-language transcription of media content and goes on to outline the details of a technical feasibility study.

Subtitles, Transcription, Universal Design for Learning (UDL), Same Language Subtitles (SLS)

Introduction

During the past decade, use of multimedia for teaching, particularly digital video, has become extremely widespread in higher education. This is driven in large part by the cultural shift in education towards digital and blended learning models, exemplified particularly by the flipped classroom, but also by access to affordable digital technology, faster internet speeds and a rise in digital production skill sets. As part of this shift many universities are also refitting traditional lecture theatres and building collaborative teaching spaces to augment these types of pedagogical approaches. In short, pedagogical models in higher education are changing and digital video plays a significant part in this change.

Digital video can also play a key role in increasing access for students with varying abilities. For example, the flexible modes of consumption of digital video mean that students can access their lecture or course content at a time which best suits them, they can slow down and speed it up as they need, can review material for revision or access content specifically tied to an assessment. Students usually prefer video over audio only solutions as digital video can provide richer content for learning. Provision of these options for students conforms to one of the 3 key principles of Universal Design for Learning (UDL). Principle 1 states that course content must have 'multiple means of representation' (CAST, 2011). This means that students must be able to access similar material through multiple means, thus levelling the playing field for all students. Adding same-language subtitles (SLS) is an effective way of achieving this, with numerous studies, outlined in Gernsbacher (2015),demonstrating the benefits of adding captions or subtitles to video.

The process of creating fully-automated transcriptions represents a significant technological challenge for an institution, particularly a large university that creates 100's of hours of content each week. What follows is a brief outline of the benefits of subtitling for students and the details of a feasibility study conducted at the University of South Australia to assess the current capability to provide fully-automated SLS for all our video content.

Pedagogical benefits of subtitles and transcription

The benefits of incorporating digital video in to your course content are many, and have been documented elsewhere (Kuomi 2014, Woolfitt 2015). The addition of SLS with this digital video content potentially creates an environment for students which can greatly increase not only comprehension and engagement but equitable access for a range of students with varying abilities and needs. Some of the benefits include:

1. **Increased accessibility for deaf or hard of hearing viewers** – Perhaps the most obvious advantage of subtitles or captions is their use by those with hearing difficulties (Wald 2006, Burnham et al 2008, and Stinson 2009). The advantage of subtitles for those with hearing problems is clear, but it can also mean that video becomes more accessible for all students in sound sensitive situations.

2. **Improves comprehension for all students** – SLS can have a powerful impact on comprehension for all students, Steinfeld (1998), Kothari (2008), Brasel and Gips (2014). Providing this kind of access for students is an excellent example of UDL principle 1 (Provide multiple means of representation): it can enable the curriculum for all students, not just those with disabilities. 'Multiple studies have shown that the same options that allow students with physical and sensory disabilities to access materials, specifically captioning and video description, also provide educational benefits for students with other disabilities, English language learners, and general education students.' (Sapp, 2009, p. 496)
3. **Translation into foreign languages** – As higher education becomes increasingly globalised with many courses available internationally the need to provide means of comprehension for students from a variety of language backgrounds is crucial (Kruger, Hefer & Matthew 2014). For example, 25% of the University of South Australia's internal cohort are international students and the ability for those students to easily translate course content in to various languages can aid comprehension.
4. **Enhances foreign language Learning** – Multiple studies, such as Zanón (2005), Etamadi (2012), Vanderplank (2013), and Mohsen (2015) have outlined the effectiveness of SLS for students learning a new language. This is because they influence factors like pronunciation, context, speed, reading skill, understanding colloquialisms and aid with rapid word recognition.

There are other positive aspects of SLS which may apply to the general student cohort. For example, this more flexible style of delivery aid to personalised learning – students are able work at their own pace and blend the time and place of their learning. Subtitles and transcripts can also help make content searchable, so students can locate the relevant information among an enormous amount of material.

Outline of Research Project – Design and Methodology

In order to test our capability to create fully-automated subtitles for all our digital video content we conducted a feasibility study. We used an automated process to transcribe sample videos housed on our dedicated media server. What we aimed to test was the accuracy vs. cost of using automated voice-to-text generators, given that a very high level of accuracy is essential in higher education due to the use of technical and discipline specific language. A number of experiments were designed to answer the following research question: *Can automated speech-recognition provide acceptable results for lecture recordings?*
In total, 30 recordings from the university media library were used, ranging from 2 minutes (a short welcome message) to 2 hours (a standard university lecture). Four key areas were considered during data collection:

1. **Discipline area:** covering IT, law, management, engineering and health science.
2. **Single voice vs multiple voices:** Covering sole speaker and multiple speakers (seminars and workshops).
3. **English speakers from different native language background:** covering British, Chinese and Indian.
4. **With and without background noise:** Covering recordings from the lecture theatres, individual offices and classrooms.

Three engines were utilised to perform speech recognition on sample videos (used with default settings, no training required).
1. **Google Speech-to-Text:** Industry leading, available as beta-testing to selected users only.
2. **IBM Bluemix Speech-to-Text:** Industry leading, available commercially to the public (enhanced and cloud version or Dragon Naturally Speaking).
3. **CMUSphinx:** leading open source solution, developed at Carnegie Mellon, free to the public.

Unlike CMUSphinx (an offline solution), both Google and IBM engines are cloud-based and require audio data to be sent as chunks (e.g. 60 seconds per chunk). This project has also considered the potential recognition results differences between short and large chunks (large chunks contain more context so the accuracy is potentially improved).

Due to a very high volume of recordings (approximately 250,000 hours recording per annum at the authors' university) and the varying background of lecturers there are other requirements, outlined below, when adopting a speech-recognition system and preparing the audio for transcription:

1. **Speaker-independent:** It is time-consuming and nearly impossible to create training voice data sets for individual speakers. Although the training model of the Dragon Naturally Speaking software can be exported and re-used on a different machine, due to the recording hardware (different microphones) and background noise, the applicability of the training model significantly degrades.
2. **Context-specific:** University lectures often have discipline-specific terminologies. The speech-recognition engine should be capable of identifying terminology based on the content discipline.
3. **Big Data friendly:** University recordings are managed by a central server. In a large scale deployment (to take a large volume of recordings), recognition cannot be done on individual lecturer's computers, a fully automated server environment is essential.

4. **Usable results:** In addition to the expected level of accuracy, the results need to be provided to the end-users (both staff and students) in a way that makes viewing recordings more effective and efficient.
5. **Minimum human intervention:** Human transcribing and editing is expensive and time-consuming.

Further to the considerations outlined above, a typical speech recognition process includes four elements:

1. **Core engine:** Process the input audio files and match the dictionary words base on the statistical models specified in the language model and acoustic model;
2. **Pronouncing Dictionary:** It can map from words to their pronunciations (e.g. en-US, in the ARPAbet phoneme set, a standard for English pronunciation).
3. **Language model:** A simple one may contain a small set of keywords (e.g. used in automated phone answering machine) and the grammar of the language. The other variant, statistical language models, describe more complex language. They contain probabilities of the words and word combinations. Those probabilities are estimated from a sample data; and
4. **Acoustic model:** This is a statistical model as a result of a large set of training data which are carefully optimised to achieve best recognition performance (e.g. adapter to a certain accent and recording environment).

In addition to these core components, there are other components which are designed to further improve recognition accuracy. For example, speaker dependent speech recognition software (e.g. Dragon Naturally Speaker) includes a software component to build the acoustic model from the speaker's voice (which is often referred as the 'training' process). Many cloud-based engines will use the recognised keywords to search for the possible context. Once the context is identified, a more relevant language model will be used instead of the generic one. Additionally, advanced engines such as Google speech-to-text API have built-in prediction algorithms (searching the database for similar results base on the recognised keywords). Taking in to consideration this wide range of factors and variables the researchers were confident of comprehensive and nuanced results in response to the research question.

Feasibility Study Results

In terms of the way the results are expressed it is worth noting the difference between user perceived accuracy and the machine confidence indicators. Both Google and IBM engines provide a confidence indicator (1 as the highest value) for the recognition results. The researchers read the text scripts while listening to the original audio for personal judgement. It was noted that over 30 recordings, the average accuracy confidence exceeded 0.70 (the highest one being 0.981). By listening to the audio, it can be determined that the machine confidence indicators are an underestimation of overall accuracy. The actual level of accuracy is significantly higher. For example:

> **[TRANSCRIPT]** seek out an activity or resource scroll to the bottom of the page and click the URL [resource] please add into the name of the URL resource and description open the video confirmation email highlight the link right click and copy the link close the email scroll down and paste the link into the external URL field. [confidence: 0.8921]
>
> **[TRANSCRIPT]** scroll to the bottom of the page and click save and return to course click the video resource link and hit the video. [confidence: 0.9311]

The above two transcripts actually matched every single word in the original audio, yet the confidence indicators do not reach 1. This finding is consistent across all sample data. Generally speaking, user perceived accuracy is higher than the machine generated confidence indicators.

Another area of difficulty from the transcribed results relates to the issue of readability. The transcripts may have a relatively high level of word recognition accuracy but their readability is low. For example:

> **[TRANSCRIPT]** if I wish to use the Today Show two of you to manage an appointment so I can click through on appointment time and that I showed you here I get a summary of all appointments for a particular guy I can talk with you today by using the left and right arrow or using the calendar drop down I can arrange to buy stuff. [confidence: 0.7954]
>
> **[TRANSCRIPT]** information about who the appointments with and if this unit but did you see here that older white coloured Apartments off of Mormons and the purple coloured appointments are booked appointments if I have the mass of it as appointments so I can get more details about the petition appointment down the bottom here we have a link for college and our country that gives a summary of all the symbols. [confidence: 0.7577]

The above two scripts represent the general accuracy level. Although it is possible to read through the scripts by themselves, it does not provide a pleasant reading experience for various reasons:

1. **Lack of punctuation:** Nearly all recognition engines skip punctuations if the speaker does not explicitly specify (e.g. say "Full Stop"). It seems that the Google and IBM engines will occasionally put one or two while still missing the majority. During the lectures, it is simply not practical for lecturers to say the punctuations. Without full stops, the scripts become difficult to read.
2. **Lack of grammar:** During speaking, speakers tend to focus less on grammar and the completeness of sentences. There is also tendency for speakers to repeat words that they think are important. However, while reading, without grammar and sentence structures, the reading experience is further reduced.
3. **Missing words:** Different speech recognition engines have different ways of dealing with mismatches or a complete miss. The Google engine seems to ignore the words if the quality of match is low. On the other hand, the IBM engine always tries to give some results even if it is not entirely accurate (as underlined below). Unfortunately, neither approach makes reading any easier. For example:

> **[Google]** recording is protected by copyright know. Maybe we produced without the prior permission of the University of South Australia. free moving into the final of the course which is all that digital communication is going to be looking at pricing for websites like designing and driving traffic to website was going to be looking at social media in the next few weeks sorry I'm sure you're very familiar with social media.
>
> **[IBM]** This recording is protected by copyright no part may be reproduced without the prior permission at the university of South Australia. I'm. Your. Hello everyone welcome. I have to excuse me tonight if I sound a bit nicely up quite a bit of a shocker called happening side has taken it's a bad bad I'm yeah obviously just if I sound a bit strange that's why tonight so you'll have to excuse me for that. So this week we.

From the above examples, both sourced from the same recording it is evident that currently, fully automated speech recognition, is not able to provide readable scripts from lecture recordings without extensive manual editing.

Subtitle creation
One the key aims of this feasibility study was to determine whether acceptably accurate subtitles could be automatically generated. Although it is possible to read the scripts while listening to the audio (or watching the videos) we concluded that this function is not feasible (without manual editing) for the following reasons:

1. **Timestamp is not accurate:** In order to link the scripts to actual play time, the audio has to be processed in small chunks – e.g. 5 seconds. Although it is technically possible to cut the audio into 5 seconds chunks, it is not possible to ensure that the speaking words are not chopped (e.g. start speaking at 4.9 seconds and finish speaking at 5.1 seconds). The smaller the chunks are, the more likely this will happen. As a result, the recognition result will be reduced. When cutting the audio in to tiny chunks, it appears that the recognition engines are not able to identify meaningful context from several words thus reducing the quality of recognition.
2. **Silence detection:** It is possible to cut the audio base on the pauses of speaking. This approach will not be able to guarantee consistent audio duration for each cut thus making the timestamp extremely complicated.
3. **Missing words or mismatching words**: Some audio chunks may not yield any results. For example, the following result below actually missed two sentences (that's also the reason why the confidence indicator is relatively low).

> **[TRANSCRIPT]** yeah I mean it's not the place to come and I'm happy to talk to you afterwards about it but I'll let you know around 6 I should go to professional internship. [confidence: 0.6304]

Results in relation to key research areas
1. **Discipline area:** Google and IBM engines perform very well in identifying specific words from different domains. For example:

> **[TRANSCRIPT]** products with heterosexual that that this culture of metrosexualality and they're more willing to be in the sea are submissive places such as exhausted as the epitome of metrosexuality the fall of David Beckham in the top shelf there but we do have the same maybe you changes in masculinity and in this regard let me to skip across a few here and there is change in relationships have to their bodies you actually changes.

[TRANSCRIPT] the old racism and whether you're right since it was erasing some of those I'm on my way to find racism in the consequences of that and use the case study of asylum-seekers is a case to think about racism but also to think about what might be a sociological approach to studying a highly controversial contested issue like this sociology as we talked about is collecting empirical information contrasting that testing social theories developing social theories but it's also you know I can't do it is.

2. **Single voice vs multiple voices:** The recognition results from single speakers are generally acceptable. However, it is not in the case in workshops where students will ask questions. The major issue is that the audiences are too far from the recording device thus not able to provide quality audio for recognition. For example, a 3 minute group discussion only produced the following results.

    [TRANSCRIPT] Belkin netcam out why do you want to share something about yourself.

    [TRANSCRIPT] emoticons greetings examples.

    [TRANSCRIPT] yeah, yeah, yeah, yeah.

3. **English speakers from different native language background:** Despite the speakers' background, the overall results are generally acceptable. However, for native English speakers who speak slowly and clearly, the recognition results are much better. For example, the example below almost had 100% accuracy.

    [TRANSCRIPT] seek out an activity or resource scroll to the bottom of the page and click the URL resource please add into the name of the URL resource and description open the video confirmation email highlight the link right click and copy the link close the email scroll down and paste the link into the external URL field.

4. **With and without background noise:** IBM and Google engines come with noise cancellation techniques. These techniques worked well for background music, but were less ideal for background human voices. For example, the example below wasn't effected by the loud background music.

    [TRANSCRIPT] become dishonest as adults lying to customers colleagues and even their Partners but all is not lost for the next 4 weeks I will be your lead educator guiding you through an exploration of several important questions such as what is academic Integrity why is it so important in Academia and how can you as a student at University but she with Integrity in this course will explore the answer to these and other questions each week.

Commercial vs Open Source
Open source engine CMUSphinx is able to produce some results, but not on par with Google and IBM, which both generated similar results exceeding researchers' expectations.

IBM: This recording is protected by copyright no part may be reproduced without the prior permission at the university of South Australia.

Google: This recording is protected by copyright know. Maybe we produced without the prior permission of the University of South Australia.

CMUSphinx: this record is protected by copyright know what may be reproduced without our permission could the university.

Conclusion

For the creation of fully-automated, highly accurate subtitles in digital video it is recommended that a high quality audio recording is sourced, those related to podcasts rather than recorded lectures. The shorter average length of these types of recording mean manual editing would be more efficient. The level of accuracy currently available, however, is high enough to provide meaningful results for text analytics or topic modelling purposes and this is the direction in which this research now progresses. This is a potentially fruitful area of research and a function which may provide many benefits for students, though not to the extent that would fully support students in the ways mentioned above. After completing this feasibility study we concluded that, currently, none of the 3 transcription engines used are able to reach an acceptable level of accuracy for subtitle creation, without costly and time consuming human intervention. Given the amount of content produced by a university the level of manual editing would be far too costly to be of practical use.

References

Brasel, S. A., & Gips, J. (2014). Enhancing television advertising: same-language subtitles can improve brand recall, verbal memory, and behavioral intent. *Journal of the Academy of Marketing Science, 42*(3), 322-336.

Burnham, D., Leigh, G., Noble, W., Jones, C., Tyler, M., Grebennikov, L., & Varley, A. (2008). Parameters in television captioning for deaf and hard-of-hearing adults: Effects of caption rate versus text reduction on comprehension. *Journal of deaf studies and deaf education, 13*(3), 391-404.

CAST. (2011). Universal Design for Learning Guidelines Version 2.0. Wakefield MA.

Etemadi, A. (2012). Effects of bimodal subtitling of English movies on content comprehension and vocabulary recognition. *International journal of English linguistics, 2*(1), 239.

Gernsbacher, M. A. (2015). Video Captions Benefit Everyone. *Policy Insights from the Behavioral and Brain Sciences, 2*(1), 195-202.

Janfaza, A., Jelyani, S. J., & Soori, A. (2014). Impacts of Captioned Movies on Listening Comprehension. *International Journal of Education & Literacy Studies, 2*(2), 80.

Kothari, B. (2008). Let a billion readers bloom: Same language subtitling (SLS) on television for mass literacy. *International review of education, 54*(5-6), 773-780.

Koumi, J. (2014). Potent Pedagogic Roles for Video. *Media and learning association*.

Kruger, J.-L., Hefer, E., & Matthew, G. (2014). Attention distribution and cognitive load in a subtitled academic lecture: L1 vs. L2. *Journal of Eye Movement Research, 7*(5).

Mohsen, M. A. (2015). The use of help options in multimedia listening environments to aid language learning: a review. *British Journal of Educational Technology*.

Sapp, W. (2009). Universal Design: Online Educational Media for Students with Disabilities. *Journal of Visual Impairment & Blindness, 103*(8), 495-500.

Steinfeld, A. (1998). The Benefit of Real-Time Captioning in a Mainstream Classroom as Measured by Working Memory. *Volta review, 100*(1), 29-44.

Stinson, M. S., Elliot, L. B., Kelly, R. R., & Liu, Y. (2009). Deaf and hard-of-hearing students' memory of lectures with speech-to-text and interpreting/note taking services. *The Journal of Special Education, 43*(1), 52-64.

Vanderplank, R. (2016). 'Effects of' and 'effects with' captions: How exactly does watching a TV programme with same-language subtitles make a difference to language learners? *Language Teaching, 49*(02), 235-250. doi: doi:10.1017/S0261444813000207

Wald, M. (2006). Creating accessible educational multimedia through editing automatic speech recognition captioning in real time. *Interactive Technology and Smart Education, 3*(2), 131-141.

Woolfitt, Z. (2015). The effective use of video in higher education: The Hague. Retrieved from https://www. inholland. nl/media/10230/the-effective-use-ofvideo-in-higher-education-woolfitt-october-2015. pdf.

anón, N. T. (2006). Using subtitles to enhance foreign language learning. *Porta Linguarum: revista internacional de didáctica de las lenguas extranjeras*(6), 4.

Please cite as: Dinmore, S. & Gao, J. (2016). Voice-to-Text Transcription of Lecture Recordings. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 197-202).

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Learning Design Research in Action

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The new field of Learning Design is gaining traction in higher education, aiming to address a number of challenges in technology enhanced learning and teaching. This symposium seeks to build on the national Learning Design Research strengths and help highlight Australian Learning Design theory and practice expertise. It also aims to further consolidate the Australian and international Learning Design community.

The content of this submission directly addresses the following topics: An introduction of the Learning Design Framework, Generic Templates, Teacher Design Thinking in Higher Education, Connecting Connectivism and Learning Design, and Translating Learning Outcomes into Learning Designs. The symposium will be divided into five topic-based presentations. The topic discussions will be led by members of the Australian Learning Design network. Discussion will be open and audience interaction will be encouraged.

Keywords: Learning Design Research, Learning Design Framework, Connectivism, design thinking, design practice, generic templates, learning outcomes

Paper 1 – Learning Design SIG Update and an introduction of the Learning Design Framework

This presentation will provide a short overview of the rationale of the Learning Design Special Interest Group, report on the first Webinar, and canvasing ideas and Webinar topics for next year. This will be an interactive presentation inviting new SIG members to join and canvasing ideas and research topics. It will also introduce the Larnaca group’s Learning Design Framework.

Discussion Leads:
Eva Dobozy: Curtin University, Perth, Australia
Leanne Cameron: Australian Catholic University, Sydney, Australia

Paper 2 - Generic templates: Promoting the use of high quality learning designs in higher education

With research pointing to a relationship between student engagement and attrition rates, lecturers need to be mindful of a wide range of factors when designing for their students’ learning. Learning design is a professional activity for which many of our academic staff is not trained. There exist examples of learning designs which apply to the most recent research into learning, but a number of studies have shown that they are not widely utilised in all disciplines (Cameron, 2013; Neumann, Parry & Becher, 2002 and Scott, 2006). More and more generic template designs are being developed (Dobozy & Dalziel, 2016) to assist lecturers construct student-centric and engaging learning experiences. This presentation will introduce a number of these templates and explore with the audience how suitable these might be for a variety of contexts.

Discussion Lead:
Leanne Cameron: Australian Catholic University, Sydney, Australia

Paper 3 – Investigating Teacher Design Thinking in Higher Education

A routine yet important aspect of a university teacher's role is to design learning experiences for students. The field of learning design emerged as a strategy to support this design work, with a particular focus in supporting technology integration. However, in order to progress this field, we need to gain a better understanding of teachers' design work, to build an empirical evidence base so that future design support initiatives are closely aligned with teacher design practices. This presentation will summarise what we have discovered from our research about university teacher design practices. A key finding is that university teachers exhibit design thinking characteristics (Bennett, Agostinho, & Lockyer, 2016; Lockyer, Agostinho, & Bennett, 2016) thus the presentation will stimulate discussion of why it is important to conceptualise university teacher work as 'design'.

Discussion Lead:
Shirley Agostinho: University of Wollongong, Sydney, Australia

Paper 4 – Connecting Connectivism with Learning Design

Connectivism (Siemens, 2005; 2006) is a relatively new learning theory that has both advocates and detractors. Detractors and advocates seem to agree that connectivism can contribute to the current evolution of learning theories. Connectivism originates in social constructivist theories, by mixing human and non-human tools for learning, analysing and meaning making. This presentation will explore the link between Connectivism and Learning Design and provide some practical examples to illustrate this nexus.

References:
Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning 2*(1). Retrieved from: http://itdl.org/Journal/Jan_05/article01.htm.
Siemens, G. (2006a). Connectivism: Learning theory or pastime for the self-amused? Retrieved from http://www.elearnspace.org/Articles/Connectivism_self-amused.html

Discussion Leads:
Chris Campbell: The University of Queensland, Brisbane, Australia
Eva Dobozy: Curtin University, Perth, Australia

Paper 5 – Learning Design and Social Network Analysis

In this presentation we will explore the potential of Social Network Analysis (SNA) as a method to help us improve Learning Design practices. Panos will use the results from a comparative study between an intensive mode delivery and a traditional standard delivery mode of the same unit to demonstrate how SNA helped him improve his understanding of learning in collaborative activities. He will provide an analysis that shows how people learn, what they learn, and in particular with and from whom they learn. He will conclude with a discussion around the impact that learning design can have on the formation of different networks of learners online, including the impact of the role of the tutor.

Discussion Lead:
Panos Vlachopoulos: Macquarie University, Sydney, Australia

Biographies of Panel Members

A/Prof Eva Dobozy is Deputy Dean, Learning and Teaching at the Curtin Business School in Perth. Her interest and research work is concerned with the issue of effective pedagogical modelling in face-to-face, blended and online learning environments through the design of learning-centric and highly interactive curricula. Her research focuses on template construction, reuse of learning designs and small data learning analytics.

Leanne Cameron is currently Lecturer in Educational Studies in the Faculty of Education & Arts at the Australian Catholic University. She spent a number of years working on several federally funded learning design projects with MELCOE (Macquarie E-learning Centre of Excellence) and has published regularly on Learning Design. The focus of her current work is investigating how effective learning designs can be used to introduce different teaching and learning approaches to different disciplines/subjects.

A/Prof Shirley Agostinho is a teaching and research scholar in the School of Education at the University of Wollongong. Shirley's research career focuses on investigating how information and communication technology (ICT) can be used to enhance learning. Her research is devoted to designing effective learning environments and encompasses the dual perspectives of examining how teachers can be supported to design high quality learning experiences and how learners can support their own learning through the use of ICT. Her current research work is investigating teacher design thinking.

Dr Chris Campbell is a Lecturer in Digital Technologies at The University of Queensland and has been conducting research into the area of learning design for the past few years. She currently has a project in Malaysian schools investigating teachers' cloud-based learning designs. Chris is also interrogating learning design with the Smithsonian Learning Lab as part of her 2016 Queensland-Smithsonian Fellowship. Her other research is into new and emerging technologies.

Dr Panos Vlachopoulos, is a Senior Teaching Fellow in Learning Innovations in the Faculty of Medicine and Health Sciences at Macquarie University. He studied Philosophy and Pedagogy at Aristotle University of Thessaloniki Greece, followed by an M.Ed in E-learning from the University of Manchester and a PhD in Education (Online Pedagogy) from the University of Aberdeen. His areas of expertise include online tutoring, the facilitation of student-driven learning, and the development of academic staff capabilities for teaching online. He has international experience of online learning design, teaching and research in technology-enhanced learning from diverse educational contexts such as universities in the UK, Hong Kong, New Zealand and Greece.

References

Bennett, S., Agostinho, S., & Lockyer, L. (2016). The process of designing for learning: Understanding university teachers' design work. *Educational Technology Research and Development*, 1-21. doi:10.1007/s11423-016-9469-y

Cameron, L. (2013). Giving Teaching Advice Meaning: The Importance of Contextualizing Pedagogical Instruction within the Discipline. In B. Tynan, J. Willems, & R. James (Eds.) *Outlooks and Opportunities in Blended and Distance Learning* (pp. 50-65). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-4205-8.ch004

Dalziel, J., Conole, G., Wills, S., Walker, S., Bennett, S., Dobozy, E., Cameron, L., Badilescu-Buga, E., & Bower, M. (2016). The Larnaca Declaration on Learning Design. *Journal of Interactive Media in Education*, 1(7), pp. 1–24, DOI: http://www-jime.open.ac.uk/collections/special/reflections-on-the-larnaca-declaration-on-learning-design/

Dobozy, E. & Dalziel, J. (2016). The use and usefulness of Transdisciplinary Pedagogical Templates. In: James Dalziel (Ed.). Learning Design: Conceptualizing a Framework for Teaching and Learning Online. (pp. 183-207). New York, N.Y.: Routledge

Lockyer, L., Agostinho, S., & Bennett, S. (2016). Design for e-learning. In C. Haythornthwaite, R. Andrews, J. Fransman & E. M. Meyers (Eds.),*The SAGE Handbook of E-Learning Research* (2nd Edition) (pp. 336-353). London: SAGE Publications.

Neumann, R., Parry, S. & Becher, T. (2002). Teaching and learning in their disciplinary contexts: A conceptual analysis. *Studies in Higher Education*, 27, 4.

Scott, G. (2006). *Accessing the student voice: Using the CEQuery to identify what retains students and promotes engagement in productive learning in Australian higher education. Final Report.* Barton, ACT: Commonwealth of Australia.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning 2*(1). Retrieved from: http://itdl.org/Journal/Jan_05/article01.htm.

Siemens, G. (2006a). Connectivism: Learning theory or pastime for the self-amused? Retrieved from http://www.elearnspace.org/Articles/Connectivism_self-amused.html

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The Power of the Crowd: Promise and Potential of Crowdsourcing for Education

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Crowdsourcing is the term often used for processes of data collation and creation where individuals or groups of users who are not necessarily located centrally generate content that is then shared. While the term originates within the world of business, it has since gained traction within a number of academic and professional disciplines. Drawing upon two examples that have originated within the Republic of Ireland, this paper reflects on the educational potential of crowdsourcing. Firstly, it reports a unique one-year open crowdsourcing initiative which compiled a comprehensive A-Z directory of edtech tools for teaching and learning through collaborative contributions. Secondly, it describes an initiative to develop a crowdsourced repository of study tips and suggestions for adult, part-time, online and flexible learners embarking on further study. These two case studies provide a valuable context for considering the wider potential of crowdsourcing applications for teaching and learning purposes.

Keywords: crowdsourcing, collaboration, directory, edtech, flexible learning, open

Background

The term ‘crowdsourcing’ is generally attributed to the work of Jeff Howe (2006) who defines it as ‘the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call’. Howe outlines that the crucial prerequisites are the use of the open call format and the large network of potential labourers with regard to the crowdsourcing focus. The general concept of crowdsourcing, however, predates Howe’s work by some time; Hossain and Kauranen (2015), for instance, cite one instance of a crowdsourcing project that dates back to the early eighteenth century, and also outline how a crowdsourcing process was used in 1884 by the Oxford English Dictionary to catalogue words through a ‘crowd’ of eight hundred readers. While Howe’s is undoubtedly the most commonly utilised definition for the term crowdsourcing, it is by no means the only one; Estellés-Arolas and González-Ladrón-de-Guevara (2012) compare over forty definitions for the term and outline how it is often confused and conflated with similar meaning terms, as well as contested in its core meaning. The authors propose eight attributes common to any crowdsourcing initiative: the crowd, the task at hand, the recompense obtained, the crowdsourcer or initiator of the crowdsourcing activity, what is obtained by them following the crowdsourcing process, the type of process, the call to participate, and the medium. With regard to this final element (the medium) it is acknowledged that advanced internet technologies have made crowdsourcing practicable for an immeasurably wider audience, at a larger scale, for a greater number of products and services, and at greatly enhanced speed (Saxton, Oh, & Kishore, 2013).

As recognition of the potential and power of crowdsourcing has grown, so too has the range of uses for which it is employed. In their comprehensive literature review of crowdsourcing, Hossain and Kauranen (2015) identify a number of applications of the process that includes idea generation (whereby crowds are called upon to submit new ideas and the best ones are chosen), microtasking (whereby users can select and complete small tasks, often for monetary or non-monetary rewards) and citizen science (whereby the participation of crowds is utilised in solving real-world problems through a form of collaborative research). Crowdsourcing has found particular resonance with regard to open source software development, notably through the evolution of the Linux operating system (Abraham et al., 2016). It has found application in clinical research, where Armstrong et al. (2012) suggest that it can facilitate recruitment of larger, more diverse patient populations and relatively low costs for data collection, as well as the ability for patients to provide research data from any location and any time. It has found use in the discipline of law, where Orozco (2016) adopts the term ‘lawsourcing’ to describe various ways that legal crowdsourcing has developed to achieve substantial legal reform and innovation in the United States and beyond.

We can see, therefore, that many advantages exist with regard to crowdsourcing. It can enable access to a potentially global range and diversity of locations, opinions and problem-solving options, as well as provide a means of voicing opinions that otherwise would not be shared, and to bring together communities of interest and concern (Paulin & Haythornthwaite, 2016). Crowdsourcing can fulfil the old maxim that the whole is often greater than the sum of its parts through assimilating many small contributions into resources of high quality (Corneli & Mikroyannidis, 2012).

Case Studies

Set against this backdrop of promise and potentials for crowdsourcing, we now turn our attention to two specific and applied uses of crowdsourcing which originate in the Republic of Ireland. The first is a crowdsourcing initiative which compiled a directory of tools for teaching and learning through collaborative contributions, and the second is an initiative to develop a crowdsourced repository of study tips and suggestions for learners embarking on further study.

Case Study 1: Project 252

Project 252 (http://project252.donenda.com) was a year-long open crowdsourcing initiative which was undertaken to collaboratively compile an A-Z directory of edtech tools for teaching and learning. The project ran for the entirety of one calendar year (January 2015 to January 2016 – although the project website remains active and the crowdsourced directory freely available) and was implemented around a chronological and sequential model of design: every two weeks for the fifty-two weeks of the year (hence '252') the project focused upon one letter of the alphabet (starting with A and going through to Z). For the two weeks of the 'featured letter', an open call was issued which invited contributors to submit the details of an edtech tool (for instance, an app, Web 2.0 service or software package) that begins with that letter. In order to allow for instances where participants 'missed' a certain letter, and for those participants who discovered the project after a featured letter had passed, four 'back catalogue' sessions were introduced to allow for such submissions to be included (for instance, a back catalogue at featured letter 'G' at the end of March 2016 meant that participants could submit a contribution for the featured letter as they usually would but could also submit a contribution for any of the previous letters A-F). Submissions were published on the project website within hours following review by a moderator.

Contributions were invited via a standard form which specified a number of criteria that included the name of the tool, a URL to access/download/purchase it, a technical classification for the tool (online or specific to a particular operating system or device), suggested uses for the tool in an educational setting, suggested academic subjects for its usage, pricing structure (free, free trial followed by purchase, once-off purchase, recurring cost), suggested educational level (primary, secondary or higher education) and any suggested links to online tutorials or reviews for the tool. Contributors could choose to make a submission by logging in to the site using their Twitter credentials (in order to associate their Twitter profile with their submission) or else anonymously (for those who did not have a Twitter account or did not wish to associate their Twitter account with their submission). The project's own Twitter account (@proj252) was used to announce each new 'featured letter' as it occurred and the imminent conclusion of the current one, and to publicise each contribution as it was added to the directory. Over 850 tweets were sent during the duration of the project.

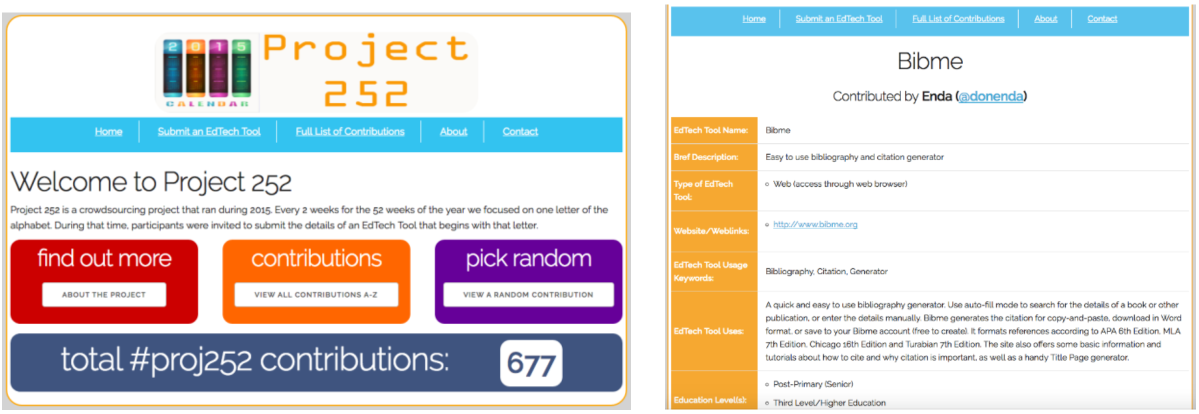

Figure 1: 'Project 252' Homepage and Sample Contribution

By the time the project reached completion in January 2016, it had received a total of 667 contributions (see Figure 1). These were compiled from a total of 96 named contributors with a further 27 contributions submitted anonymously (it is not possible therefore to tell if any of these anonymous contributions were from repeat contributors and how many were once-off contributions). The letter which received the most contributions is ‘S’ with a total of 61 submissions, while the smallest number of contributions was received for letter ‘X’ with a total of 7. There were 24 instances where a particular edtech tool was submitted more than once (from different contributors), with all other contributions (626) being unique.

An initial analysis of submissions for the project reveals a number of interesting outcomes. For instance, the most popular type of edtech tool was online (in terms of technical classification) and free (in terms of pricing classification) – a particularly notable outcome when considering the open nature of the project in terms of design, collation and dissemination of contributions. An analysis of named contributors reveals an appreciable spread of submissions from across the education spectrum; for instance, the top ten contributors comprised 3 teachers from the primary sector, 2 post-primary/secondary teachers, and 5 from the higher education sector. This cross-sectoral range is also reflected in the classification of edtech tools submitted: 483 of the 667 submissions are suggested as suitable for senior post-primary pupils, 481 as relevant for higher education students, and 401 for senior primary pupils. While the majority of submissions come from educators based in Ireland (which is to be expected as this is the context for this particular project) it is notable that contributions were also received from educators in the United Kingdom, Argentina, France and the United States. The geographical spread is, however, significantly more pronounced in terms of visitors to the project website: a review of Google Analytics data for the site reveals visitors from over one hundred different countries across five continents. On the final day of the project in January 2016 the directory of submissions had received almost 70,000 views, and this has increased significantly to 118,000 views in the six months since the project finished, which indicates continued and ongoing usage of the directory of edtech tools after the crowdsourcing activity has concluded.

Beyond the scope of this paper is a more in-depth analysis of the motivations of contributors and the nature of the community that formed around this distributed group collection and sharing activity. However, we do draw some tentative lessons from the design and iterative development of the project that contributed to its success. Extensive use was made of Twitter in designing the social layer of the tool (see Figure 2). Almost all contributors were Twitter users and the project lead had a relatively large Twitter following (2,717 followers) and an above average level of social media influence as measured by a klout score of 47 (Rao, Spasojevic, Li, & DSouza, 2015). Simple but effective gamified elements that encouraged participation included the two week windows during which each letter was open; this encouraged contributors to suggest tools early in the window to get their suggestion in ahead of other contributors, and also encouraged entries late in the two week period as the window was about to close. Similarly to the cueing effect of the closing of the windows, which the project Twitter account would remind people of (e.g. ‘only 12 hours to go for the letter P’). The community was also alerted to key approaching milestones such as the 300th contribution, the halfway mark, and so on. Back Catalogues, during which users could add entries from previous weeks whose windows were now closed, served to provide not just temporal anchors but also a sense that there were only limited opportunities in which to participate. The project played upon the affordance of these limited opportunities to participants to give up their labour in a light-hearted way and chats would regularly bubble up on Twitter around aspects of the project.

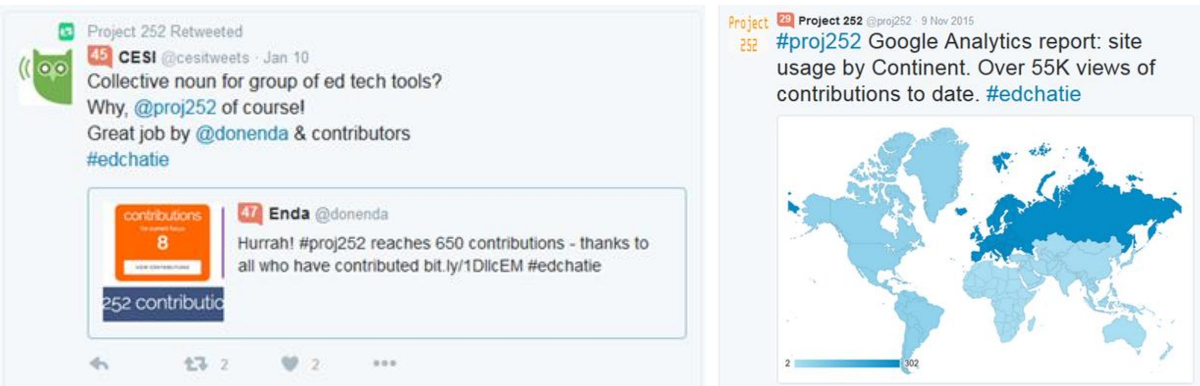

Figure 2: Use of Twitter for Social Layer of ‘Project 252’

Case Study 2: Student Success Toolbox

The Student Success Toolbox project (http://studentsuccess.ie/) seeks to address the problem of effective transitions and the foundations for student success during the initial stages of the study lifecycle with a specific focus on flexible learners. In the context of this project a broad definition of flexible learners is adopted, which includes adult learners engaged in part-time and online/distance learning. The particular focus of this project is on supporting flexible learners through key transitions in the early stages of the study lifecycle: from thinking about study, making choices, the registration process and through to the first few weeks. A basic premise of the project is that the foundations for student success start early in the study lifecycle, and that the importance of the period before flexible learners formally commence their study is insufficiently recognised. A related underlying assumption is that this crucial transition period may be enhanced by the availability of appropriately designed digital readiness and preparation tools, which help to scaffold both prospective students and those about to embark on part time or online/distance study for the first time.

Following a preliminary literature review and analysis of digital tools adopted internationally to enhance transitions to study for this unique sub population of learners (Brunton et al., 2016) a strategically targeted suite of research-informed digital readiness tools was designed and developed to focus primarily on facilitating adult learners who are transitioning to part-time undergraduate study. This toolbox of eight digital tools can be accessed through the project website at http://studentsuccess.ie/the-toolbox/ (see Figure 3).

Figure 3: 'Student Success Toolbox'

One of the tools designed for this project is 'Study Tips for Me' (see Figure 4) which is developed using the Tumblr platform. This tool is designed to crowdsource study tips, suggestions and support for flexible learners from other flexible learners. Each student is free to post on the site and materials submitted are intended to be generic and beneficial for any flexible learner (rather than focusing upon course- or discipline-specific content). Through encouraging interaction between students in this manner it is intended to be of benefit to all students in overcoming challenges and developing suitable plans for study.

Submissions are invited via a standard form which invites the contributor to write a message to a learner who is about to embark on a course of study at the higher education level for the first time. Contributors are asked to share a tip that they would like to have been given when they themselves started out, or an experience that has helped inform them as a learner. Suggestions include sharing a link to a helpful website that the contributor has used to help them study, or an inspiring quote that has motivated them, or a snippet of advice for learning, or a photograph of any place or thing that they associate with having learned successfully. Flexible learners are welcome to post any tips they wish to give other flexible learners. The contributor tags each submission using a list of possible tags, and includes their name and email address so that they can be credited and contacted if necessary. The submitted tip is then reviewed by a moderator and approved for publication on the 'Study Tips for Me' page. Within the scope of this project the tool can be used when an individual is considering the prospect of becoming a flexible learner, when they have made a decision to become a flexible learner and are waiting to begin their first year of study, and/or as part of an 'on-entry' orientation (Brunton, 2016).

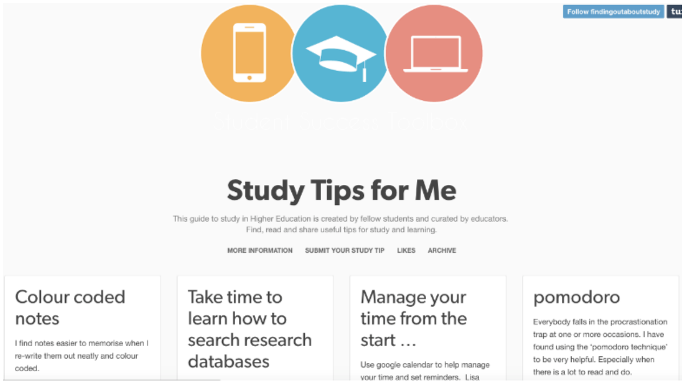

Figure 4: 'Study Tips for Me' Tool

Although the tool has yet to be formally launched, to date, a total of 26 study tips have been submitted and shared via the 'Study Tips for Me' tool. Submitted tips include advice on note-taking, time management, examination preparation, participation in study groups, attendance, and undertaking an assignment. A primary purpose of creating the 'Study Tips for Me' tool was to demonstrate how such a tool can be built and utilised using existing social media platforms. This approach can be employed for broad uses, such as in this particular case study, or for specific discipline or course uses. While the tool was developed following input from a number of focus groups it remains to be seen how prospective students, and those at the early stages of the study life-cycle, engage with this form of crowdsourcing. The 'Study Tips for Me' tool will be launched for the new academic year in the Northern Hemisphere starting in September 2016.

Conclusion

Foulger (2014) claims that crowdsourcing has yet to have much impact in education, although it has proven to be successful in business and industry. Nevertheless the two case studies described in this paper illustrate a number of benefits with regard to the use of crowdsourcing for educational activities and more specifically within teaching and learning contexts. Consistent with previous literature, the benefits include the value of the open call with regard to sourcing a diverse range of contributions and from a wide geographical base (Paulin & Haythornthwaite, 2016); the effectiveness of web-based technologies (Saxton et al., 2013) and in particular social networking tools and platforms (Corneli & Mikroyannidis, 2012) in facilitating the collation and dissemination of contributions; and how individual contributions can prove more helpful in collation than in isolation. While a question remains over the validity or trustworthiness of the crowdsourced offerings, the two examples of Project 252 and the Flexible Learning Toolbox illustrate the power of the crowd for collaboration, contribution and collation, and provide valuable insight for considering the wider potential of crowdsourcing for teaching and learning.

References

Abraham, J., Bhatnagar, V., Hasteer, N., Nazir, N., Bansal, A., & Murthy, B. K. (2016). Crowdsourcing Software Development: Many Benefits Many Concerns. *Procedia Computer Science*, *78*, 48-54. doi: http://dx.doi.org/10.1016/j.procs.2016.02.009

Armstrong, A. W., Cheeney, S., Wu, J., Harskamp, C. T., & Schupp, C. W. (2012). Harnessing the Power of Crowds: Crowdsourcing as a Novel Research Method for Evaluation of Acne Treatments. *American Journal of Clinical Dermatology*, *13*(6), 405-416.

Brunton, J. (2016). *Student Success Toolbox Project: Guide for Supporting Flexible Learner Transition*. Dublin: Dublin City University. http://goo.gl/SAnxrf

Brunton, J., Brown, M., Cleary, A., Costello, E., Delaney, L., Fox, S., Galvin, C., Gilligan, J., O'Regan, L., & Ward, J. (2016). *Lost in Transition: A Report on Enabling Success for Flexible Learners*. Dublin: Dublin City University. http://goo.gl/6MkHDC

Corneli, J., & Mikroyannidis, A. (2012). Crowdsourcing education on the Web: a role-based analysis of online learning communities. In A. Okada, T. Connolly & P. Scott (Eds.), *Collaborative Learning 2.0: Open Educational Resources* (pp. 272-286). Hershey, PA: IGI Global

Estellés-Arolas, E., & González-Ladrón-de-Guevara, F. (2012). Towards an integrated crowdsourcing definition. *Journal of Information Science*, *38*(2), 189-200.

Foulger, T. S. (2014). The 21st-Century Teacher Educator and Crowdsourcing. *Journal of Digital Learning in Teacher Education*, *30*(4), 110.

Hossain, M., & Kauranen, I. (2015). Crowdsourcing: a comprehensive literature review. *Strategic Outsourcing: An International Journal*, *8*(1), 2-22.

Howe, J. (2006). *Crowdsourcing: A Definition*. http://crowdsourcing.typepad.com/cs/2006/06/crowdsourcing_a.html [viewed 15 July 2016]

Orozco, D. (2016). The Use of Legal Crowdsourcing ("Lawsourcing") to Achieve Legal, Regulatory, and Policy Objectives. *American Business Law Journal*, *53*(1), 145-192. doi: 10.1111/ablj.12074

Paulin, D., & Haythornthwaite, C. (2016). Crowdsourcing the curriculum: Redefining e-learning practices through peer-generated approaches. *The Information Society*, *32*(2), 130-142.

Rao, A., Spasojevic, N., Li, Z., & DSouza, T. (2015). *Klout Score: Measuring Influence Across Multiple Social Networks.* Paper presented at the 2015 IEEE International Conference on Big Data.

Saxton, G. D., Oh, O., & Kishore, R. (2013). Rules of Crowdsourcing: Models, Issues, and Systems of Control. *Information Systems Management*, *30*(1), 2-20. doi: 10.1080/10580530.2013.739883

Please cite as: Donlon, E., Brown, M. & Costello, E. (2016). Power of the Crowd: The Promise and Potential of Crowdsourcing for Education. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 206-211).

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Open Educational Practices: A focus on instructional design

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Demand for higher education is increasing globally, and to help meet the demand, there are plenty of Open Educational Resources (OERs) available. OERs are openly licensed educational materials. Unfortunately, OERs are slow to be adopted. What is needed are Open Educational Practices (OEPs) which are policies, tools, and actions, among other things that create an environment suited to using OERs. This research aims to find ways to support OEP implementation, particularly the OEPs related to the design and development of effective courses. The research methods include action research on course design and ethnography to describe the organizational context. This poster presents emerging findings from the pilot study carried out at the Open Education Resource universitas (OERu).

Instructional design, Learning Design, Open Educational Practices, OER, OERu

Context: What are OEPs and why are they needed?

Demand for higher education is increasing globally, and higher education qualifications are necessary in highly knowledge-based societies, seeing that “by 2020, 40% of the global workforce will be knowledge workers” (Kanwar & Daniel, 2010, p. 404). Globally, the number of higher education enrollments is expected to increase by approximately 100 million from the current 165 million by 2025 (UNESCO & COL, 2015).

One option to help fill this demand is to use open educational resources (OERs). OERs are instructional materials such as books and courses in print and digital forms that are openly licensed and thus available for reuse, adaptation, and redistribution (Butcher, 2011). There are plenty of OERs available, and UNESCO and the Commonwealth of Learning have published several books for guiding the adoption of OERs (e.g. UNESCO & COL, 2015). What appears to be missing to make use of the great amount of OERs is the implementation of open educational practices (OEPs), which are tools, policies, instructional and technological training, quality assurance frameworks and other actions, resources, and infrastructure which facilitate the use of OERs (Conole, 2012). One of the organizations promoting OEPs and the use of OERs in higher education is the OERu. The OERu is “An international network of recognised partner institutions from five continents – providing top-quality tertiary courses to students everywhere” (OERu, n.d., para. 1).

The problem addressed by this study, and research questions

The problem is that open educational practices (OEP) are not common in higher education, and where they do occur, there are issues of quality in their implementation (Conole, 2012; Murphy, 2013). In particular, there is concern about the quality of the OERs used for creating accredited courses. The purpose of this research is to determine how to improve instructional design processes for designing and developing high-quality courses using OER within the context of organizational change in higher education with regards to the implementation of OEP.

Main research question and guiding sub-questions

How can the design and development of courses using OERs be improved for use in higher education institutions that implement OEPs?

- How are higher education institutions and networks using instructional design processes for open education?
- What are the current and desired cultures at the institutions involved in this research?
- Which resources and processes may facilitate the implementation of OEPs, particularly for instructional design for open education?

Instructional design

Instructional Design underpins this research. According to Chen (2008) instructional design (ID), also known as learning design, is:

> the systematic process of planning events to facilitate learning. The ID process encompasses a set of interdependent phases including analysis of learners, contexts and goals; design of objectives; selection of strategies and assessment tools; production of instructional materials; and evaluation of learner performance and overall instructional design effort (Chen, 2008, p. 1).

Instructional design techniques stem from instructional design theory, which guides practice; it offers direction on how to design instruction. In other words, it describes specific instructional methods, such as providing feedback, and the kinds of situations where the methods are relevant and irrelevant (Reigeluth, 1999).

Plan for the study and researcher roles: The pilot study

This research involves a pilot study and the main study. In each phase, I intend to examine institutional approaches to implementing OEPs and methods of course design. The pilot starts an ethnographic study to examine the organizational culture and processes involved in the implementation of OEPs. The pilot includes interviews with people in different roles such as administrators and faculty regarding their role in implementing OEPs. Other data will be gathered from document review and observation of the OERu and its open design processes. The pilot study serves to examine the OERu and its current course design, development, and delivery processes to identify areas that can be improved. In particular, I aim to determine how instructional design theories are used by the OERu and how they fit into the course design process.

The OERu was chosen for its potential to provide a rich case study of OEPs; additional selection criteria for including other institutions in this research will be developed after the pilot study. The findings from the pilot will also inform my research plan on course design in the main study. While my role in the pilot study will be that of a researcher only, the participant action research of OEP planned in the main study will involve me as an instructional designer as well as a researcher. This poster presents emerging findings from the pilot study, which can be conceptualized as a sketch of the OERu’s open educational practices. Emerging findings from the documentary evidence include processes for planning and developing courses. The open culture appears to be developed through web publication of plans and discussions, invitations to volunteers to innovate, and invitations to the public to observe meetings in progress.

References

Butcher, N. (2011). *A basic guide to open education resources (OER).* Vancouver: COL & UNESCO. http://oasis.col.org/handle/11599/36

Chen, I. (2008). Instructional design methodologies. In T. T. Kidd & H. Song (Eds.), *Handbook of research on instructional systems and technology* (Vol. 1, pp. 1-14). Hershey, PA: Information Science Reference.

Conole, G. (2012). Integrating OER into Open Educational Practices. In J. H. Glennie, & N. &. Butcher (Eds.), *Open educational resources and change in higher education: Reflections from practice* (pp. 111 – 124). Vancouver: COL & UNESCO. http://oasis.col.org/handle/11599/80

Kanwar, A., & Daniel, J. (2010). Distance Education and Open Universities A2 - Peterson, Penelope. In E. Baker & B. McGaw (Eds.), *International encyclopedia of education* (3rd ed.) (pp. 404-410). Oxford: Elsevier.

Murphy, A. (2013). Open educational practices in higher education: Institutional adoption and challenges. *Distance Education*, *34*(2), 201-217. doi:10.1080/01587919.2013.793641

OERu. (n.d.). *OERu partners.* http://oeru.org/oeru-partners

Reigeluth, C. M. (1999). What is instructional-design theory and how is it changing? In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. II, *pp.* 5-29). Hillsdale, N.J: Erlbaum.

UNESCO, Commonwealth of Learning. (2015). *Guidelines for open educational resources (OER) in higher education*. Vancouver: COL & UNESCO. http://oasis.col.org/handle/11599/60

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Learning gains in a flipped classroom to teach the principles of envenomation

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Diagnosis and management of venomous bites and stings, particularly snakebite, is important for Australian clinicians. In 2015, a flipped classroom was trialled to teach the principles of envenomation to year 1 medical students in a MD program. A bespoke online resource was developed and then used by students to prepare for a face-to-face class tailored to their learning needs. Students reported positively about learning the principles of envenomation with the online resource and found it useful. Responses from students also indicated that the interactive class was beneficial to their learning, particularly the clinical application of envenomation. These findings were supported by comparisons of pre- and post-test scores that showed significant learning gains across eight questions. The study also provided some insights into students' perception of knowledge retention and why some students may prefer to prepare individually for content attainment.

Keywords: Flipped classroom, learning gains, learning benefits, biomedical science education

Introduction

The flipped classroom is a learning model that is gaining popularity in higher education. The Flipped Learning Network (2014) provide the following definition:

> "Flipped Learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter"

As this definition suggests, the transmission of information that typically occurs during a traditional face-to-face lecture is moved to out of class time, freeing up in-class time for active learning. The key to the approach, therefore, is individual work by students outside of class, either to prepare for the in-class application of newly gained knowledge, or to follow up and reinforce their learning after class. This places the responsibility of preparing for class, interacting during class, or consolidating knowledge after class with the student, so the approach is considered to be student-centred (McLaughlin et al, 2014).

The in-class component of the flipped classroom is teacher facilitated and involves the implementation of active learning tasks, for example: open questions; debates; audience response to clicker questions; quizzes; role-play; student presentations; and discussions (DeLozier & Rhodes, 2016). Many of these activities can be either implemented as individual, paired or group activities. The model has been described as 'technology infused' because lecture recordings, video and/or online resources are often provided to support students' individual preparation during the out-of-class phase (Jensen, Kummer & Godoy, 2015).

Although adoption of the flipped classroom model has been rapid and widespread in recent years, research into the benefits and effectiveness of the method have not kept pace with implementation. This is not surprising considering the variation present in flipped classroom implementations. As indicated above, teachers can choose from a wide range of both in-class and out-of-class activities and technologies, which can be combined and sequenced in numerous ways. Additionally, some teachers may opt to flip all of their lectures, while others might only flip a proportion resulting in a 'partial' flip (DeLozier & Rhodes, 2016), although there is no evidence to suggest that flipping an entire course is more beneficial than a 'partial' flip (O'Flaherty & Phillips, 2015).

Most studies evaluating the effectiveness of the flipped classroom model in higher education have relied on student perceptions and self-reports of learning, which have been generally positive (O'Flaherty & Phillips, 2015). Although there have been some exceptions, where students have expressed negative views towards the flipped classroom approach (see Strayer, 2012). These exceptions highlight the fact that the flipped classroom may not be suitable for all subject matter.

In recent years, the number of flipped classroom studies that report measures of student performance has been steadily increasing across a range of disciplines. In language learning, for example, a study that compared three different formats (flipped, semi flipped and control group) found increased mean scores on lesson assessments for the flipped group over the other two formats (Hung, 2014). Also, Webb and Doman (2016) found that gains on grammar achievement were significant only for a flipped classroom group in a pre- post-test quasi-experimental mixed methods study. Studies on attainment are also emerging from the science disciplines. For example, recent longitudinal studies in chemistry have shown a reduction in Ds, Fs, withdrawal and failure rates, together with increases in student grade point averages and improvements in student scores, for flipped classroom groups (Fautch, 2015; Flynn, 2015). Weaver and Sturtevant (2015) were able to show a statistically significant increase in standardised exam scores for students in flipped classrooms compared with the prior lecture-based course in general chemistry.

These studies indicate that while the framework of the flipped classroom is reasonably solid, how learning gains are actually realised in a flipped classroom remains unclear. Research by Gross, Pietri, Anderson, Moyano-Camihort and Graham (2015) suggest that it may in part be due to students interacting with course material in a more timely and accurate manner. Another study by Jensen, Kummer and Godoy (2015), which compared an active flipped classroom with an active non-flipped classroom while only varying the role of the instructor, suggests that it may be the active learning that is implemented along side the flipped classroom that causes the positive effect on student performance, rather than the order in which the instructor participates in the process. For example, the study demonstrated equivalent student learning outcomes regardless of whether the instructor facilitated content attainment during class and then students performed individual concept application after class, or inversely, students engaged in individual content attainment before class and then the instructor facilitated concept application during class.

That other research has shown that the effect of flipped classrooms is more pronounced for the bottom third of students (measured by pre-test score or percentile rank) (Ryan & Reid, 2016) and those with lower grade point averages (Gross et al, 2015), points to the fact that there is still much to be learnt about the intricacies of implementing flipped classrooms, particularly if the desired outcomes for students are improved learning gains and attitudes towards learning.

Teaching the principles of envenomation

Envenomation is the introduction of venom into a body by means of the bite or sting of a venomous animal, for example, snake, spider, jellyfish, octopus, tick or platypus. Diagnosis and management of venomous bites and stings, particularly snakebite, is important for Australian clinicians working in rural and tropical locations, and increasingly for doctors practicing in urban fringes where wetlands and ‘green wedges’ have brought people into close proximity with snakes.

An understanding of the principles of envenomation brings together elements from several biomedical and bioscience disciplines, including, biochemistry (mechanism of toxin action), physiology (signs that characterise toxin responses), pharmacology (mechanism of antivenom action) and zoology (creature identification), placing them in a clinical context. This means that the topic doesn’t neatly fit into the teaching streams that are typical of first year graduate medicine curricula.

Our university’s Doctor of Medicine (MD) program, is a full-time, masters level course delivered over four years. The first year of the MD curriculum is designed to consolidate students’ biomedical science knowledge and prepare them for clinical placement. The former is achieved through a year-long subject *Foundations of Biomedical Sciences* (FBS*)*. This subject utilises a mix of bioscience lectures, clinical cases and practical classes, and is organised around a series of teaching streams: Foundation, Cardiovascular; Respiratory; Gastrointestinal; Renal; Neuroscience; Endocrine; Metabolism; Locomotor; Exercise; Reproduction; and Intersystems. The bioscience lectures delivered in FBS generally follow a traditional face-to-face lecture format - to our knowledge there have been no flipped classrooms implemented across the teaching streams.

Principles of envenomation is taught during the *Intersystems* stream – this is the last teaching stream of the year finishing just prior to swat vac. *Intersystems* is designed to revise many key issues introduced in earlier streams, as well as introducing students to issues they will face in their clinical years. Students attend a two-hour ‘practical’ on the principles of envenomation where information is delivered in a traditional didactic style supported by a PowerPoint presentation; it has no ‘wet’ laboratory component.

Given the timing of the teaching stream, and its aim to introduce clinical issues, the content expert teaching the topic (who is both an academic and clinician) expressed an interest in moving away from the traditional style of delivery towards one that:

- reinforced the clinical differential diagnosis process;
- demonstrated the clinical relevance (and case-based nature) of the topic;
- incorporated active learning strategies for students;
- made the learning process more engaging for students; and
- could potentially improve student performance.

For these reasons, we decided to trial a flipped classroom to teach the principles of envenomation to year 1 MD students. This paper describes: the design and development of an online resource to support students' preparation for the class; the implementation of the flipped classroom approach; and evaluation findings that demonstrate learning gains made by students together with their perceptions of the flipped classroom as a useful learning experience

Methods

The project was conducted in three phases: Development of an online resource, Implementation of the flipped classroom, and Evaluation. Each of these phases is described below. A mixed methods design was used to evaluate the flipped classroom model (Creswell, 2014), which involved three data collection methods:

1. a questionnaire to provide a quantitative measure of students' perspectives of the online resource and interactive session for learning,
2. open-ended items to provide a qualitative measure of students' perspectives of the online resource and interactive session for learning, and
3. Pre- and post-tests to measure student learning gains.

The study proceeded with approval from the host university's human research ethics committee.

Developing an online resource

An online resource was developed to help students prepare for the face-to-face component of the flipped classroom. The resource was designed to help students build a differential diagnosis framework and to develop basic management plans for the diagnosis and treatment of venomous bites and stings. Specifically, on completion of the resource students were expected to be able to: identify the key presenting features of a venomous bite or sting in Australia; utilise appropriate management principles in such a presentation, with special reference to snakebite; understand the mechanism of action of venom in the human body; and understand the values and limitations of antivenom in the treatment of venomous bites or stings in Australia but with special reference to snakebite.

The resource was designed around a case study of a 50 year old farmer who is brought into hospital unconscious one summer afternoon. Students are guided through a series of menu options – History, Investigations, Physical examination, and Creature identification - to gather further information for a provisional diagnosis. As students continue through the resource they are provided with information about:

- Snakebite first aid;
- Snake venom effects (neurotoxicity, myotoxicity, renal function, necrosis, coagulopathy);
- Antivenom (how it's made, how it works, risks, when to use it);
- The dynamic nature of snakebite;
- Risks after discharge; and
- Additional resources and readings.

As students progress through these sections they encounter questions they are expected to answer that are related to topics they have been studying. Learning tasks were supported by a variety of media, including, videos, images, animations, and an interactive timeline. The resource was designed to take one hour to complete.

The resource was developed using an iterative development process on Smart Sparrow's adaptive eLearning Platform (https://www.smartsparrow.com/). It was created as part of the Biomedical, Education, Skills and Training (BEST) Network - a community of university academics who collaborate to create and share online resources for biomedical science education (see https://www.best.edu.au/).

Implementing the Flipped Classroom

The year 1 MD cohort (n=367) was divided into three groups of approximately 122 students each, and three classes were scheduled over a two-week time period towards the end of second semester 2015. Prior to their class, students were informed about the flipped classroom and were provided with general information about the model and its benefits for learning. Although the students had not been exposed to the flipped classroom model in the MD, since it is a graduate program some students may have had prior experience with flipped classrooms in their undergraduate studies. Students were also informed of the content expert's expectations that they should prepare for the face-to-face class by completing the online resource. Students were also given instructions on accessing the resource. Depending on when their class was scheduled, students had between one to two weeks in which to complete the one-hour online resource.

The resource began with a pre-test of eight questions to gauge students' prior understanding of the topic. This task was designed to help students prepare for the face-to-face class and therefore students were allowed multiple attempts. On the day before a class, students' electronic scores were extracted from the learning platform and analysed to determine the percentage of students obtaining a correct answer to each question. The data from all attempts was included in this analysis. This feedback was used by the content expert to inform the focus of class activities on the following day.

Face-to-face classes were 1.5 hours long and were held in a 126 capacity lecture theatre. They followed a Q&A format, which centered around discussions of real-life clinical scenarios of snakebite.

Evaluation

Immediately after the face-to-face class students were administered a paper-based post-test composed of the same eight questions that they had encountered at the beginning of the online resource. Post-tests were manually scored to determine the percentage of students obtaining a correct answer for each question.
After the face-to-face class, a questionnaire was also administered to students, which asked them to rate on five point Likert scales (1 strongly disagree, 5 strongly agree) their response to six items about the online resource:

1. Improved my venomous bites and sting-related knowledge;
2. Taught me to be mindful of diagnostic uncertainty in a clinical context;
3. Taught me strategies to improve my diagnostic framework for possible venomous bites;
4. Taught me about snakebite first aid;
5. Was interesting;
6. Will assist my preparation for clinical practice.

And eight items about the flipped classroom:

1. The interactive class was useful for learning about the clinical relevance of envenomation;
2. The interactive class was beneficial to my learning;
3. The interactive class clarified questions I had about envenomation diagnosis and management;
4. I was able to contribute to the interactive class.
5. Preparing for class in my own time was beneficial to my learning;
6. I had sufficient time to prepare for the class;
7. The online resource was useful in preparing for the class;
8. I prefer the combination of prior online learning with an interactive class to the standard lecture format;

The questionnaire ended with two open-ended items:

1. Please describe the most useful aspects of the flipped classroom approach
2. Please describe anything that you feel would improve the flipped classroom approach

Simple descriptive stats were used to analyse students' responses to questionnaire items. Responses to the open-ended items were manually analysed by one researcher (KE) to identify emerging themes (Krippendorf, 2004) and cross-checked by the second researcher (KW). The frequency of themes was calculated as a percentage of total number of comments, and selected quotes have been used to illustrate key themes identified.

Results

The majority of students came prepared to the face-to-face class with 308 (84%) students having completed the entire resource beforehand, taking a medium time of 39 minutes.

Pre- Post-tests

259 students (71%) completed the paper-based post-test immediately after the face-to-face class. When the scores of the post-test were compared to pre-test scores extracted from the learning platform, learning gains were seen across all eight questions (Figure 1). The greatest learning gains were observed in questions where specific knowledge was required to answer them, for example: Q2- Clinical investigations (11% correct pre-test, 65% post-test); Q3- Creature identification (23% correct pre-test, 94% post-test); Q5- Management of envenomation presentations (8% correct pre-test, 62% post-test); and Q8- Antivenom (16% correct pre-test, 82% post-test).

Moderate learning gains were seen in questions where some students may have had prior knowledge gained else where in the course, for example: Q1- Differential diagnosis (41% correct pre-test, 82% post-test) - students have a general understanding of this concept from their case-based learning tutorials; Q4- First aid (63% correct pre-test, 96% post-test) and Q6- Bite site (73% correct pre-test, 93% post-test) – some students may have covered basic snakebite information in their first aid training. While learning gains were observed for Q7- Neurotoxicity, students generally performed poorly on this question (0.5% correct pre-test, 19% post-test), suggesting it was either a particularly difficult topic for students to grasp, or the design of the question was poor.

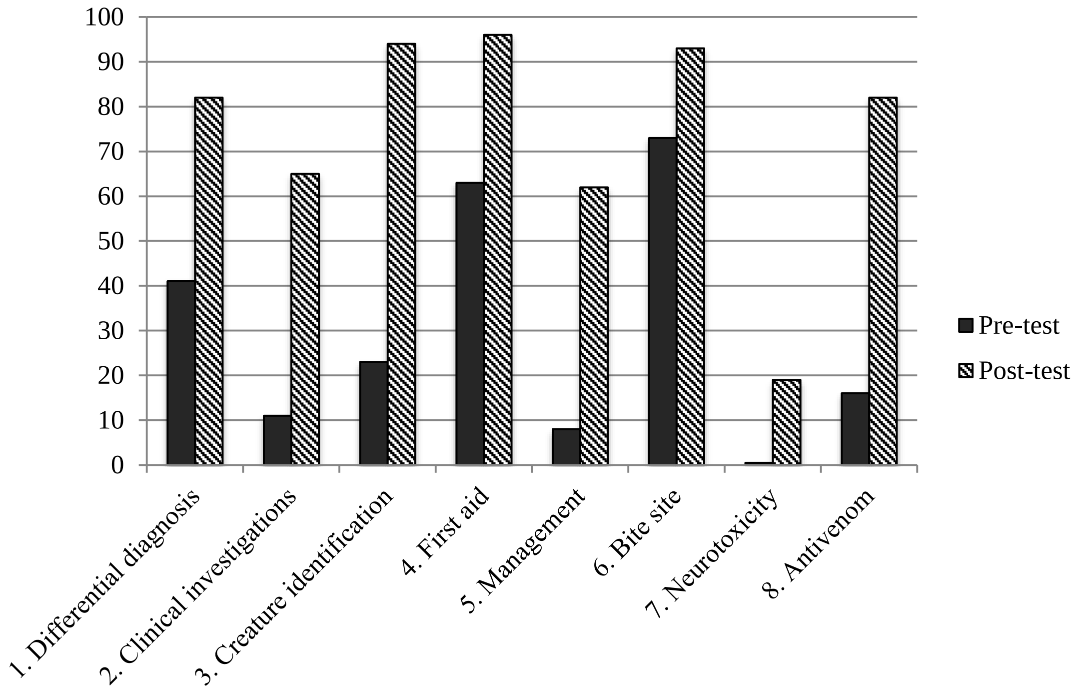

Figure 1: Percentage of students obtaining a correct answer to eight questions on the pre- and post-test

Pearson's chi squared and Cramer's V tests were performed on the pre- post-test data, which showed that the learning gains across all eight questions were significant at $p<.001$, and that the strength of the effect was moderately to extremely strong (see Table 1).

Table 1: The significance and strength of the effect of learning gains across eight questions on the pre- and post-test

	Pre-test		Post-test			
	n*	%	n	%	χ^2 (1)	Cramer's V§
Q1. Differential diagnosis	466	**41**	259	**82**	114.8†	.40
Q 2. Clinical investigations	452	**11**	259	**65**	231.7†	.57
Q 3. Creature identification	446	**23**	259	**94**	335.7†	.69
Q 4. First aid	440	**63**	259	**96**	98.3†	.38
Q 5. Management	436	**8**	259	**62**	240.6†	.59
Q 6. Bite site	434	**73**	259	**93**	42.8†	.25
Q 7. Neurotoxicity	425	**0.5**	259	**19**	77.5†	.34
Q 8. Antivenom	422	**16**	259	**82**	281.1†	.64

* This includes multiple attempts by some students on the pre-test
† $p<.001$
§ Effect strength: very weak (.00-.15), moderately strong (.25-.30), extremely strong (>.40)

Questionnaire responses

295 students (80%) completed the questionnaire immediately after their scheduled face-to-face class. Their responses to six items about the online resource are shown in Table 2. Students were positive about learning with the online resource, reporting that it had improved their venomous bites and sting related knowledge (mean = 4.2). Students also agreed that it had taught them: to be mindful of diagnostic uncertainty in a clinical context (mean = 4.2); strategies to improve their diagnostic framework for possible venomous bites (mean = 4.1); and snakebite first aid (mean = 4.1). It was reassuring to see that students also agreed that the resource was interesting (mean = 4.1).

Table 2: Student responses to six items about the online resource used to prepare for the flipped classroom

Online resource	**Mean**	**SD**
Improved my venomous bites and sting-related knowledge	4.2	.65
Taught me to be mindful of diagnostic uncertainty in a clinical context	4.2	.61
Taught me strategies to improve my diagnostic framework for possible venomous bites	4.1	.60
Taught me about snakebite first aid	4.1	.64
Was interesting	4.1	.70
Will assist my preparation for clinical practice	4.0	.72

Student responses to eight items about different aspects of the flipped classroom are shown in Table 3. Students reported that the interactive class was beneficial to their learning (mean = 3.9), particularly in relation to the clinical context of envenomation (mean = 4.0). However, there was only moderate agreement that they had been able to contribute to the class (mean = 3.5), or that they preferred the flipped classroom approach to the standard lecture format (mean = 3.7).

Table 3: Student responses to eight items about the flipped classroom

Flipped classroom	**Mean**	**SD**
The interactive class was useful for learning about the clinical relevance…	4.0	.78
The interactive class was beneficial to my learning	3.9	.81
The interactive class clarified questions I had	3.8	.80
I was able to contribute to the interactive class	3.5	.91
Preparing for the class in my own time was beneficial to my learning	3.8	.90
I had sufficient time to prepare for the class	3.8	.92
The online resource was useful in preparing for the class	3.9	.78
I prefer the combination of prior online learning with an interactive class to the standard lecture format.	3.7	.90

Qualitative responses

Of the 295 students who completed the questionnaire, 112 (38%) provided written feedback to the open-ended items. These students provided 109 comments on the most useful aspects of the flipped classroom, and 39 comments on how it could be improved. A thematic analysis of comments on the most useful aspects identified nine major themes: Being prepared; Flexibility; Identifying knowledge gaps; Testing knowledge; Interest; Engagement; Learning; First-aid training; and Resource features. The frequency of comments relating to each of these themes is shown in Table 4.

Table 4. The frequency of comments relating to nine major themes on the most useful aspects of the flipped classroom approach

Theme	Frequency (%)
1. Resource features	35.5
• Video	22.0
2. Flexibility	20.2
3. Interest	14.7
4. Learning	13.8
5. Testing knowledge	11.0
6. First-aid training	11.0
7. Being prepared	10.1
8. Identify knowledge gaps	10.1
9. Engagement	10.1

Students reported that it was useful knowing in advance what to expect in the face-to-face class, knowing what the important areas were and the main points, so that they were better prepared:

> "I now know what to expect before going into the classroom, rather then going in with no idea what's happening and thinking about it for the first time as I'm doing it"

> "Sometimes in lectures, I find myself taking notes without really processing what's going on and then learning the material after the class. This way I've been able to get a basis handle on the information and was less overwhelmed in the prac"

In preparing for the face-to-face class, students appreciated the flexibility of being able to work on the online resource at their own pace and at a time that was convenient to them:

> "The ability to engage with the material at my own pace helped learn the content, which was rather foreign to me"

> "Able to learn at my own pace and in my preferred time"

Students' comments regarding the flexibility of using the online resource for preparation accounted for 20.2 % of all comments.

Students also felt that preparing prior to class allowed them to identify gaps in their knowledge, which they could repair before coming to class through information easily found in the online resource:

> "Gave me a chance to see where areas of weakness were prior to starting. Also made it feel like I was actually learning things I wasn't 100% sure on - by realising I had a lack of knowledge at the start, it made me more interested in the material"

They also commented that structuring the online resource around a quiz had allowed them to test their knowledge as they progressed through the resource, applying new information to see what they had learnt:

> "Starting with the questions was really helpful because it got me interested in the topic and looking for answers as I was reading the information. I think it's really useful to have this kind of information before going to class"

Both these processes (repairing knowledge gaps and testing knowledge) contributed to students feeling better prepared for class.

Students reported that the preparation phase of the flipped classroom had increased their interest in the topic:

> "I wasn't expecting our course this year to cover bites and stings at all, and I was pleasantly surprised that we do have a prac on it. The online resource was certainly interesting and it encouraged me to read more widely about the topic"
>
> I was a bit hesitant with this pre-prac thing, but I have to say I found it interesting and I learnt a lot"

Nearly 15% of all comments related to students' interest in the topic.

Enjoyment of the flipped classroom was related to the clinical application of the material, especially in the interactive class:

> "I really enjoyed the clinical nature of the task – I find I am able to remember things much more easily when they are linked to a patient. I know this would have taken a fair while to put together, though it would definitely be worth having more activities like this in the course"
>
> "I particularly enjoyed the clinical scenarios and real life examples"

The preparation phase also increased student engagement with the topic for the interactive class and had enabled greater participation:

> "Allows me to think about content and any related questions for when we have contact time with an experienced tutor…rather than using that time just learning the basics and not processing it effectively until later"
>
> "Gave me an opportunity to research as I wished and collate any questions I had"

Students commented that through preparation, everybody was at the same level and content was reinforced during the face-to-face session.

> "By the time of the interactive session, I was hearing the information for the second time, so it was already like a first revision. I feel like this will definitely improve my long term retention of the information"

Students reported on various aspects of learning that the flipped classroom had supported. These comments, which represented 13.8 % of the total, were grouped under the general theme of Learning and included: active learning (rather than listening passively), critical thinking, lateral thinking, extending the learner, reinforcing content, solidify concepts, targeted learning (direct and focussed). The revision of first aid, or first aid training was another benefit of the flipped classroom that 11.0% of students commented on.

A large proportion of responses (35.5% of all comments) were related to features of the online resource that students found useful. Remarkably, 22 % of all comments specifically related to the usefulness of video – explanation of material, informative, engaging.

The thematic analysis of comments about how the flipped classroom could be improved identified four major themes: Time; Technical issues; Video; and Lecture format. The frequency of comments relating to each of these themes is shown in Table 5.

Table 5. The frequency of comments relating to four major themes about how the flipped classroom approach could be improved

Theme	Frequency (%)
1. Time	30.8
2. Technical issues	12.8
3. Video	7.7
4. Lecture format	5.1

The theme of time identified in student responses related to three different aspects: timing of the flipped classroom approach – some students felt it would have been better to implement it earlier in the year; time to complete the online resource – some students felt it was too long and took too much time to complete; and time for out of class preparation – some students felt they didn't have sufficient time to prepare. Technical issues related to glitches that some students experienced while using the online resource, for example, videos not playing, questions not registering inputted answers, or clicking the Next button and not letting you pass. Several students reported that some videos were too long, while others reported that they would have preferred a lecture format than the flipped classroom approach.

Discussion and Conclusion

Students in this study were generally positive about learning about the principles of envenomation with the online resource and found it useful for preparing for the face-to-face component of the flipped classroom. Students also reported that the interactive class was beneficial to their learning, particularly regarding the clinical application of envenomation.

While student perceptions of improved learning were supported by significant learning gains made by students from the time of the pre- to the post-test, the nature of the study means that it is difficult to identify where the learning gains originate from. For example, it is not possible to conclude if the learning gains were the result of the preparation activity, the in-class activities or a combination of the two components. It could also be argued that the use of the same questions for the post-test may have been testing students' recall from the pre-test, rather than knowledge gains, however, we were cognisant of the risk of introducing potential variation in the level of difficulty through the use of different questions. Therefore, although the findings show promise they need to be interpreted with some caution.

The qualitative responses of students regarding the usefulness of the flipped classroom provide some understanding of students' perception of the retention of their envenomation knowledge, particularly when it is linked to a clinical context – *"I am able to remember things much more easily when they are linked to a patient"*, and when information is reinforced in the face-to-face class – "*by the time of the interactive session, I was hearing the information for the second time, so it was already like a first revision. I feel like this will definitely improve my long-term retention of the information*". This suggests that there may be components of the flipped classroom model, such as the application of the bioscience information to a clinical context, or the revision of learning that contribute to knowledge retention.

The study by Jensen, Kummer & Godoy (2015) indicate that it is the active learning implemented along with a flipped classroom that is a better predictor of increased student performance, rather than whether the instructor has facilitated content attainment or concept application during class time. However, the qualitative responses of students in this study provides insights as to why students may prefer to prepare individually for content attainment, and what the additional benefits of this preparation might be for the class as a whole. Individual benefits reported by students in the current study, included, increased interest and engagement with the topic, identification of knowledge gaps (and being able to repair them), and testing of knowledge. Benefits of preparation for the class as a whole, included, everybody being at the same level, and the consolidation of knowledge as a group – rather than doing a post-prac follow up, realising as an individual that you have questions, and not having a convenient opportunity to follow them up.

However, findings from the questionnaire data suggest that not all students felt they were able to contribute to the interactive class. On reflection, the content expert was surprised that more students didn't ask questions or come prepared with questions to the face-to-face class. There seemed to be a reluctance on the part of some students to ask questions, especially in front of the 100 plus cohort. The content expert reflected that some students had waited until after the class to ask questions one-on-one. We had intended to conduct student interviews with a group of students to tease out this behaviour, but only two students volunteered. When asked if this situation might be improved by dividing the cohort into subgroups that reported back to the larger group, one of the two interviewed students felt this would make the process more competitive, and therefore more stressful. The implementation of clicker questions that can be anonymous might provide a solution here (DeLozier & Rhodes, 2016).

Furthermore, it appears that not all students prefer the flipped classroom approach to a standard lecture format. This finding has been reported elsewhere (Jensen, Kummer & Godoy, 2015) and was confirmed by one of the two interviewed students who commented that the flipped classroom was good for some topics, but not all. This student felt that the flipped classroom was good for topics that were more intuitive, or that students had some prior knowledge of. He specifically mentioned anatomy as a subject that would not be suitable for a flipped classroom as he felt it would be too intimidating to begin learning the intricacies of, for example, the structure of the knee, without being guided as to what was important, or what to focus on. The student remarked that this initial guidance gives learners the confidence to continue with individual learning.

It is noteworthy that since this study was conducted, the FBS curriculum has been reviewed and there is a strong desire on the part of subject co-ordinators to implement more flipped classrooms across the current lecture intense teaching streams. The findings of the current study will be used in part to inform this implementation, including the initial choice of topics to target for flipping. The intention of a more systematic implementation of flipped classrooms across year 1 of the MD program, underscores the importance of providing students with explicit education about the approach – its benefits and what is expected of them. This may assist students in feeling more comfortable with the approach, particularly in relation to asking questions, thereby encouraging greater participation and learning benefits.

In summary, this study has shown that a flipped classroom model comprised of a bespoke online resource for preparation, together with an interactive classroom that utilised a Q&A format (centered around discussions of real-life clinical scenarios of snakebite), resulted in improvements in students' understanding of the principles of envenomation. However, further research is required to determine if the observed learning gains were the result of the preparation activity, the in-class activities or a combination of the two components**.**

References

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, California: Sage Publications, Inc.
DeLozier, S. & Rhodes, M. (2016). Flipped classrooms: a review of key ideas and recommendations for practice. *Educational Psychology Review*. Early online. DOI 10.1007/s10648-015-9356-9
Fautch, J. M. (2015). The flipped classroom for teaching organic chemistry in small classes: is it effective? *Chemical Education Research Practices*, 16, 179-186.
Flynn, A. B. (2015). Structure and evaluation of flipped chemistry courses: organic and spectroscopy, large and small, first to third year, English and French. *Chemical Education Research Practices*, 16, 198-211.
Gross, D., Pietri, E. S., Anderson, G., Moyano-Camihort, K. & Graham, M. (2015). Increased preclass preparation underlies student outcome improvements in the flipped classroom. *CBE – Life Science Education*, 14, 1-8.
Hung, H. (2014). Flipping the classroom for English language learners to foster active learning. *Computer Assisted Language Learning*, 28(1), 81-96.
Jensen, J. L., Kummer, T. A., & Godoy, P. D. M. (2015). Improvements from a flipped classroom may simply be the fruits of active learning. *CBE – Life Sciences Education*, 14, 1-12.
Krippendorf, K. (2004). *Content analysis: An introduction to its methodology*. Thousand Oaks, California: Sage Publications, Inc.
McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., & Mumper, R. J. (2014). The flipped classroom: a course redesign to foster learning and engagement in a health professions school. *Academic Medicine*, 89, 236-243.
O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: a scoping review. *The Internet and Higher Education*, 25, 85-95.
Ryan, M. D., & Reid, S. A. (2016). Impact of a flipped classroom on student performance and retention: a parallel controlled study in general chemistry. *Journal of Chemical Education*, 93, 12-23.
Strayer, J. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*, 15(2), 171-193.
The Flipped Learning Network. (2014). *What is flipped learning?* [Online] Available: http://flippedlearning.org/definition-of-flipped-learning/ [2016, Oct 13]
Weaver, G. C., & Sturtevant, H. G. (2015). Design, implementation, and evaluation of a flipped format general chemistry course. *Journal of Chemistry Education*, 92, 1437-1448.
Webb, M., & Doman, E. (2016). Does the flipped classroom lead to increased gains on learning outcomes in ESL/EFL contexts? *The CATESOL Journal*, 28 (1), 39-67.

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A case study exploring video access by students: wrangling and visualising data for measuring digital behaviour

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Every click made by a student is being captured by our learning platforms and integrated web-based tools. This store of data acts as, in its simplest form, part of an individuals' digital behaviour with measurable points of interest. But how can this data give teachers an indication that our energy, time and potentially money spent making educational videos is worth the investment? Do-It-Yourself (DIY) videos are more commonly being made by teachers to replace written or face-to-face spoken content, provide an alternative instruction format or provide assessment feedback, to name just a few. This paper explores how we can help answer the most common question asked by teachers who undertake DIY video creation: are DIY educational videos being accessed by students? To answer this question, usage data generated by Moodle (student access point) and YouTube (video host) was collected. Simple analysis tools were employed to make sense of the typical log points generated by each system. Using a first year nursing subject as a case study, this project compared student access behaviour of pre-recorded one hour weekly video lectures. The results indicated an overall declining trend in viewing the video content online throughout the semester yet an increased video access when videos are presented in small segments assembled in YouTube playlists. An additional important outcome of this study was learning and sharing how to wrangle Moodle logs and YouTube Analytics data by non-statistical experts to quickly visualise video access. This information may ultimately support video creators to evaluate their videos, spend their time more efficiently when initially making videos, support decisions to change content or update curriculum, and to ultimately re-evaluate the role videos play in learning and teaching online environments.

Keywords: learning design; learning analytics; digital behaviour

Introduction

In this concise paper, a small scale pilot study responded to the increased discussion for using data captured through access (view) logs in Moodle and YouTube for determining whether a custom-made digital resource like a video was being accessed by students and therefore worth the energy, time and money spent to create them. This study specifically asked how data wrangled and visualised from Moodle logs and YouTube Analytics database around the student's digital behaviour access of weekly video lectures could provide both educational designers and academic teaching staff with practical considerations for the potential learning design of topics and/or digital content. This study related strongly to the type of digital behaviour explored extensively by authors such as Rowlands et al. (2008), who commonly associated human behaviour with digital information seeking behaviours using log files as a record. This paper makes connections between the patterns represented by usage of online videos using available log data to determine what can be glimpsed in human (student) behaviour around online learning activities. Ultimately this will help to inform staff around the possible learning potential for their educational videos and to reinforce that more planning should be considered during the design of topic and individual digital resources, to overall strengthen the student value of videos.

At a South Australian university, the use of videos created by teaching staff has seen an increase in recent years, due in part to the increase in student numbers which cannot be housed together in a single lecture facility. Additionally, there is an increased demand for learning flexibility for a blended on-campus and distance/off-campus study that is supported by a range of technologies such as web-based tools and online learning platforms. This is reiterated by Heimann and Pittenger (2000) who stated that videos, as a form of communication, had many benefits to education, especially when a voice presentation is integrated with lecture slides. However, video as a communication tool has the potential to be of high value beyond the traditional lecture style and should not be confused with the recording of a traditional face-to-face lecture. The new wave of videos in education are done by the lecturer in a low-tech way, using simple video recording and editing tools, and are hosted on a learning platform or cloud storage tool to be accessed by students as part of their course resources. These videos are usually heavily content-based, as a way to replace or strengthen the traditional lecture, but an increasing number are being created for improving visibility of a lecturer or tutor in an online space (Borup, West, & Graham, 2012; Kelly, Lyng, McGrath, & Cannon, 2009).

It is well recognised in educational fields that multimedia materials are increasingly being used in a range of learning and teaching activities to harness learner attention and interest through the delivery of an eLearning system or education-focused website (Chen & Sun, 2012; Copley, 2007). The education field also recognises that there is potential for students to enhance their learning potential by using media-rich resources, as created and shared by their teachers (Ragusa & Crampton, 2014). Research conducted by Wells, Barry, and Spence (2012) indicates that when videos (and potentially other media) are well-designed, are assessment-focused and readily available when and where students need them, videos have the potential to improve student satisfaction and grades. Another positive value of videos is their potential to build and maintain a social presence and display quality instruction in a highly online environment (Homer, Plass, & Blake, 2008; Kim, Kwon, & Cho, 2011). Zhang, Zhou, Briggs, and Nunamaker (2006) reiterate the value of videos to student learning outcomes when interactivity is included. These considerations should be made when designing topics for online and blended learning environments where video and other multimedia tools and resources are utilised as part of the online learning design.

Research design

This study explored what was being captured by the learning platform (Moodle) reports and YouTube (Analytics), with an emphasis of not using sophisticated statistical software for analysis, but relying on quick visualisation tools available to all staff. In order to answer the research question; are DIY educational videos being accessed by students? The principle behind the decision to use access log data, was to replicate what a non-statistical expert academic teaching staff member could readily use to view how/when their students access digital content, using the example of the weekly online video resource. Microsoft Excel with a pivot table and graph function was one analytical tool used throughout this study, simply because it is accessible to the majority of university staff and simple to use. YouTube Analytics dashboard was a new tool trialled for its value in visually displaying the *views* of individual videos, a group of videos and playlists.

The main aim of this case study was to investigate how Moodle logs and YouTube Analytics could be used to quickly visual the use of videos accessed by students, whilst also testing the potential value in dividing one hour lectures into 2-10 minute sections, which are then combined in a YouTube playlist. Overall this project's aim was to visualise access data of content-focused pre-recorded video lectures in a large (n=406) cohort of first-year nursing students in 2015. Alterations between the one hour videos lectures used in 2014 and segmented 2-10 minute videos presented in a topic playlist structure in 2015 are presented. This study uses two years of access data on weekly video lectures and hypothesises that flexible use of streamed segmented lecture videos stored in YouTube playlists will increase the access of the videos compared to those stored as 1 hour lectures in 2014 (n=413). The study continues the discussion of whether the energy, time and money it takes to plan, create and publish videos for replacing face-to-face lectures is a reliable form of information transfer for students if the majority of students are not accessing the content created.

Results and discussion

The potential investment of time and money it takes a non-video expert to make digital content-rich resources which is engaging for the audience and their importance as a replacement to the one-hour lecture cannot be underestimated. The videos created for this study used a balance of low-technology for their creation (Microsoft PowerPoint and Camtasia Studio 8) but were content-rich using images from the topic textbook. So how do we know they are being accessed? Moodle logs in the learning platform seemed to be a simple way forward. In 2014 student access of pre-recorded one hour lectures for ten weeks indicated only 46% (n=190) of students watched an average number of supplied videos (9 of 24 videos), but also as the weeks progressed, the trend continued to display a declining view of lecture video content. In 2015, the Moodle logs identified 54% (n=220) of students watched an average number of supplied videos (6 of 12 videos). While the number of videos changed between the years, the length of each video did not change. This was due to the repurposing of the videos, where two videos on the same content (Part 1 and Part 2) were merged into one playlist divided video. This resulted in the number of videos created and presented to students dropped from 24 to 12 between 2014 and 2015. Overall, access to video content was an important component to the design of the topic, as students were encouraged to access the video resources before their practical classes because the weekly theoretical content was only delivered digitally through video.

Figure 1 indicates that Moodle logs for the access of lecture video by students in 2014 (n=413) and 2015 (n=406). The results are visualised using Microsoft Excel pivot table chart and are meant to be a guide for staff to identify the access of the video content, not a measure of engagement. Interestingly, the percentage of students in 2014 who accessed all 24 videos at least once was 5.33% while in 2015 the students who accessed all 12 videos at least once is 13.79%. The results indicate that the number of videos presented to students is an important decision, as too many and they are unlikely to access all of them.

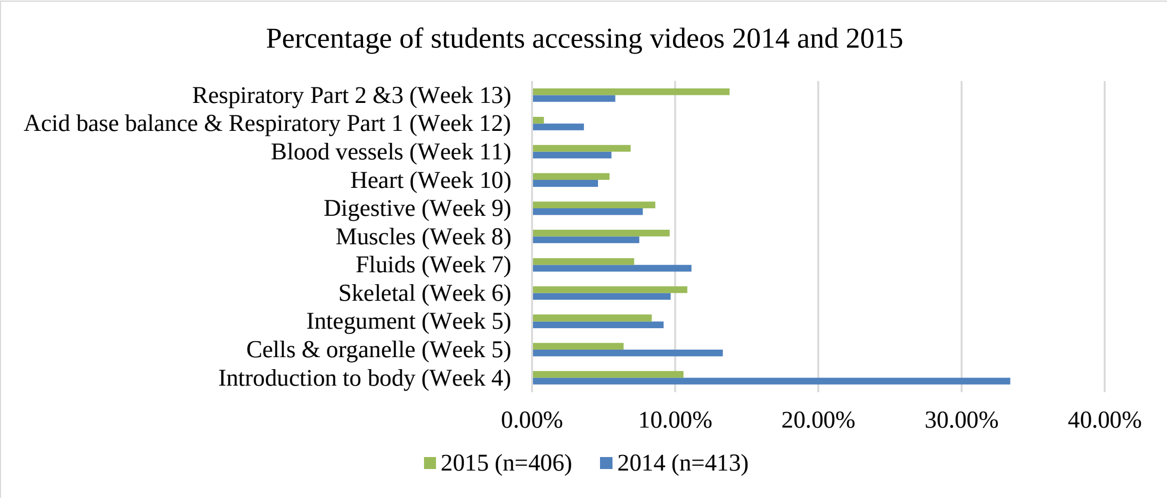

Figure 1: Comparing 2014 to 2015 video access in Moodle

Taking on board the low measured views of videos in semester 1, 2014, obtained from Moodle reports, a meeting between the topic coordinator and an educational designer resulted in editing the one hour video lectures used in 2014, into segmented shorter concepts (2-10 minutes in length) and stored in an unlisted YouTube playlist by topic/week. This playlist was then embedded into the online platform topic for semester 1, 2015, for students to access when needed. A total of eleven playlists were created, one for each unit of study within the topic. By using YouTube as a video host, the aim was to visualise access data of videos to determine if the use of playlists improved the video accessibility for students to review sections of the weekly content because of its menu-like feature. All videos were hosted in the topic coordinators' YouTube channel. YouTube also provided YouTube Analytics for measuring the *view* (click) of videos where no users were identifiable (See Figures 2A and 2B). Within the YouTube Analytics section is a valuable tool *Groups* when connected to the *Audience Retention* option, provides visual displays of the average view (access) duration of each video within a group (a *group* being a collection of videos or playlists). The flexibility of this feature enabled comparisons to be made between video segments or across playlists. This topic created all eleven playlists into a single group for analysis (Figure 2.A) and created an independent single playlist for each week's content (example for Week 4 provided in Figure 2.B).

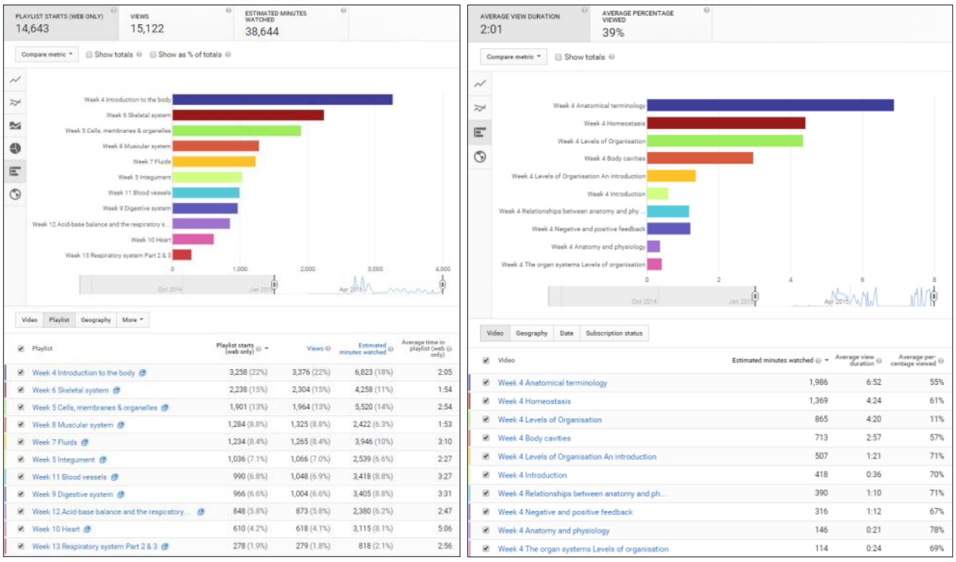

Figure 2: Visualising possibilities in YouTube analytics samples (2015):
A: comparing playlists in topic; B: individual playlist videos (an example of the week by week playlists)

The audience retention feature (determined by length of time video was accessed) captured by YouTube has been invaluable throughout this study, as it provides an overall view of the video visually with the view response from students at any given point in time of the video (illustrated in Figure 3). Interestingly, the YouTube Analytics summary for 2015 videos by topic playlist (Figure 2.A) identified that of the 118 videos (comprised of 2-10 minute video segments of the original 1 hour video) loaded into YouTube, the average view duration is 2:33 minutes per video. As illustrated in Figure 2.A, the trend displayed by the views in all playlists indicated the typical dwindling of access for later weeks' content (Week 4 is represented by blue and Week 13 is represented by red). The same can be applied for an individual playlist, as illustrated in Figure 2.B. Using YouTube Analytics for the example of Week 4 playlist containing 10 short videos, we clearly and quickly highlighted the average duration students spent for each section (content video) within the playlist. Additional filters can be viewed using the *metrics*, which are defined as individual measurements of user activity.

Overall the audience retention feature for each video displayed an interactive visual dashboard, enabling the user to pinpoint the section of the video that is poorly viewed (see Figure 3). Audience retention is defined by Google (2015) "as an overall measure of your video's ability to retain its audience" (para. 1). There are two types available; *absolute* and *relative*. The most useful type is the absolute which "shows the views of every moment of the video as a percentage of the number of videos views" (Google, 2015, para. 1). Once again, the emphasis of where (content location) students were spending their time is visually obvious and using the audience retention preview (see Figure 3), the user can play the video at the point where the majority of students appear to stop. This may lead to last minute changes in teaching focus (just-in-time direction), or highlight that the video had not been edited correctly (as case in point for Week 5 where a 20 minute black gap was accidently left in between video segments). Further information may be asked from the students during class to determine whether students were coping with the content, or rather not coping. This would allow for targeted concepts to be evaluated in a face-to-face class or online discussion, or through the use of knowledge checkpoints (quizzes) as used in this topic. As illustrated in Figure 3, the YouTube audience retention visually demonstrated where in a video the majority of viewers switch off (stop watching defined by stopping video). The definition for the majority of viewers for our purposes was 50%.

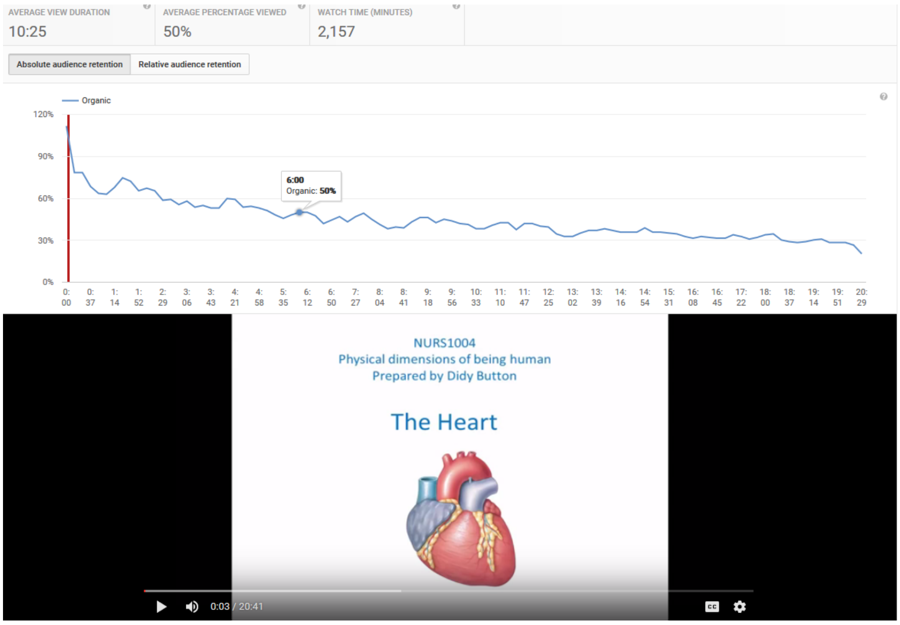

Figure 3: YouTube audience retention example for the heart topic in 2015

As video segments were on average 2-5 minutes in length across all eleven playlists, the relationship to the required practical laboratory knowledge was not used in the study, however the potential to identify the point at which the video was stopped may be useful in determining whether the content being covered is appropriate and/or required prior to a practical lesson. In the example provided in Figure 3, the anatomy of the heart has a 2 hour practical laboratory class. If only 50% of the video content was played to the end by half of the students, would the teaching staff expect a different level of preparedness on the whole from their students than for the 23% of students who did play the video to the end? It may be considered that the nature of the video lecture, a voice over a PowerPoint slide, may not be a suitably engaging for learning basic heart anatomy. Would you question whether this content could be taught more visually, thereby making use of the video content? These are some questions which have arisen from analysing the 2015 data, but many more could come to mind in moving forward to consider the use of videos in 2016.

Conclusion

So do you know if your DIY educational videos are being accessed by your students? The potential access of videos created by the teaching staff is an important consideration in the future of tertiary education. Workload time required to develop the necessary technical skills required to learn video software may be a significant investment. Additionally, the potential cost to create online videos can come from a time or monetary perspective. This case study highlighted the potential value in not only supporting teaching staff to learn how to create engaging and good quality educational videos, but also to be able to measure basic access data by using simple data analysis tools to determine how the videos are being accessed. To help up-skill teaching staff in video development, it is recommended that supportive training workshops, guiding educational designers and accessible technical support are required as the demand for creating quality teaching videos continues to increase. While Moodle logs is readily available to all teaching staff at this university, it is acknowledged that not all teaching staff have the knowledge to interpret the data collected, nor manipulate the data into visual logs to gain insight. Whilst YouTube provides a more valuable analysis because of its visualisation power, Moodle logs could reinforce where a student went next online in Moodle, whereas YouTube was restricted solely to the videos hosted in the tool. Further exploration into YouTube Analytics potential is warranted as to how it can be used to design the online space to improve learning potential for students, but also how it can be used to change teaching practices in face-to-face classes. However, the power to use simple data analysis tools enables anyone to analysis how videos are being accessed and whether this has any impact on the learning potential. Moving forward, other considerations for university staff using analytic tools could include learning how to best encourage the creation of quality and engaging video content. Supporting approaches for the sustainability of the video content and identifying the value of interactive quiz throughout the video content may need further considerations. Ultimately, how to improve audience retention to increase learning potential is required as we move forward in this space. Additional studies into student opinions, motivation and engagement relate to how they want to use content-related videos would also strengthen any future use of these types of videos in the online and blended tertiary environment.

References

Borup, J., West, R. E., & Graham, C. R. (2012). Improving online social presence through asynchronous video. *Internet and Higher Education*, *15*(3), 195-203. doi: 10.1016/j.iheduc.2011.11.001

Chen, C.-M., & Sun, Y.-C. (2012). Assessing the effects of different multimedia materials on emotions and learning performance for visual and verbal style learners. *Computers & Education*, *59*(4), 1273-1285. doi: http://dx.doi.org/10.1016/j.compedu.2012.05.006

Copley, J. (2007). Audio and video podcasts of lectures for campus-based students: Production and evaluation of student use. *Innovations in Education and Teaching International*, *44*(4), 387-399. doi: 10.1080/14703290701602805

Google. (2015). Audience retention report. Retrieved from https://support.google.com/youtube/answer/1715160?hl=en

Heimann, B. A., & Pittenger, K. K. (2000). Incorporating video as a teaching strategy in interpersonal communication. *Developments in Business Simulation and Experiential Learning*, *27*.

Homer, B. D., Plass, J. L., & Blake, L. (2008). The effects of video on cognitive load and social presence in multimedia-learning. *Computers in Human Behavior*, *24*(3), 786-797. doi: 10.1016/j.chb.2007.02.009

Kelly, M., Lyng, C., McGrath, M., & Cannon, G. (2009). A multi-method study to determine the effectiveness of, and student attitudes to, online instructional videos for teaching clinical nursing skills. *Nurse Education Today*, *29*(3), 292-300.

Kim, J., Kwon, Y., & Cho, D. (2011). Investigating factors that influence social presence and learning outcomes in distance higher education. *Computers & Education*, *57*(2), 1512-1520. doi: 10.1016/j.compedu.2011.02.005

Ragusa, A. T., & Crampton, A. (2014). *Any voice will do: Distance students' perceptions of audio lectures.* Paper presented at the Ascilite Rhetoric and Reality: Critical perspectives on educational technology, Dunedin, New Zealand.

Rowlands, I., Nicholas, D., Williams, P., Huntington, P., Fieldhouse, M., Gunter, B., Withey, R., Jamali, H. R., Dobrowolski, T., & Tenopir, C. (2008). *The Google generation: The information behaviour of the researcher of the future.* Paper presented at the Aslib Proceedings.

Wells, J., Barry, R. M., & Spence, A. (2012). Using video tutorials as a carrot-and-stick approach to learning. *IEEE Transactions on Education*, *55*(4), 453-458.

Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & Management*, *43*(1), 15-27.

Please cite as: Garnett, T. & Button, D. (2016). Learning how to wrangle and visualise data for measuring digital behaviour: A case study exploring student video use. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 225-230).

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It’s what you do with IT that matters!

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> ‘The reality is that technology is doing more harm than good in our schools’ says education chief (Bagshaw, 2016, article title).

This April 1st headline for a Sydney Morning Herald article was no April fool’s joke. It referenced comments made in an address by OECD education director Andreas Schleicher at a global education forum. The statement is quite poignant for the ASCILITE (2016) conference given its theme is “Show me the learning”, focussing upon “demonstration of learning aided by the adoption of technology in the education space” (para 4).

This paper will examine questions raised by these comments, vignettes from a doctoral study that offer some answers to them, and propose the need for holistic assessment of contexts to more fully understand what is happening within them. It is suggested that while this paper is particularly relevant to initial teacher education, the principles are applicable to tertiary education more broadly.

Keywords: ICT, computer, education, teach, learn, school, university, ITE, PISA, OECD, CHAT, research

Background

The use of ICTs for learning and teaching is of interest in Australia and internationally because of the perceived potential for educational advantage through their use in the classroom, and the belief that students’ skills with ICTs are a critical part of 21st century capabilities (Australian Curriculum, Assessment and Reporting Authority, 2013; US Department of Education, 2013; UK Department for Education, 2013). The Organisation for Economic Co-operation and Development (OECD) suggests that its Program for International Student Assessment (PISA) is designed to assess the acquisition of “key knowledge and skills that are essential for full participation in modern societies” (OECD, 2014, p. 3). Along with its focus on 15 year old student’s capabilities in reading, maths, science and problem-solving, the PISA also optionally assesses ICT use and capabilities. In 2012, approximately 510,000 students sat the PISA test, representing 28 million 15 year olds in 65 countries including all 34 OECD countries (OECD, 2014). Given the magnitude and status of the PISA, it is concerning that with reference to the 2012 results, the OECD education director Andreas Schleicher was cited as stating that “The reality is that technology is doing more harm than good in our schools” (Bagshaw, 2016, article title).

The nature and level of ICT use in schools is not a new issue. The desire in the field of education to see greater and more effective use of ICTs extends back to the 1990s (An, Wilder & Lim, 2011) when microcomputers became relatively commonplace and affordable, and clearly remains to the present day where ICT use has become ubiquitous. The news article title and other points included in the story raise many questions that are helpful when considering ICT use in educational settings. The following excerpts highlight some prominent issues:

> "Education is a bit like the stock market, it overshoots." said St Paul's Catholic College principal Mark Baker. "Computers have been oversold and there is no evidence that it improve outcomes.”
>
> John Vallance, the principal of one of Sydney's most expensive private schools, Sydney Grammar, said that laptops were not necessary in class and that more traditional teaching methods were more effective.
>
> Australia has spent $2.4 billion putting laptops in the bags of as many school children as possible through the Digital Education Revolution of the Rudd and Gillard governments. (Bagshaw, 2016, April 1)

Based on inferences from these points, questions to ask could be: Has there been a tendency to expect or promise more from computer use than what they can deliver? What influences can use of ICTs have on educational outcomes? Why would traditional teaching methods be seen to be more effective than those that involve use of ICTs? What has been the effect of providing laptops for Australian school children?

So what has been the result of the 1:1 laptop scheme funded by the Australian Governments' Digital Education Revolution (DER) initiative? Without citing any research, the Department of Education, Employment and Workplace Relations Annual Report for 2012-2013 describes the effect of the DER as follows:

> For more than a decade, governments and school communities around Australia have been working to harness the power of ICT to improve educational opportunities, boost outcomes and further enhance the learning experience. The Digital Education Revolution has accelerated this by establishing a strong technology base in schools. The program review concluded that the Digital Education Revolution 'is broadly regarded as a major success' and 'credited with generating a catalytic positive impact across Australian schools'. (DEEWR Annual report 2012 – 2013, p. 38)
> https://docs.education.gov.au/system/files/doc/other/deewr_annual_report_2012-13.pdf

Based on a lack of directly linked evidence, Cuban (2006) suggested claims that providing laptops to students will "revolutionize teaching and learning" and "increase test scores" were "outlandish" (p. 29), and his views have altered very little since that time. Offering insight into this, and explanation of why ICTs are yet to deliver on what has been promised, Cuban (2015) suggests that while new ICTs are being used by school teachers, they have not effected a shift from traditional teaching methods to the "hoped for student-centred approach" (para 6). The implication is that if teaching approaches remain the same, albeit utilising new technologies, the results of that teaching will likely be the same. Could this also be the case for tertiary education?

How accessible are computers in Australian schools, and how are they being used? The PISA results advise that Australian student access to computers and the internet has increased since the 2009 assessment (greatest increase across the OECD), and that their use in class and for homework also increased (OECD, 2015, pp. 63-64). Australian students reported the highest level of access to a computer (93%), and the highest amount of use, more than twice the OECD average of 25 minutes, browsing the internet at school 58 minutes per day (p. 55). ICT use for schoolwork outside of school in Australia was around 50% higher than the average mean index (p. 60). The percentage of students reporting use of computers by both teachers and students during mathematics lessons was around 20% above the OECD average.

What are the results of this use? Australian students, and those from a number of other countries reporting relatively higher levels of student use of computers during maths lessons "perform better on mathematics tasks that require the use of computers to solve problems compared to their success on traditional tasks"(OECD, 2015, p. 82). Perhaps not surprisingly given time spent doing it at school, Australian students amongst others including those from the United States and Canada ranked "highest for the average quality of their web browsing (task-oriented browsing)" (p. 106). Interestingly, four of the countries reporting the lowest internet use at school (Korea, Hong Kong-China, Japan, and Shanghai-China "were the top-performing countries/economies in digital reading in 2012; and "… Shanghai-China, followed by Korea, Hong Kong-China, Macao-China, Japan and Chinese Taipei were top performers in the 2012 computer-based mathematics assessment" despite reporting the lowest levels of student's use of computers for mathematics in class.

With Australia's PISA overall performance falling relative to previous assessments and other countries, the results cited above may prompt further questions. For example, is close to 60 mins per day browsing the internet at school the best use of Australian student's time, when Shanghai China students, the highest overall performers in 2009 and 2012, are only 8% behind in quality of browsing capability, and spend the 2nd least amount of class time browsing the internet (approx. 10 mins per day)? Is this the right kind of question? Advice from the PISA report would indicate perhaps not, suggesting the need for a much broader set of considerations.

> … successful integration of technology in education is not so much a matter of choosing the right device, the right amount of time to spend with it, the best software or the right digital textbook. The key elements for success are the teachers, school leaders and other decision makers who have the vision, and the ability, to make the connection between students, computers and learning. (OECD, 2015, p. 192)

A focus on the particular can sometimes lead to decisions based on limited perceptions. A poem by John Saxe, an American author who immortalised an old fable from India about six blind men who came upon an elephant is analogous to this situation. The essence of the story is that based on what each of the men could determine from the aspect of the elephant that they were accessing, they argued long and hard about what an elephant was, with all failing to come to anywhere near a full understanding of it.

Similarly, investigating one or even a sub-set of elements of ICT use in education may only gain a narrow sense of what is happening, and the issues that are present. Speaking of research in this area, Tondeur, Valcke and van Braak (2008, p. 494) suggest that “current studies succeed only partly in explaining differences in the integration of educational computer use”, surmising that “one of the reasons for this might be that most researchers have investigated the influence of just a few characteristics on the integration process” and that “as a consequence, studies tend to ignore the complex systemic nature of ICT integration".

A PhD study currently underway responds to the need for more holistic studies of ICT in education. The intent of the study is to gain a fuller and more complete picture of the nature and reasons for use and non-use of ICTs for learning and teaching by pre-service primary school teachers while on professional placement. In order to gain a broad understanding of the contexts in which this takes place, an approach guided by Cultural Historical Activity Theory (CHAT) was adopted. The use of CHAT enabled, and in-fact requires acknowledgement and reference to the past as well as the present, and consideration of the influence of communities, including their culture, rules, motives, and roles. The design of the PhD study, and vignettes from three of its cases will now be briefly discussed to help answer some of the questions posed by the newspaper article.

Overview of the research project

The questions that the study is investigating relate to pre-service teacher practice while on professional placement, and are as follows:

- When and how are ICTs being used for learning and teaching?
- What are the influences behind use and non-use of ICTs for learning and teaching?

A qualitative collective case approach (Stake, 2005) has been employed to investigate these questions within the selected teacher programs. The sample comprises:

- 11 x 4th year pre-service teachers drawn from two regional university campuses in NSW (5 x B Ed (Primary); 3 x B Ed (K-12); and 3 x B Ed (EC/Primary) students.
- 10 teachers supervising these students while on professional experience placements
- 14 university lecturers teaching into the Initial Teacher Education (ITE) programs

Data has been gathered through three means of collection:

1. via observation of pre-service teacher classroom practice (one hr per student);
2. semi-structured interviews with pre-service teachers (one interview pre and post the lesson), their supervising in-service teachers, and ITE program lecturers;
3. accessing documents such as teacher preparation program and subject profiles, and school policies or statements relating to ICT use for teaching.

Analysis

These data will be analysed using two approaches, one according to emerging themes, and the other according to the principles and framework of CHAT. The rationale for engaging two approaches is the expectation that including more than one perspective should reveal more about the identified issue than using either on its own. Given the necessary breadth of this investigation, a macro view of the situation is appropriate, and a 3rd generation of Engestrom’s (2008) activity system model has been developed to encompass the interacting activity systems of the university and school contexts; these comprise the unit of analysis.

At the time of writing, all of the data had been collected, and analysis of them was underway. When considering the news headline, a number of vignettes from the study came to mind as being relevant for the questions raised.

The tale of three schools

The context for the first of these cases is a small school in a rural area where one of the project participants was placed for professional experience. The school was well-equipped with an interactive whiteboard (IWB), notebook computers for each student, and a wireless network. All of these ICTs were used by both the supervising and pre-service teacher.

The relevance of this case to the news story is that the teachers of this school had gotten together and planned a response to the lowest scoring aspect of their 2014 National Assessment Program – Literacy and Numeracy (NAPLAN), grammar and punctuation. Olivia (pseudonym) the supervising teacher advised that they "did some research into the IXL program" used by the school, and how it could be employed as a part of their overall approach to increase the motivation of the students to learn, as the students were more "excited by doing it on the program and seeing the medals and rewards" than they were completing worksheets. The teachers used IXL's analytic information about student performance to individualise exercises, and to extend the level of their learning. This was done in conjunction with the teacher's own observations and assessments of student progress and achievement through this and other classwork.

The year 5 students NAPLAN overall results for 2015 for grammar and punctuation have since been accessed, and they show a full band level of increase from those achieved in 2013 and 2014 (bottom of band 6 to the lower end of band 7). More specifically, performance improved from 2014 where 50% of students were in band 5, 33% in band 6, and 17% in band 7, to 2015 where all students were in band 6 (40%) or band 7 (60%), placing them well compared with statistically similar and other Australian schools.

While due to the infinite array of variables and lack of a formal study this intervention could not be considered causal, the results do provide some support, given the performance of the two preceding years and other schools relative performance, for deliberate, insightful, and purposeful use of ICTs to enhance learning and teaching.

The second case was a government primary school in a regional area, which advertised on its website many purported benefits for, and a large uptake of its 1:1 notebook program. Here and despite this commitment to use ICTs, mature-age Early Childhood/Primary pre-service teacher Amanda's (pseudonym) use of ICTs for learning and teaching was not extended, and was reportedly significantly hampered. While in the observation phase of her placement, the supervising teacher had reportedly not used the IWB interactively, more "like a slide projector and sometimes [to present] a YouTube clip". When she did start to teach, Amanda advised that she had asked her supervising teacher if she could be hooked up to the interactive whiteboard, and the answer was "Oh it's too fiddly for me to do that for you." She posed possible reasons for this, including that "the teacher knew that she didn't have capabilities in that area and didn't want to be shown up by … a student who only teaches babies", however, she could not be certain of why this was the case.

This limitation was both disappointing and frustrating for Amanda as she had many interactive and media rich resources and activities to utilise on the IWB, and was unable to do so. Amanda advised that in her class some students had their own laptops, and others did not. For those without their own computers, a central pool of 20-30 laptops was available according to a roster for each of the schools' classes. Relayed uses for the laptops included guided reading activities, cyber safety 'lessons' via a government website, and 'on-demand' comprehension and numeracy testing. Computer use in class was frustrating for Amanda, as she advised it took 10 minutes for the students to get logged in to an intranet, they were 'slow', and opportunities that arose to utilise them went by, as not all of the students had them all of the time.

While the researcher's access to the classroom for an observation was refused, it would seem that despite the school's intended direction and significant investment, there was in this class a measure of resistance to the use of ICTs in the interactive and collaborative manner espoused in the school website. While it may be speculative to state that this could limit student learning opportunities, it is clear, and of concern for ITE providers, that this professional experience placement did not reach its potential to assist the development of the pre-service teacher's ability to use ICTs for learning and teaching. Casual observation of a pre-service teacher using ICTs in an adjoining class was an indicator that this experience was not common to all ITE students.

The third case was a non-government high school where Nigel (pseudonym) a K-12 pre-service teacher was placed just prior to his final practicum. In this school, Nigel advised extensive use was made of an online learning environment, every classroom had an IWB, every lesson was run off the teacher's laptop, and in his class all 26 students had MacBooks. In his words, "… the school was very tech savvy, so everyone was using that kind of thing." Interestingly and of particular relevance to the news story, and while seeing value in using ICTs and gaining computer literacy, Nigel also reported that

> on the flip side of that their written and … reading literacy was very low. So one of the key things that I was asked to work on with the year 10 class was their reading, writing, grammar and punctuation- Because they couldn't, I mean they just have spell check and grammar check so when asked to do their tests, like their NAPLAN or their … [year 10 exams] and doing their essay writing and … [written] responses, it became a bit of an issue … communicating their thoughts onto paper.

This case rings of similarities to the PISA results for Australia which indicate that while performance in computer based maths tasks is quite good, performance in traditional tasks is falling (OECD, 2015). This case may also lend support to Sydney Grammar Principal John Vallance's contentions regarding the necessity of laptops in class, and the greater effectiveness of 'traditional' teaching methods (Bagshaw, 2016, April 1). Responding to these cases, a key question for all educators using ICTs might be, how is the medium affecting the message?

While these vignettes when considered together might provide affirmation for the conclusion that "schools and education systems are, on average, not ready to leverage the potential of technology" (OECD, 2015, p. 190), and the first case does point to the way forward in terms of the need for "the teachers, school leaders and other decision makers who have the vision, and the ability, to make the connection between students, computers and learning" (OECD, 2015, p. 192), this is not the end point. Although it provides insight into part of the 'elephant' that is ICT use in education, "PISA data cannot be used to characterise initial teacher training, professional development, and teachers' working conditions" (OECD, 2015, p. 62), all of which are important to ICT integration as they represent key aspects of the "inter-locking cultural, social and organisational contexts in which [pre and in-service teachers learn] live and work" (Somekh, 2008, p. 450). What data are we in higher education using to make decisions about ICT use for learning and teaching? How can the potential of technology to enhance learning and teaching be leveraged?

Schleicher suggests in his foreword to the PISA report that the use of ICTs for learning and teaching is key, as "Technology is the only way to dramatically expand access to knowledge… to access specialised materials well beyond textbooks, in multiple formats, with little time and space constraints… [and provide] great platforms for collaboration in knowledge creation where teachers can share and enrich teaching materials …[and] perhaps most importantly, … support new pedagogies that focus on learners as active participants with tools for inquiry-based pedagogies and collaborative workspaces" (OECD, 2015, p. 4). Questions for all educators and indeed institutions include how might this work in my context? What is happening and what are the challenges to meet? Where and how does it become possible to develop or further the necessary knowledge and skills?

Conclusion

ICTs have an important role to play in both learning and teaching, however, for desired benefits to be achieved, there is a need for teachers, educational leaders, and decision makers to have clarity around how they will enhance the learning of students, and to make informed and supported decisions about their application. While this paper focussed upon the use of ICTs for learning and teaching in the school context, it is suggested that the principles discussed apply to the tertiary sector generally, not only to ITE, as commonalities exist between them at the macro and micro levels. The contention is also made that study designs such as the one outlined here can help to fulfil the need to understand each educational situation, in order for it to be possible to address identified needs. A concluding commendation is to remember, as the old saying goes, that 'all that glitters is not gold', and that it is how we use ICT that matters!

References

An, H., Wilder, H., & Lim, K. (2011). Preparing elementary pre-service teachers from a non-traditional student population to teach with technology. *Computers in the Schools*, *28*(2), 170-193. doi: 10.1080/07380569.2011.577888

ASCILITE. (2016). ascilite 2016: 33rd International Conference on Innovation, Practice and Research in the Use of Educational Technologies in Tertiary Education. https://ascilite.org/2016-conference/

Bagshaw, E. (2016, April 1). 'The reality is that technology is doing more harm than good in our schools' says education chief. *The Sydney Morning Herald.* Retrieved from: http://www.smh.com.au/national/education/the-reality-is-that-technology-is-doing-more-harm-than-good-in-our-schools-says-education-chief-20160330-gnu370

Cuban, L. (2006). The laptop revolution has no clothes. *Education Week, 26*(8), p. 29.

Cuban, L. (2015, 5 Feb) Larry Cuban on school reform and classroom practice: The lack of evidence based practice: The case of classroom technology. Retrieved from https://larrycuban.wordpress.com/2015/02/05/the-lack-of-evidence-based-practice-the-case-of-classroom-technology-part-1/

Engeström, Y. (2008). *The future of activity theory: A rough draft*. Keynote lecture presented at the ISCAR Conference in San Diego, Sept. 8-13. Keynote retrieved from: http://lchc.ucsd.edu/mca/Mail/xmcamail.2009_01.dir/pdftx2SyzoolF.pdf

OECD. (2014). *PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know.* OECD Publishing. http://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf

OECD. (2015). *Students, Computers and Learning: Making the Connection*, PISA, OECD Publishing. *http://dx.doi.org/10.1787/9789264239555-en*

Somekh, B. (2008). Factors affecting teachers' pedagogical adoption of ICT. In J. M. Voogt & G.A. Knezek (Eds.), *International Handbook of Information Technology in Primary and Secondary Education* (pp. 449-460). Retrieved from http://CSUAU.eblib.com/patron/FullRecord.aspx?p=364220

Stake, R. (2005). Qualitative case studies. In N. Denzin & Y. Lincoln. *The Sage handbook of qualitative research*. (3rd ed.). London: Sage.

Tondeur, J., Valcke, M., & Van Braak, J. (2008). A multidimensional approach to determinants of computer use in primary education: teacher and school characteristics. *Journal of Computer Assisted Learning*, *24*(6), 494-506. doi:10.1111/j.1365-2729.2008.00285.x

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Video-based feedback: Path toward student centered-learning

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Sufficient feedback is in the core of Student centred-learning. Text based feedback has certain limitations and can be seen by students as generic rather than personalised. Video feedback is welcoming alternative to personalised and individualised reflection on student's works and greatly valued by students. Such personalised connection between tutors and students increases student's own motivation and enhances possibility for self-assessment and self-reflection. Computer software for screen capture and audio narration have been used to create videos which are provided to students as a video-based feedback. The video-based feedback has been made using student's electronic submissions and narration which are video and audio recorded. Webcam has been used to capture tutor's facial expression to make whole experience even more personalized. Initial video-based feedback pilot created positive reaction among students indicating that further experimenting is greatly desirable.

Keywords: Video-based feedback, feedback, assessment, learning.

Introduction

Importance and the role of feedback is widely acknowledged in educational sector (Evans, 2013; Hattie & Timperley, 2007). Over the years, many institutions, enforced policies related to formative feedback provided to students within specific period (Bailey & Garner, 2010). However, it seems that quality and amount of constructive feedback has been reduced due to modularised courses, semester structure at educational institutions, curriculum flexibility and enlarged class sizes. Video-based feedback should be seen as value added to the process of constructive feedback provided to students in higher education. Intention of the video-based feedback is not to replace text based feedback but rather to become accompanying part where, due to the time constraints or complexity, it can take precedent over text based feedback.

Assessment

Assessments in combination with constructive feedback are considered core of student's learning (Biggs & Tang, 2011). Some academic staff may see feedback as repetitive process where same or similar feedback is provided during each iteration of the subject. The purpose of the feedback should be to enhance learning rather than just providing judgmental outcome at the end of assessment process. Usage of video-based feedback will allow academics to make comments and critiques on specific sections of student's submission initiating future learning.

Video as visual medium has a potential to support learning in a different way enabling better demonstration using screen-capture technology (Crook et al., 2012). This is also great feedback enhancement for academic staff allowing them to address complex issues in student's submission verbally, being more time productive.

Video-based Feedback

Study conducted by Crook et al. (2012) indicates that 80% of student liked use of video as feedback method. This is strong indicator that investment in video-based feedback can not only improve quality of the feedback but also increase student's satisfaction. We can also argue that video-feedback will improve communication between academics and their students. This view is also supported by Higgins, Hartley, and Skelton (2001) indicating that we should pay more attention to feedback as a 'process of communication'. Furthermore, formative and summative feedback must be used as motivator for learning rather than just concluding comments on submitted wok. Video-based feedback can become one of the most desirable types of feedback due to its personalised nature.

Video-based feedback is also time efficient method for academics to provide more personalised feedback to a particular student in a shorter period of time. Duration of the video-based feedback is also crucial as motivator for student improvement. Cann (2007) argues that viewing platform should be used as a guide for acceptable duration of the video where mobile devices should be used for videos <5 minutes and computer screen for videos <10 minutes. These guides should be taken into consideration when video-based feedback is used as part of teaching and learning practice. Video-based feedback should not be more labour intensive in comparison with text-based feedback once video duration guidelines are implemented and followed by academics.

Pilot

Computer software for screen capture and audio narration have been used to create videos which are provided to students as a video-based feedback. The video-based feedback has been made using student's electronic submissions and narration which are video and audio recorded. Webcam has been used to capture tutor's facial expression to make whole experience even more personalised. This type of the video-based feedback allows students to understand provided feedback in a much comprehensive way, as they are able to make connection between comments provided by tutor and exact segments of their work. Example of video-based feedback has been illustrated in Figure 1.

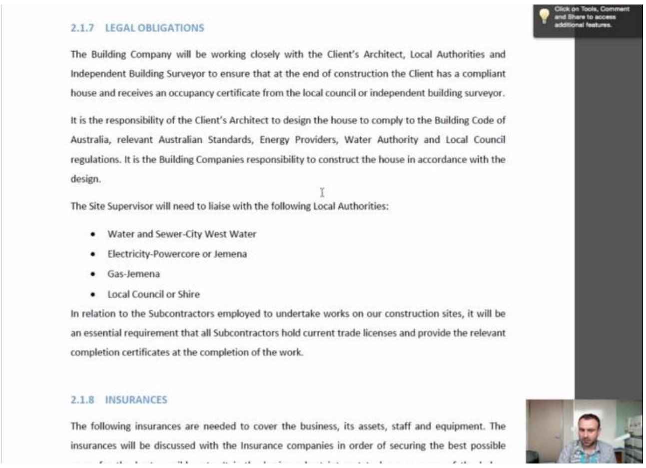

Figure 1: Example of video-based feedback (extract from video)

Conclusion

Students greatly valued personalised feedback of their work especially ability to 'see' their tutor in the video-based feedback. This small feature made them feel like having private oral feedback from a tutor. Video-based feedback seems to have been more supportive, constructive and easier to understand. Students also reported that such feedback is very authentic. Some weaknesses are identified as 'ease of access' meaning that it is not possible to skim read whole feedback as it is case with text-based feedback.

Initial video-based feedback pilot created positive reaction among students indicating that further experimenting is greatly desirable.

References

- Bailey, R., & Garner, M. (2010). Is the feedback in higher education assessment worth the paper it is written on? Teachers' reflections on their practices. *Teaching in Higher Education, 15*(2), 187-198.
- Biggs, J. B., & Tang, C. (2011). *Teaching for quality learning at university: What the student does* (4 ed.). England: Open University Press.
- Cann, A. J. (2007). Podcasting is Dead. Long Live Video! *Bioscience Education, 10*(1), 1-4.
- Crook, A., Mauchline, A., Maw, S., Lawson, C., Drinkwater, R., Lundqvist, K., . . . Park, J. (2012). The use of video technology for providing feedback to students: Can it enhance the feedback experience for staff and students? *Computers & Education, 58*, 386-396.
- Evans, C. (2013). Making Sense of Assessment Feedback in Higher Education. *Review of Educational Research, 83*(1), 70-120.
- Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research, 77*(1), 81-112.
- Higgins, R., Hartley, P., & Skelton, A. (2001). Getting the Message Across: the problem of communicating assessment feedback. *Teaching in Higher Education, 6*(2), 269-274.

Please cite as: Gladovic, C. (2016). Video-based feedback: Path toward student centered-learning. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 237-239).

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Harvesting the interface: Pokémon Go

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What can we harvest from Pokémon Go? This is a conceptual paper about the use of Pokémon Go in Accounting and Education in higher education. The authors provide readers with an overview and context of Pokémon Go, then ways in which this disruptive technology can be used in educational settings. Outlined are ways in which the Pokémon Go app can be used as a tool to provide problem based learning, problem solving and a variety of other skills in the areas of accounting and education.

Keywords: Pokémon Go, social media, disruptive technologies, accounting, education

Introduction

Pokémon Go is a clever application (app) used on smart devices that incorporates principals from several successful apps in the one app. Apps incorporated are ones such as those where you have to throw a ball to catch an object, i.e., Angry Birds, those that measure your walking, i.e., FitBit, and those that test your navigation skills using GPS tracking, such as the geo-caching type app, Ingress (which Pokémon Go is based on), and includes augmented reality overlays. Pokémon Go brings the classic 20-year old game 'Pokémon' together with augmented reality (Reuters, 2016). It is a spinoff of the game Ingress, Pokémon Go's early version, which was launched in 2012 (Niantic Inc, 2016; Rosner, 2016), where individuals navigated around their cities/countries/world, to find landmarks using geo-caching principles.

On 6 July 2016 Pokémon Go was released to selected countries across the world – Australia, New Zealand, U.S.A., Germany, United Kingdom, Italy Spain and Portugal (DN Reviews, 2016). On 17 July, 26 more countries were added to the initial list. Japan, the founding country of the original Pokémon game, had to wait until 22 July to access the new craze in gaming, Pokémon Go. Canada gained access on 18 July. Pokémon Go has been so successful in its slow release that on 7 August 2016 it was ready to release to 15 more countries across Asia and Oceania (Alwani, 2016), including Brunei, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, Vietnam, Taiwan, Papua New Guinea, Fiji, Solomon Islands, Federated States of Micronesia, and Palau.

The day that Pokémon Go was released, it was reported that the free game to download and use, with built in app purchases, had already generated $14.04 million (Fields, 2016). Just two days later, the market-value gains were estimated to be $7.5 billion (Reuters, 2016). Niantic Inc, the owners of Pokémon Go, is on track to make $740 million in revenue this year (Kar, 2016).

Background and context

Pokémon Go has several different, but compatable, objectives. One objective is to gain experience points in order to level up. But, the "ultimate goal of the game is to complete the entries in the Pokédex, a comprehensive Pokémon encyclopedia, by capturing and evolving to obtain the original 151 Pokémon" (Wikimedia Foundation, Inc, 2016, online). The app contains 148 Pokémon, however, in the original Pokémon card game, there are 720. For a full list of Pokémons, please see: http://www.pokemon.com/us/pokedex/. Users have to walk to landmarks to gain inventory items at PokéStops and catch Pokémons (Murphy, 2016). A PokéStop is a place, usually a significant landmark, that has a virtual stop to gather items to go in individual's inventories. These can be things such as Pokéballs (the ball used to capture a Pokémon) or potions, lures and revive items. The key way of gaining experience points is by capturing Pokémons. The manner of capturing is very similar to that employed by the Angry Birds app. You need to swipe a ball to hit the target (in this case, a Pokémon). You can also acquire Pokémon's by:

- Hatching an egg (this involves physically walking – 2 km, 5 km or 10 km, depending on the egg), which uses GPS tracking
- Evolving an existing Pokémon to a higher level

These alternatives generate high experience points. The object of the game is to gain experience points in order to go up levels. Accessing a PokéStop will also earn experience points. Fighting for a gym can provide experience points. A gym is a virtual space where individuals can place an image of their avatar along with one of their Pokémon when you have 'won' the gym (there are three groups to choose from: yellow, red, blue). See Figure 1, owner of a gym, with their Pokémon, Pinsir. Gyms and PokéStops are usually located at significant landmarks and therefore, some places do not have the PokéStops and Gyms to gain access to (Saxena, 2016), such as rural or isolated communities or even built-up areas in towns. Pokémons appear in nests (that is, at the same location) at regular intervals, i.e., hourly.

Figure 1: Owner of a Pokémon gym

Discussion

Disruptive technology

According to Rouse (2014, online), a "disruptive technology is one that displaces an established technology and shakes up the industry or a ground-breaking product that creates a completely new industry". Manykia, Chui, Bughin, Dobbs, Bisson and Marrs (2013, online) believe that disruptive technologies are "advances that will transform life, business and the global economy. Pokémon Go is a great example of disruptive technology. It is disrupting the way people think and do things and is providing alternate means to engage with the community, become physically active and learn.

From a business perspective, Pokémon Go is an obvious example of digital disruption and an example that many higher education students can relate to. It is a real world game, in that it is set in the traditional physical space with actual physical landmarks. However, it is set in a different dimension. This new dimension only became accessible through the Pokémon Go app. It brings together features of other successful applications.

This new dimension opens up considerable space for business activities. The Pokémon Go dimension is an ideal dimension for connecting with a substantial number of people. One source of revenue is advertising and other sources include placing items in the Pokémon Go dimension that will lure people to the physical space. The game has an item called a lure and this acts to lure Pokémon to a PokéStop, so that they can be captured. This is a great metaphor for what it can also do to people.

Pokémon Go as a serious game

Pokémon Go could also be considered a serious game in that its primary purpose may not be purely entertainment but could also be used in the higher education sector in accounting and education as a tool for learning. Serious games incorporate strategy and decision making elements and Pokémon Go provides an arena to hone in on these skills. Serious games enable the educator to incorporate and integrate gameplay into every day classroom activities to enhance student's learning (Ketamo, Kiili, Arnab, & Dunwell, 2013) as outlined more fully in the following two sections.

Accounting concepts and how they can relate to Pokémon Go

Many of the elements of the game display key accounting concepts while it is also potentially a window into future directions of accounting such areas as reporting. Following are some key accounting concepts.

The Accounting Cycle and Reporting – accounting is built around the accounting cycle. In summary, transactions are recorded in a journal, posted to a ledger, summarised in the trial balance and finally reported in the financial statements. In Pokémon Go, one class of transactions is recorded in a journal. While these journal entries are then posted to a ledger equivalent, this ledger equivalent is not visible. There is not an obvious trial balance. Reporting is an area that may be a window into the future of accounting reporting, well at least in part. A strength of the reporting is that it is more user friendly. Take the reporting of Pokémon's captured. This is more visual and can be easily rearranged (for example, by name, combat power, recently captured, favourites, health points or number). There is also the capacity to easily drill down for more specific information. There are also elements where a physical sensation is used as part of the reporting mechanism. When a Pokémon is sufficiently near to be captured, your phone will vibrate.

Triple Bottom Line Reporting – following the belief that you get what you measure, there has been a push in accounting to measure things other than profit. This is referred to as triple bottom line reporting – financial, social and environmental. However, a skill that is not generally strong is how to value each of these bottom lines. Pokémon Go has two main bottom lines – experience points and number of different Pokémon. This is a potential vehicle for players to develop decision-making skills related to achieving different values.

Decision making skills – Pokémon Go provides a number of opportunities to develop skills that are commonly used for business decisions. There are numerous decisions to be made around maximizing experience points which require similar skills to making decisions related to maximizing profit.

Educational affordances of Pokémon Go

This section provides ideas for pre-service teachers for when they are in the classroom and engaging their students on how to use Pokémon Go in an educational setting. If pre-services teachers are able to demonstrate their knowledge of latest technologies or innovative hypes, they will be able to engage their students in their learning. As Williamson (2016) succinctly puts it, there are five things that education technology could learn from Pokémon Go. These are:

Using the augmented reality features to incorporate real world features with the game features to make it "more exciting". Williamson provides an example of cooking a fish, through the use of the Pokémon, Magikarp, augmented onto a frying pan. An example of augmented reality is provided in Figure 3 (a and b).

The game provides levels and increased difficulty. Therefore, when a user begins Pokémon Go, they aren't challenged too greatly. As they increase in levels, Pokémon are more difficult to catch and gyms are more difficult to take over.

New features of the game are released as a user levels up. Therefore, the user can hone in on their skills before being challenged further.

There is a growth mindset encouraging users to practice to increase their skill levels.

The app encourages real life communities. For example, people congregate to catch Pokémon, gain gyms and access PokéStops to fill their inventory items. See Figure 2 for an example of an estimated 3,000 users gathered at Southbank on Saturday 23 July 2016 in order to increase their skill levels and play the game. "South Bank has really blossomed as the best place to get stuck into Pokémon Go and the people playing it, because it has a quite rare PokéStop placement of three PokéStop intersecting near the ferry terminals" (Chester, 2016, online).

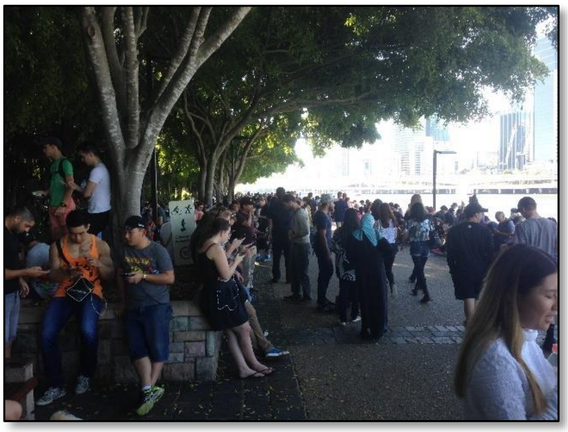
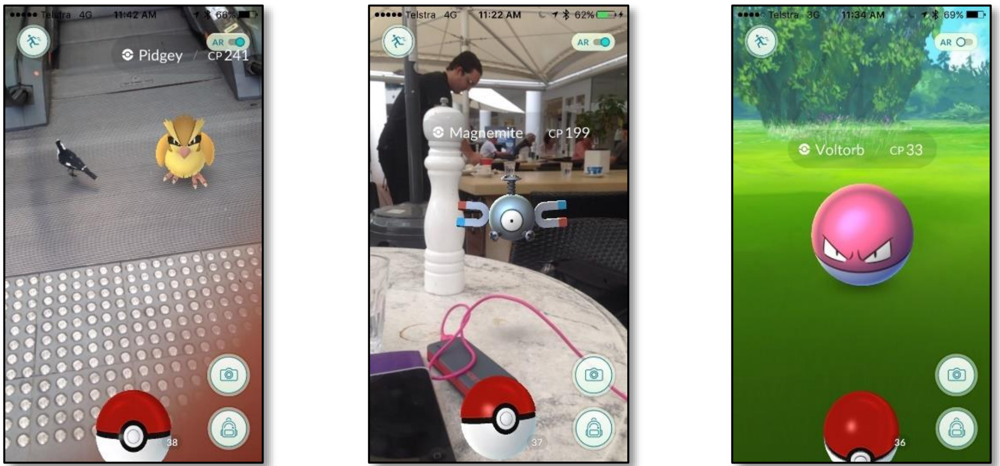


Figure 2: South Bank, Brisbane, Pokémon Go users (23 July 2016)

Other educational uses of Pokémon Go are acquiring map-reading skills. This would be a great exercise for students to go in the playground, be physically active, with a task at hand to find a Pokémon. Of course, Pokémon would need to be available in the first place and they 'nest' in certain locations. If the school is located in an area where there are Pokémon and PokéStops, fun homework for the students would be to go on a Pokémon treasure hunt. This could also assist the students to gain basic orienteering and geo-caching skills. These are map-reading skills enabling the user to be able to locate their location on the map and also find other items on a map.

Augmented reality can be used with Pokémon Go. It has the ability to overlay the real world with a Pokémon. See, for example, Figure 3 (a, b, c), attempting to catch a Pidgey, Magnemite and a Voltorb. Augmented reality can provide immersive experiences for students. It can also be distracting whilst trying to catch the Pokémon.



(a) (b) (c)

Figure 3: Using augmented reality to catch a Pokémon (a and b) and traditional screen (c)

Exercise is required to hatch an egg. This gets a Pokémon player active. Individuals need to walk a specified distance to hatch and egg. These are in various sizes from 2km, to 5 km to 10 km. Once an egg is hatched, the user is rewarded with a new Pokémon, many times one they haven't caught before, providing many more experience points.

There are various skills involved when playing Pokémon Go. It can provide students with problem solving skills. They may be challenged to decide whether or not to catch certain Pokémons. Their inventory items or even Pokémons may be full requiring the student to decide what things they will keep and what they delete, or, in relation to Pokémons, transfer. This can also require basic mathematic skills such as addition. The student may have to calculate how may Pokémons they keep and which ones, depending on what the Pokémon is worth. Therefore, they are also using decision-making skills. To catch a Pokémon requires hand eye coordination. As a user's skill levels go up, these skills become more essential and technique could be significant when catching a Pokémon.

There are a variety of different ways the Pokémon Go app could be used in an educational setting. If pre-service teachers use the tools that the students are engaging with in educational contexts, they will find the students more receptive to undertaking certain tasks. If they don't wish to use Pokémon Go with their students, they may consider looking at Ingress.

Conclusions

Provided was a brief overview of how Pokémon Go is used and ways in which it could be used in accounting and education. Many skills can be honed in by using Pokémon Go. Don't just play Pokémon Go, understand what it heralds for the future and what it brings from the past.

References

Alwani, R. (2016, August 7). *Pokemon Go Out in 15 Countries Across Asia and Oceania; India Release Date Soon?* Retrieved from http://gadgets.ndtv.com/apps/news/pokemon-go-out-in-15-countries-across-asia-and-oceania-india-release-date-soon-870037

Chester, R. (2016, July 30). *Pokemon Go, Brisbane: App taking over Queensland capital*. Retrieved from http://www.couriermail.com.au/news/queensland/pokemon-go-what-is-it-all-about/news-story/a9e88c8b4f57336371c99d9d3fe4c5d9

DN Reviews. (17 July). *Pokemon GO – Now Available In 26 New Countries!* Retrieved from https://dnreviews.net/2016/07/17/pgo-newco/

Fields, S. (2016, July 6). *Pokemon GO Has Made Over $14 Million Already [GameRant]*. Retrieved from http://gamerant.com/pokemon-go-14-million-profit /

Kar, I. (2016, July 25). *Pokemon Go creator Niantic is now worth over $3 billion.* Retrieved from http://qz.com/741117/the-company-that-created-pokemon-go-is-now-worth-over-3-billion/

Ketamo, H., Kiili, K., Arnab, S., & Dunwell, I. (2013). Integrating games into the classroom: Towards new teachership. In S. de Freitas, M. Ott, Popescu, Maria Magdalena, & I. Stanescu (Eds.), *New Pedagogical Approaches in Game Enhanced Learning: Curriculum Integration* (pp. 115–135). Hershey, PA: IGI Global. Retrieved from https://core.ac.uk/download/pdf/30618156.pdf

Manykia, J., Chui, M., Bughin, J., Dobbs, R., Bisson, P., & Marrs, P. (2013). *Disruptive technologies: Advances that will transform life, business, and the global economy.* Retrieved from http://www.mckinsey.com/business-functions/business-technology/our-insights/disruptive-technologies

Murphy, J. (2016, July 17). *The real lesson of Pokemon Go.* Retrieved from http://www.news.com.au/technology/home-entertainment/gaming/the-real-lesson-of-pokemon-go/news-story/076a82908c64b959ba58c768e2f81157

Niantic Inc. (2016). *Ingress.* Retrieved from https://www.ingress.com/

Reuters. (2016, July 11). *Pokemon Go Has Added $7.5 Billion to Nintendo's Market Value.* Retrieved from http://fortune.com/2016/07/11/pokemon-go-nintendo-market-value/

Rosner, H. (2016, July 15). *Wish Pokémon Go were better? Welcome to Ingress.* Retrieved from http://www.polygon.com/2016/7/15/12188262/pokemon-go-ingress-niantic-nintendo

Rouse, M. (2014, July). *What is disruptive technology? - Definition from WhatIs.com.* Retrieved from http://whatis.techtarget.com/definition/disruptive-technology

Saxena, J. (2016, July 13). *Pokémon Go is harder for people in rural communities.* Retrieved from http://www.dailydot.com/parsec/pokemon-go-rural-divide/

Wikimedia Foundation, Inc. (2016, July). *Pokémon Go - Wikipedia, the free encyclopaedia.* Retrieved from https://en.wikipedia.org/wiki/Pok%C3%A9mon_Go

Williamson, D. (2016, July 15). *Five Things Education Technology Could Learn from Pokémon Go.* Retrieved from https://medium.com/@new_edu/five-things-education-technology-could-learn-from-pok%C3%A9mon-go-819f4752b53f#.7ms3zubr3

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Exploring virtual world innovations and design through learner voices

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Student voice has played a big role in shaping the development and measure of success/failure of virtual worlds in education. Data on past and ongoing educational uses and contexts of use of virtual worlds and associated student feedback was gathered via a survey of educational researchers specialising in virtual worlds. Introduced are a range of specific uses that provide the source of and context for student feedback. Ten major themes emerged from student voices that highlight strengths and weakness and point the way forward for both educators and the students themselves. Positive feedback highlighted experiences of both pedagogical design and the ability of the technology to support it. Negative feedback revolved around technical problems, seen as hampering the effectiveness of student learning experiences. Student voice regarding virtual worlds is both positive and rewarding, and commending of staff who have dedicated their time and effort to transform the learning experience.

Keywords: Virtual worlds, Second Life, student voice, learning design, lifelong learning

Introduction and background

In 2009, the Australian and New Zealand Virtual Worlds Working Group (VWWG) was formed. Members of the VWWG have written papers for ASCILITE conferences since 2010 to update the community on the use of virtual worlds in education across the two countries. This year, members of the VWWG are concentrating on student perceptions of their learning in virtual worlds. While there is much attention given to educator perceptions about using virtual worlds for teaching (for example, see Gregory et al., 2015), there is less focus on student voices. This is the focus of this paper, authored by VWWG members. A survey was sent to members of which 20 provided feedback in relation to past and current educational uses of virtual worlds and student perceptions of their learning in these virtual worlds from 17 different institutions across the two continents.

Past papers by VWWG members for ASCILITE have focused on global audiences (2015 - 30 authors), critical perspectives on educational technologies (2014 - 32 authors), past, present and future (2013 - 52 authors), sustaining the future through virtual worlds (2012 - 46 authors), how the VWWG are contributing to change (2011 - 47 authors), and transforming the future through virtual worlds (2010 -21 authors). This paper is timely in that members of the VWWG are now considering what their students have to say about their experiences in using a virtual world for learning.

The paper sets the context for analysis of student voices. We offer a definition of virtual worlds that includes a brief look at a range of technologies and educational uses associated with virtual worlds from the broader perspective. This is followed by a brief description of specific use cases of contributors to the paper to establish the disciplinary breadth from which data is drawn. These use cases are described in more detail later in the paper to provide a greater depth of context for the student voices analysed in this paper. The literature review then presents discussion of a theoretical framework to conceptually contextualise student feedback. Further, a range of literature on student voice and its role in informing the design of technology-assisted learning and indeed in transforming students' own attitudes towards learning facilitated by technology is canvassed and discussed.

In the Method we describe how the data was collected and analysed. In Findings we provide an in depth look at the specific use cases from which student feedback has been drawn, including looking at the types of activities students are engaging in and the disciplines involved. Against this background we then present specific examples of student voices grouped into key themes that emerged from our theme-based analysis of student feedback.

Literature review

Virtual worlds represent a range of technologies and software platforms that are internet based, user created 3D worlds that are used for education, business and government (Dass, Dabbagh, & Clark, 2011). These virtual world technologies and platforms support a range of interaction modes including: interaction in the 3D environment solely via a graphical avatar (e.g. Second Life, OpenSim, Kitely, etc); blended synchronous interaction (combing face-to-face class with participants in a virtual world); and the use of video avatars (e.g. iSee) (Bower, Lee, & Dalgarno, 2016). Each of the technologies has strengths that are suited to specific learning objectives. One of the main purposes of using virtual worlds is that they are a great scalable way of connecting people across campuses, states, country or worldwide (Gregory, Jacka, Hillier, & Grant, 2015).

The authors have contributed substantially to literature on the design of virtual worlds. This includes work by Grant who designed a simulation of a small Chinese township with a number of authentic venues that provide the background and context for specific language and culture-focused task-based activities that are representative of a range of activities that one would encounter when visiting or living in China or are part of the regular Chinese cultural calendar. Work by McDonald involved the design and construction of a virtual multidisciplinary health care facility. Students engage in a range of focused role-play activities as they work their way through a library of tutorials. A small campus environment designed by O'Connell was used to accommodate a range of activities such as conference presentations, group discussion, display areas, and tutorial nooks. A grand hall and outdoor area was crafted by Nikolic in order to create a conference venue environment facilitating multiple simultaneous presentations and social discussion for non-co-located participants. Gregory created a virtual environment designed to provide pre-service teachers with opportunities to undertake situated role play that enabled them to gain classroom management skills, lesson design and implementation experience. A virtual world environment designed to teach New Zealand native flora and fauna through designing 'Koru' (a spiral shape based on a new unfurling silver fern frond and symbolising new life, growth, strength and peace – Wikipedia, n.d.) was carried out by Gaukrodger. These worlds showcase the wide and diverse possible learning experiences available to students. However, greater understanding is needed about the student experience with virtual learning environments and how this is expressed through the student voice (Howitt & Wilson 2015).

User voice is undeniably shaped by experience and the constructs of user acceptance. In 2003 Venkatesh, Morris, Davis and Davis presented the Unified Theory of Acceptance and Use of Technology (UTAUT) model. It identified four key constructs of user acceptance: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is the extent to which technology will benefit users when performing certain activities. Effort expectancy is the user-friendliness of the technology being utilised. Social influence relates to the degree to which users perceive that important others feel they should use the technology in question (e.g. classmates, teacher). Facilitating conditions refers to a user's perceptions of the resources and support provided to perform a behavior (Vankatesh et al., 2012, p. 159). Significant moderating influences of experience, voluntariness, gender, and age were also confirmed as integral features of individual acceptance of information technology (Venkatesh et. al., 2003). "Voluntariness" is described as a spectrum ranging from behavior that is absolutely mandatory through to completely voluntary.

In 2012 Venkatesh, Thong and Xu, updated this research in the form of the UTAUT2, incorporating a wider view of consumer use that included several new constructs (hedonic motivation, price and habit) and removing "voluntariness" as a moderating influence (Venkatesh et al., 2012, p. 159). As the UTAUT2 attempts to explain the acceptance of consumers who, unlike students, have "no organisational mandate and thus, most...behaviours are completely voluntary" (Venkatesh et al, 2012, p. 159), the concept of "voluntariness" was found to not be relevant. In this regard UTAUT better encapsulates the prescribed nature of learning design.

Hedonic motivation, in the context of this paper, has been defined as "the fun or pleasure derived from using technology" (Venkatesh et al., 2012, p. 161). This helps us understand and place into context many of the learner views that are expressed in feedback from learning tasks or projects involving virtual worlds in learning. The comments from students presented herewith reflect that hedonic factors should be considered when adopting and adapting a virtual world for educational use, and that it would be of great use for further research to report such modifying factors such as age, gender etc. McDonald et al. (2012) warn that much of the dissatisfaction of students regarding virtual worlds can be due to the level of the students' digital literacy (experience). Thus hedonic motivations may be marred by misdirected frustration with the technology.

Another key concept in the UTAUT2 relevant to understanding student feedback is the more direct relationship between 'facilitating conditions' and behavioral intention it postulates. Venkatesh et al. (2012) argue that organisational environments will often have freely available facilitation conditions, e.g. accommodating training framework and resources, that are 'fairly invariant' across users. They argue that in an organisational environment (e.g. a classroom), facilitating conditions can serve as the proxy for actual behavioural control and influence behaviour directly, i.e. users' actual intentions have little impact in the use of technology provided by the organisation. In contrast, the facilitating conditions available to consumers can be variable and more complex and as a consequence so are consumer intentions and behavior. Gregory et al. (2015) demonstrated that, from an educator's point of view, educational institutions were not uniform in their support, training and infrastructure (i.e. facilitating conditions). Perhaps within a single institution or project this may be true or even intentionally controlled. The authors of this paper would remind the reader that the success of virtual worlds entering into the educational mainstream is dependent on predicable deployment independent of location.

Brew (2008) consistently found that, student feedback (voice) was reliable and valuable for improving a blended learning course. The technology was quite modest and did not require much student participation. MacFadyen et al. (2015) warn that student evaluation of teaching will be heavily influenced by the characteristics of the students. They go further to say that this does not invalidate such feedback, but rather that these characteristics should be considered in context with the feedback. Brooman, Darwent and Pimor (2015) report a case where the student voice played a vital role in directly informing educational design. Temptation to apply this to virtual world educational projects must be considered at the level of the students' understanding and experience.

The notion of regulatory fit (Higgins, 2005) should be considered when designing any educational program and certainly holds true for use of virtual worlds in education. Students place value on something if they feel good about it, if it feels right to them. Oyserman, Bybee and Terry (2006) discuss the role of regulatory fit and the use of a 'possible self' where the student finds meaning and context in projecting forward. However, they also state that for this to work, an underpinning and authenticity is required. Oyserman, Destin and Novin (2015) put further context to this stating that the 'possible self' framework will be a positive motivator if the experience paints the students in a positive future self. It shows how projection to a 'possible self' can act as a motivator for learning and provide context for regulatory fit (Bennett, Roberts & Creagh, 2016). It would follow that by using the student's voice to their own benefit, there is a possible avenue to mitigate some of the concerns and difficulties expressed by students while working with virtual worlds in education. To engage the type of cohorts that may be resistant or see difficulty, having the students project how this may be relevant to their graduated selves and to have them reflect on this, may give them context and motivation to move past constraints.

Method

An online survey was distributed to members of the VWWG requesting participation focussed on information about their use of virtual worlds by themselves at their institution and student responses (i.e. student voice) to their learning in those virtual worlds. The small cohort of 20 survey completions is considered to represent experts within this field drawn from an already specialist group of educational researchers. A series of eleven open-ended questions were asked, with room for additional comment at the end. Six questions related to description of the virtual worlds and their use. Three questions related to demographics, including discipline and audiences taught (student, staff or other). Two questions focused specifically on student feedback, one relating to how feedback was collected, and the other asking for sample quotes. The survey data was manually coded into themes and these are presented herewith. These themes include: linking with industry and the professional world; communication; engagement; community of practice; flexibility, safety; reflection on learning; role-play; gamification (bringing game features to the virtual environment); value; and technical and other issues/beliefs. There were also some general comments. The findings from the study are reported in the following section.

Findings

This section synthesises the information provided by the VWWG members. It outlines the makeup of activities; the learning students undertake in their virtual world; and their feedback and perceptions of their learning.

What are students doing in the virtual world?

VWWG members were asked to describe activities/tasks that the students in higher education were asked to perform when in a virtual world. Virtual tours (15%), machinima (in-world video) (13%), role-plays (13%) and a place/space for discussions (11%) are the major uses. These are followed with simulations (8%), virtual lectures (6%), virtual guest lectures (6%), research (8%), presentations (6%), other (6%), creative arts 4%), game design (2%) and career planning (2%)

The respondents noted in detail how they were using the virtual world with their students. They were being used for tours, web quests, role plays, building, scripting, guest lecturers, excursions, exploring, purchasing, sharing items (web objects), interacting with bots (non-player characters), honing their communication skills and participating in global challenges. Others focused on sharing the best elements of physical and online learning experiences to both spaces. Others used the virtual world to interact with alumni, other members from industry and students from other campuses. Respondents believe that using a virtual world is about improving project ideas, gaining a global context and developing networking and communication skills (Jarmon, Traphagan, Mayrath & Trivedi 2009).

The disciplines in which members of the VWWG are using virtual worlds for their teaching are education (25%), health (16%), social and behavioural studies (10%), science (7%) languages, visual and performing arts, engineering, and sociology (all 6% each), other (6%), construction, law, art, business (all 3% each). While there is a great diversity in the use of virtual worlds, Education and Health are the two largest disciplines represented utilising virtual worlds for teaching, accounting for 41% of the total respondents.

Description of innovative uses of virtual worlds

Members of the VWWG described a number of innovative uses of virtual worlds – role-plays, virtual tours, curriculum knowledge, communication, cross between school and university learning, blended learning and wearable technologies, and exploration (outlined further below). These innovative reasons are why there are so many student voices in relation to students learning in virtual worlds. These voices follow this section.

Role-plays were used by several members of the VWWG. They were used to demonstrate a point or concept. Many were unscripted providing a transformative learning experience. Students had to participate in the role-play requiring them to reframe the knowledge gained from their training. Another innovative use was the active or passive interdisciplinary interaction. At times this was designed as part of the interaction, while at other times learners would learn from students of other disciplines. Also used is the ability to move seamlessly from one avatar to another, such as a woman with cystitis to someone who is pregnant through the click of a button. Developing people and technical skills through simulated role plays with virtual characters where trainers can devise conversation trees that deploy a library of avatar responses to questions were also used.

Virtual tours were utilised by respondents so students could see places without expense and that other experts could participate inworld to impart specialist information through live virtual lectures. Another benefit was for students to be taken to places that others have created, therefore removing the need for replication of spaces.

Curriculum knowledge learning was undertaken in a variety of ways. One respondent had students compare commerce transactions and information exchange in three different environments, i.e., real world, online (2D) and virtual world (3D). Students were able to see the transaction footprint - information exchanged, types of web-objects/goods, legal issues, features of the environment and ease of use. They could appreciate different environments and how digitisation of goods and relevant technology could help businesses remodel their operations. This involved tracking of users and web objects/goods. Another respondent stated that while the students' tasks have remained essentially unchanged, they have continuously reviewed and revised the way lesson and task instructions were presented to increase clarity and pedagogical effectiveness as much as possible for an eclectic mix of students with a wide range of different motivations and abilities for studying.

A number of *designs* incorporated the use of mediating tools specially designed to facilitate student interaction with the virtual environment and the curriculum content contained therein. On a technological level, while there is no control over, for example, the proprietary interface, some academics have continued to optimise these mediating tools to improve their pedagogical effectiveness. Much of this optimisation centers on the user-friendliness and functionality of the tools. In one example, a heads-up display (HUD) was developed to enable learners to click on objects within the environment and receive linguistic and audio feedback about the objects to facilitate vocabulary learning. Also a new HUD for displaying the content of Chinese character-based conversations between students and non-player characters more clearly on-screen and to facilitate review of that content was developed. On the class management side, a new communication tool was developed for educators working in the Second Life/OpenSim virtual environment with non-co-located students that enables a teacher leading a class to attract the attention of a remote student easily and conveniently without the use of audio.

Communication has been made easier for learner collaboration across different time zones and continents. Through the utilisation of a virtual world, effective learning spaces for students have been provided to facilitate learners' practice of communication skills in an environment that is safe and conducive to learning. The ability to use text or audio provides a benefit that is difficult to replicate in other spaces. Students often use the virtual world to meet and communicate with each other as, for them, it is a more authentic learning and communication environment. They feel like they are really there with the other person (i.e., face-to-face with them).

The cross between pre-service teaching and school student learning/teaching is an important aspect of the use of a virtual world where there is intense interest and engagement by K-12 students and sometimes reluctance of pre-service teachers to develop skills in utilising virtual worlds. A way to overcome this is to utilise the work that K-12 students create in the virtual world of Sim-on-a-Stick (SoaS) in order to demonstrate to the pre-service teachers that the virtual world can be effective with their future audience. SoaS offers a safe, closed environment where work can be transferred to an online space so that the pre-service teacher can visit and explore the spaces. Innovation has played a significant part in finding ways to work around the restrictions to access to virtual worlds in both the K-12 schools and in the university through an educational download of SoaS.

Blended learning environments combine machinima and simulated documentation to contextualise student's study and provide them with the opportunity to visualise ideas and concepts. Through a project that transforms the traditional didactic approach to legal education, with its emphasis on abstracted content and the learning of rules of law, students are immersed in a series of blended learning environments (de Freitas, Rebolledo-Mendez, Liarokapis, Magoulas, & Poulovassilis, 2010) across an undergraduate degree. The project leverages students' familiarity with the continuing storylines and recurring characters featured in the machinima as a means of exploring areas of law that would otherwise be difficult to comprehend in the abstract (Matthew & Butler, 2016). In this way, bridges are built between subject areas, and students understand and address the complexities of the real world professional practice of the law in which clients are likely to have needs involving more than one area of law. The learning environments involve students in complex and challenging tasks similar to those undertaken by real world legal professionals and they are engaged and inspired to learn because their learning is situated in real world contexts (Laurillard, 2012; Karagiorgi & Symeou, 2005).

Accessibility is demonstrated through conducting events such as art and film festivals in a virtual world environment where individuals, who self-identified as having a disability or chronic illness, were asked to create an artwork/film/piece of writing demonstrating how virtual worlds gave them 'freedom'. A virtual world provides students who have a disability a means to work with their peers on a level playing field – particularly when the other users don't know of their disability. They are able to do their work without the hindrance of their disability and/or discrimination. Students have met with a community of virtual world users all of whom have some sort of mobility disability in real life. The discussion with students were eye-opening. Students developed an understanding of what it was like to have a mobility disability, how to develop and maintain a positive therapeutic relationship, and, what the virtual world experience means to the disabled.

Gamification of disciplinary content through the use of a virtual world has proved popular with students. Game spaces are rezzed (brought into play) as they are needed and then de-rezzed once level completed. This allows multiple players to proceed through the game at the same time and multiple levels to be played simultaneously.

The player is confined to the part of the game to which he/she has progressed in terms of mastering the relevant learning content, and is not able to access higher levels of play until skills are demonstrated and a certain level of proficiency achieved. In one literacy game, there are several challenges where a correct sentence has to be constructed from a given bank of words, or a sentence corrected. When a student types the correct sentence, the level is continued. Once all challenges are met, the player obtains a reward to assist achieving the ultimate objective on the final level.

Exploration - students are tasked with randomly visiting a range of virtual regions and reviewing them. The students form groups and then chose the regions to be visited. When writing their review, the groups can highlight any virtual region they have visited as part of their review.

Student voices

Over the years, members of the VWWG have been asking their students "What did you think about the lesson/your learning?" Following are representative responses to this question from students. A number of key themes emerged from the data and are presented below. These comments come from a variety of students across several institutions studying a range of disciplines, comprising of both undergraduate and postgraduate students. Student voices have been categorised into UTAUT categories indicating Performance Expectancy (PE), Hedonic Motivation (HM) and negative Effort Expectancy (-EE).

General comments (These comments did not fit into one of the themes, but provide an overview of what students felt about their learning).

- *Best part of the unit was the use of Second life as part of teaching.*
- *I did enjoy this unit, but I easily regressed back to being a floater who didn't particularly feel engaged once the SL sessions ceased.*
- *It gave me a sense of familiarity with the characters and encouraged me to understand their new problems.*
- *The continuity in storyline and characters from … was valuable because we didn't have to focus as much on who was who and could instead concentrate on the issues.*
- *I felt like I developed a personal connection with some characters. I could understand where they were coming from.*
- *It provides a focus for those interested in creating virtual world art, and a platform for those artists to be viewed and to hopefully meet each other.*
- *Need to ask specific questions in order to complete the task is very beneficial to my learning.*
- *It's fun and interesting. (HM)*

Communication (Often seen as one of the major affordances of learning in a virtual world as it is so easy to do with peers and with the lecturer, particularly for those students who are studying from afar).

- *I believe that Second Life has the potential to be an effective learning tool, one that will enhance communication and enable the sharing of knowledge between all. (PE)*
- *I liked the extra text talking today, especially the bit where we ask directions. (HM)*
- *Really good to consolidate new words, and learn new words too.*
- *It was a good chance to practice written conversation skills. It made me think about how to ask questions and answer. I feel that I have a better understanding of how to buy and sell in another … language. It was also fun.*
- *I feel like it's one of the best method of online conferencing. (PE)*
- *You can go around the platform and talk to whomever you want to talk. (PE)*
- *It was amazing to talk to someone virtually but it gives a real time talking. (PE)*

Engagement in their learning (Due to the immersive nature of learning in a virtual world, students often feel engaged in their learning).

- *I thought it was great way to bring everyone together in an efficient and engaging way. It almost felt like you were really there. (PE)*
- *[The] creation of an avatar to portray myself as a qualified [professional] was definitely an engaging method for developing interdisciplinary interactions and patient communications. (HM)*
- *It was very interactive and you got to talk to non-player characters and do problem solving. (PE)*
- *The best thing is the level of engagement with the arts community. (HM)*

Community of Practice (Students interacted with each other and from the wider virtual world audience)*).*

- *Brings community together in one place. We can see the many pieces of work.*
- *Aside from raising awareness of possibility and inspiring creativity to push their limits, probably the greatest merit of university challenges is that it has drawn people of a kind together in a friendly, diverse and vibrant environment from which has grown community. Community, yes, that's it! (HM)*
- *… offers a great experience through competition as well as the opportunity to experience all types of different artistic expression through the display of the artwork. It's also about community. Artists stagnate in a void and … challenges provide a way to connect and convene with artists from all over the world through our creative work.*

Linking with industry and the professional world (This comment demonstrates the diversity in which students used the virtual world for their learning).

- *Great way to catch up with other alumni and meet people as well as give back to university*

Flexibility of learning (A virtual world provides flexibility in many different aspects – time, space, place, accessibility, etc).

- *I would rate the ability to complete the activities at my own convenience very high. It means I can complete tasks in my own time and practice the role-play as much as I would like to (PE).*
- *The ability to work on tasks at one's own time is valuable. (PE)*

Safe learning environment (Due to the anonymity of a virtual world, students felt that they can 'be themselves' without threat of being ridiculed and were able to voice their opinions).

- *Use of an avatar gave me confidence to portray my knowledge and abilities without feeling insecure. (PE)*

Reflecting on their learning (A major benefit of a student's learning is reflection – through a virtual world).

- *The activities make me rely on words more than body language while interacting. (PE)*
- *The use of audio-visual helped with communicating on a more realistic level. (PE)*
- *I loved the continuity ... It seemed as though the program was advancing with me and my skills. It also just made the whole thing more fun. (PE + HM)*
- *I personally learnt a whole lot about myself and my capabilities through her creative and interactive lessons. I particularly enjoyed our virtual assessment where we researched a medical condition and discussed it with a virtual patient from America. It was really fun and an innovative way to assess students' capacity to communicate in a stress free environment. (PE + HM)*

Role-play (Role-plays provide authentic ways in which students can learn a concept).

- *I liked the way you can talk with someone that you don't know in person [in a role-play activity] but you can help the kind of sickness they had. I learnt how to deal with a patient and the different situation they have. (PE + HM)*
- *The best part was getting to chat to a person from around the world to experience the role playing activity. (PE + HM)*
- *I enjoyed the ability to impart my WISDOM (lol) and my research upon my patient. It made me feel useful. (HM)*

Gamification (Incorporating game like characteristics in the student's learning. An immersive way in which to engage students where, typically, the concept is difficult to get across).

- *I thoroughly enjoyed playing ... The game helped me a lot…What I liked most about the game was the way we not only learned how to write and punctuate sentences correctly, but we also learned several Maori legends…I was very disappointed when I had reached the end of the game. I really wanted to keep playing and learning more. (PE + HM)*
- *When … [academic] first spoke about the game at the very beginning at our first week of course I thought that this game was a waste of time. Little did I know that this game helped me out quite a bit… I love a good challenge and I am quite competitive… Another thing I liked about the game were the graphics, it made playing the game really fun. It wasn't boring. The game helped me with my grammar and where to put speech marks and other things like that. One other thing I enjoyed about this game was how it was based on Maori myth/legend stories. (PE + HM)*
- *I found the literacy game exciting. At first it seemed like a challenge that I wanted to participate in and I had a little rush of adrenalin especially with my classmates next to me. I was trying to stay ahead of everyone. I would often get frustrated when I got the answer wrong… The literacy game made me feel a bit more confident. I felt as though it was an easier way to understand grammar. The game challenged me in many ways. (PE)*

Understanding the learning value (Students got a sense of how useful a virtual world for their learning).

- *All in all, the Second Life exercise has been a valuable experience, via listening to ourselves [and] others conduct [a] history on the same patient has allowed [me] to identify key [mistakes] which I have made, and to see how others do the same thing and pick up on areas in which I can improve, and to give and get reflection on the task is invaluable. (PE)*
- *It made me think more about the patient's point of view, i.e. a good exercise in empathy. (PE)*
- *The learning activity of Second Life which included blog, reflecting, presentation and role play as a radiographer and as a patient enhanced my understanding about the topics as well as knowledge about the role of other disciplines.*

Students were also asked "What did you dislike about the lesson/their learning?" Some of the variety of responses are as follows:

- *I found a couple of places hard to find but most of the time that was because I didn't pay enough attention to a particular instruction or didn't notice a particular sign.*
- *Quite complicated steps, not clear enough.*
- *Everything. It makes my eyes hurt because we have to move around so much and it gives me a headache. (-EE + HM)*
- *Way too much lag! The program is frustrating slow and I am less inclined to complete the tasks properly because everything is so slow. Maybe the program is too busy or it's not a good program. (-EE + HM)*
- *Took too long.*
- *Having to make up the phrases to say.*
- *Maybe in some places too many new words.*
- *There were many characters we had not learnt which the waitress used to respond to us and thus it was difficult to breakdown her response.*
- *I find the … island a bit difficult to navigate... (-EE)*
- *…it has been quite stressful trying to get it all working. (-EE + HM)*
- *Technical aspects of virtual world: There were both pluses and minuses*
- *The drawback of virtual world i.e. lack of body language enabled student to focus on their verbal communication. (-EE + HM)*

Despite attempts, students were distracted when they encountered technical difficulties (Technical difficulties has often been a major area of frustration for students when learning through the use of a virtual world)

- *I was asking them for help rather than engaging in other more meaningful discussions about it. (-EE)*
- *Made learning frustrating. (HM)*

Discussion

Overall, the feedback from students (student voices) about their perceptions of their learning is very positive. Within the category of General Comments, students articulated a number of key elements that enhanced their learning experience such as having a sense of community, having a feeling empathy with the characters that they interacted with, and overall feeling safe within the learning environment. Indeed, for one student, there is even a sense of grievance at the loss of engagement with learning once the virtual world learning experience finished. Some of these elements also came up in a number of the other major themes, especially the sense of community and sharing of knowledge and experience. Among the other major themes, additional key elements voiced by students included proactive engagement with and the student focus of learning, problem solving, visualising the ideal self (in a specific context), flexibility and self-paced learning, enactment of knowledge, self-discovery, and the symbiosis of playing and learning. In some ways these are fundamental elements in all types of learning, so it is not surprising that in designing the virtual environments and the tasks described here, the responsible educators drew on their existing rich experience of teaching in other, more traditional, environments. Much of the positive feedback revolved around pedagogical and task design, in some ways separate from but also facilitated by the technology being used. Many of the student voices reflecting positive experiences also reflect a positive experience of the technology (in combination with the pedagogy and content), particularly in relation to performance expectancy and hedonic motivation. The themes and key elements that have emerged from the collective student voice reflected in our data both highlight existing strengths and weaknesses and point the way for the strengthening of existing pedagogical designs. In terms of the technology, the prominence of performance expectancy and hedonic motivation in student comments also point the way for future optimisation, design and the importance of ensuring that students perceive that the technology will benefit them and that it actually does (by facilitating and enhancing the delivery of the pedagogical content).

As with all learning designs, there are always factors that detract from the learning experience, some of which are within the control of the implementing educator and thus can be ameliorated and improved, some of which lie under the control of students. Students voiced these factors in the data, with negative comments usually revolving around technical difficulties (mainly as a result of negative effort expectancy and thus negative hedonic motivation). In voicing these difficulties, students are pointing the way for future improvement. Many of the virtual world learning scenarios described in this paper involve an ongoing process of iteration, with each new iteration addressing issues raised by students and observed by the implementing educators. Such improvements occur both at the lesson and virtual environment design level, for example making lessons and tasks less technically demanding, and on the platform level, with many of the platforms used to support the virtual world learning environments described here being continuously upgraded by their proprietors. At the same time, there were other frustrations that could be attributed to the students themselves, for example not paying as much attention to instructions as they should have. Some students voiced the fact that they felt the virtual world was either complicated to learn, possibly pointing to a limited knowledge of, or familiarity with, computer/internet/gaming), or frustrating (for those who possibly came from a gaming background and therefore were used to high-end graphics and speed – possibly a combination of unrealised performance expectancy and effort expectancy, thus creating negative hedonic motivation).

Overall, students outlined a variety of ways in which the virtual world did provide a unique and positive learning environment for them. While the student voices here are a small representative sample and cannot purport to represent the experience of all students engaged in learning in virtual worlds, as noted, these students were from a variety of contexts, studying both undergraduate and postgraduate studies and were using the virtual world for a vast array of contexts. It can be concluded from the student voices outlined here that a virtual world is indeed an authentic and enjoyable place in which to learn.

Conclusions

Members of the VWWG have demonstrated how virtual worlds continue to evolve into innovative and creative learning experiences to enhance student engagement. Centered on communication and connecting students and staff across any distance, students have enjoyed the benefits of role play, building relationships with other students, staff and industry, and reflecting on their learning in a safe and flexible game-like environment. While technical problems and logistics can hamper the effectiveness of their experiences, these need to be considered in light of the level of student digital literacy. In general, this paper has shown that the student voice regarding virtual worlds is both positive and rewarding, and commending staff who have dedicated their time and effort to transform the learning experience.

Age, gender and experience may alter the student voice regarding virtual worlds in education. Reliable predictions may be made for a heterogeneous cohort of students. This does apply though if the students form a diverse cohort. Thus, in most educational circumstances, the notion of novelty and other hedonic modifiers should be specifically considered and used for planning. Student voice regarding ‘possible selves’ can be encouraged and reflected back to them to enhance regulatory fit and student engagement.

References

Bower, M., Lee, M. J., & Dalgarno, B. (2016). Collaborative learning across physical and virtual worlds: Factors supporting and constraining learners in a blended reality environment. *British Journal of Educational Technology*. doi:10.1111/bjet.12435

Bennett, D., Roberts, L., & Creagh, C. (2016). Exploring possible selves in a first-year physics foundation class: Engaging students by establishing relevance. *Physical Review Physics Education Research*, *12*(1), 010120.

Brew, L. S. (2008). The role of student feedback in evaluating and revising a blended learning course. *The Internet and Higher Education, 11*(2), 98–105.

Brooman, S., Darwent, S., & Pimor, A. (2015). The student voice in higher education curriculum design: is there value in listening? *Innovations in Education and Teaching International*, *52*(6), 663–674.

Dass, S., Dabbagh, N., & Clark, K. (2011). Using Virtual Worlds: What the Research Says. *Quarterly Review of Distance Education, 12*(2), 95–111,149.

de Freitas, S., Rebolledo-Mendez, G., Liarokapis, F., Magoulas, G., & Poulovassilis, A. (2010). Learning as immersive experiences: Using the four-dimensional framework for designing and evaluating immersive learning experiences in a virtual world. *British Journal of Educational Technology*, *41*(1), 69–85. http://doi.org/10.1111/j.1467-8535.2009.01024.x

Gregory, S., Jacka, L., Hillier, M., & Grant, S. (2015). Using virtual worlds in rural and regional educational institutions. *Australian and International Journal of Rural Education, 25*(2), 73–90.

Gregory, S., Scutter, S., Jacka, L., McDonald, M., Farley, H., & Newman, C. (2015). Barriers and Enablers to the Use of Virtual Worlds in Higher Education: An Exploration of Educator Perceptions, Attitudes and Experiences. *Journal of Educational Technology & Society, 18*(1), 3–12.

Higgins, E. T. (2005). Value from regulatory fit. *Current Directions in Psychological Science, 14*, 209–213.

Howitt, S. M., & Wilson, A. N. (2015). Developing, expressing and contesting opinions of science: Encouraging the student voice. *Higher Education Research & Development*, *34*(3), 541–553.

Jarmon, L., Traphagan, T., Mayrath, M., & Trivedi, A. (2009). Virtual world teaching, experiential learning, and assessment: An interdisciplinary communication course in Second Life. *Computers & Education*, *53*(1), 169–182. http://doi.org/10.1016/j.compedu.2009.01.010

Karagiorgi, Y., & Symeou, L. (2005). Translating constructivism into instructional design: Potential and limitations. *Education Technology & Society*, *8*(1), 17–27.

Koru. (n.d.). In *Wikipedia*. Retrieved October 7, 2016, from https://en.wikipedia.org/wiki/Koru

Laurillard, D. (2012). *Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology*. New York, NY: Routledge: Taylor and Francis Group. Retrieved from https://www.routledge.com/Teaching-as-a-Design-Science-Building-Pedagogical-Patterns-for-Learning/Laurillard/p/book/9780415803878

MacFadyen, L. P., Dawson, S., Prest, S., & Gašević, D. (2015). Whose feedback? A multilevel analysis of student completion of end-of-term teaching evaluations. *Assessment & Evaluation in Higher Education*, 1–19.

Matthew, A. & Butler, D. (2016). Narrative, machinima and cognitive realism: Constructing an authentic real world learning experience for law students. *Australasian Journal of Educational Technology*.

McDonald, M., Ryan, T., Sim, J., James, J., Maude, P., Scutter, S., & Wood, D. (2012). Multidiscipline role-play in a 3D virtual learning environment: Experiences with a large cohort of healthcare students. In M. Brown, M. Hartnett & T. Stewart (Eds.), *Future Challenges – Sustainable Futures.* Proceedings ascilite Wellington, New Zealand: Massey University and ascilite. *http://www.ascilite.org/conferences/Wellington12/2012/images/custom/mcdonald%2c_marcus_-_multidiscipline.pdf*

Oyserman, D., Destin, M., & Novin, S. (2015). The context-sensitive future self: Possible selves motivate in context, not otherwise. *Self and Identity*, *14*(2), 173–188.

Oyserman, D., Bybee, D., & Terry, K. (2006). Possible selves and academic outcomes: How and when possible selves impel action. *Journal of personality and social psychology*, *91*(1), 188.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425–478.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS quarterly*, *36*(1), 157-178.

Please cite as: Gregory, S., Gregory, B., McDonald, M., Nikolic, S., Farley, H., O'Connell, J., Butler, D., Jacka, L., Grant, S., Jegathesan, J.J., McGrath, N., Rudra, A., Stokes-Thompson, F., Sukunesan, S., Zagami, J., Sim, J., Schutt, S., Gaukrodger, B., Hearns., M. & Irving, L. (2016). Exploring virtual world innovations and design through learner voices. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 245-254).

The missing link for learning from analytics

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Learning analytics is an area of growing importance in higher education. Lead practitioners acknowledge this development as a convergence of many fields, including educational data mining, technology systems development, learning design and SoTL, and encourage synergistic connections. Past experience of learning technology innovations shows that incentives and professional development for teachers are keys to successful adoption, along with easy to use tools, evidence of benefits and institutional support. However, current literature shows little evidence of initiatives designed to forge connections between these fields of practice, and a review of papers from a leading learning analytics conference does not identify professional development as a priority. This paper outlines a professional development initiative designed to address this gap and make learning analytics practice accessible to tertiary teachers. The area needs urgent attention if the potential of learning analytics to increase knowledge about learning and inform learning design is to be realized.

Keywords: Learning analytics, SoTL, professional development, learning technology innovations

Background

Learning analytics is an area of rapidly growing interest across the tertiary education sector internationally. In mid-July 2016, Google Scholar ranked the proceedings of the International Conference on Learning Analytics Knowledge (LAK) number eight of all publications in the Educational Technology category. This is remarkable considering the conference was only launched in 2011, to highlight trends in the use of learning analytics in the education sector, ranging from K12 to tertiary, vocational, and MOOC learning.

Two major areas of application for learning analytics are the use of system log data to identify and trigger support for students at risk of failure, and as evidence to inform learning design. Educational researchers have produced theoretical and conceptual frameworks; a range of analytics tools, and various cases where benefits from the use of data can be demonstrated (see e.g. Clow, 2012; Ferguson, 2012). Institutions are implementing learning analytics strategies, resolving privacy issues, promoting ethical use of data, and developing policies to support this emergent field of practice (Ferguson et al., 2014). Learning analytics seems to be on a similar path to past innovations such as educational multimedia, learning objects and virtual worlds, so warning bells about adoption and long-term sustainability should start ringing about now.

Experience has shown that a multi level approach is required to address the challenges facing an innovation with potential to change something as well established as teaching and institutional practice. In this respect, learning analytics may be a step ahead of some of its predecessors. Institutions are motivated to engage on many levels, because the stakes are high and many stakeholders are involved in using data to generate learning and business intelligence. Unlike the initial development stages of earlier learning technology innovations, learning analytics has not been left for a few enthusiastic teachers to explore as they choose. This time, student administration and business intelligence units, IT departments, institutions and even national policy makers are part of the operating environment along with teachers, researchers and learning designers. However, experience shows that the full potential of innovations is rarely realized, as investment in even the highest quality elearning systems and tools can fail to achieve the anticipated levels of engagement by target user groups. In the case of learning analytics, teachers and learning designers are one major target. A number of reasons for this failure have been proposed (Duncan, 2004; Dede, Honan & Peters, 2005). A review of progress on the promotion of learning analytics practice related to the conditions for successful adoption identified by Alexander (2001) and Ferguson et al. (2014) is timely. These conditions include supportive management and institutional context; adequate resources for development (or acquisition) and implementation of user-friendly tools; appropriate forms of professional development and training; and incentives and rewards for staff to engage. Professional development and incentives and rewards are as critical to successful adoption as all other conditions, yet there is limited evidence of action in this area at the present time. Some initiatives involve end users in scoping and design. Many appear to be developing tools and frameworks for later dissemination to these intended users. This approach may be less effective than one where target users become familiar with the concepts early on, and offer input to the scoping, design and development processes (Gunn, Woodgate & O'Grady, 2005).

This short paper outlines progress on learning analytics research and development across the higher education sector, then describes the scoping phase of a professional development initiative aimed at teachers and learning designers. Professional development of tertiary teachers has its own challenges, regardless of the topic in focus (Bamber, 2013) particularly in research-intensive institutions. Where the topic is as potentially complex and controversial as learning analytics, the challenges can only increase. The design rationale for the professional development plan is explained, and incentives and rewards for engagement are considered. While the plan is designed for the tertiary sector in New Zealand, the conceptual approach has been used elsewhere, and feedback suggests the design principles and activities will be useful in other contexts.

The leading edge of learning analytics research

The SOLAR Network's annual Learning Analytics and Knowledge (LAK) conference has come to be regarded as the world-leading event for researchers and practitioners in the field. Google Scholar's ranking of the LAK Proceedings as eighth top educational technology publication means it gives a fair indication of the priorities the research community is engaged with, and is well placed to identify any gaps that may need to be addressed.

Acknowledging learning analytics as a point of intersection between different fields of practice, the LAK16 conference theme was 'the convergence of communities'. The proceedings noted, 'the emphasis of this year's program is enhancing our impact through synergistic connections with other related research communities' (LAK16 Proceedings p1). Two areas where strong, synergistic connections are both possible and presumably desirable are teacher professional development and the scholarship of teaching and learning (SoTL). However, there is little evidence in the LAK16 proceedings that such connections are actively being promoted.

The question then arises whether the development of learning analytics systems and tools is proceeding with due consideration of the strategies required to encourage use in the teaching and learning contexts they are designed for. Lower than anticipated levels of engagement with other elearning innovations have already been noted, and post-hoc analyses of the reasons are available for review (Duncan, 2004; Dede, Honan & Peters, 2005). Technical complexity, limited functionality and inflexible tools are all acknowledged as issues to be addressed. However, the limited influence of teacher professional development programmes; a lack of evidence of benefits to teaching and learning; and limited incentives for teacher engagement are also recognized as common barriers (Alexander, 2001). In this context, the value of synergistic connections between learning analytics, the theory and practice of academic development and SoTL research seems obvious. The professional development initiative outlined in this paper aims to strengthen the links between these three related areas of practice so the potential of learning analytics can be fully explored by the people who stand to reap the greatest benefits.

Professional development is not on the agenda

In a report recommending system-wide deployment of learning analytics in Australian higher education, Siemens, Dawson & Lynch (2013, p. 25) identified skills and capability shortages in teaching as well as IT and administration. The need to build technical capacity is coupled with development of a 'culture or mindset of analytics.' The report noted that this requires planning, resources and policy integration over many years. No small task, but a worthy goal that would support the transformation of practice at grass roots, institutional and sector levels, and help to narrow the gap between technical and academic functions in learning technology. For practice level, the report proposed an open and shared analytics curriculum, which presumably universities would contribute to. There are few moves in this direction if the LAK16 proceedings are anything to judge by.

A search of titles, abstracts and full texts of 96 accepted submissions (papers, workshops, posters and demos) published in the LAK16 proceedings returned only eight that referred to professional development. Of these, one addressed skill development for researchers, two focused on technical skills, and one on using analytics in professional learning contexts. This left just four that stated any intention to develop the learning analytics capabilities of teachers and learning designers. SoTL was rather better, if sometimes indirectly represented, with around two thirds of the submissions (n=64) focused on the use of analytics data to understand student learning, and/or to inform teaching or course design. However, many of the reported initiatives were specific to the study context and not necessarily suitable for wider application. Further investigation would be required to check if the authors aimed to share findings with colleagues as well as with conference delegates. This may reflect either an immature or an exclusive field of research, where only experts and enthusiasts are involved. Another possible interpretation is that learning analytics researchers and innovative tool developers do not have the requisite skills to disseminate their work to a wider audience. Either explanation endorses the need expressed in the conference theme, i.e. to forge connections and foster synergies with related fields of practice. The question is; are moves being made to encourage these connections, or is it simply an idea waiting to be put into action? As stimulating and engaging as it was, LAK16 did not offer many clues. An outline of contributions referring to professional development reveals the limited scope of such action.

Wolff & Zdrahal (2016, p. 500-501) offered a workshop to explore how data literacy (i.e. the ability to use data in everyday thinking, reasoning and real-world problem solving) impacts on learning analytics for practitioners and end users. Literate practitioners can derive actionable insights from data. Literate end users can interpret and critique data analysis that is presented to them. The authors noted that this area requires further attention, as end users are usually not data specialists.

Ferguson & Clow (2016, p. 520-521) presented a poster describing the background and development of the Learning Analytics Community Exchange (LACE) hub, where data is presented in accessible format. They outlined the functionality of the site, gave a summary of its quantitative and thematic content, and an assessment of the evidence it presents. While this is not a professional development initiative per se, the aim is to encourage people to use and add content to a hub, which could be used for professional development purposes.

Mavrikis, Gutierrez-Santos, and Poulovassilis (2016, p. 168-172) described the iterative development of teacher assistance tools for exploratory learning environments. While the study setting was not naturalistic, evaluation of each version of the tool did involve teachers from the target user group. The authors explained the difficulty of involving teachers in scoping the tools, so it may be assumed that the design had limited input from target users. Professional development was noted as an area for future attention once the tools have been finalized.

Wells, Wollenschlaeger, Lefevre, Magoulas, and Poulovassilis (2016, p. 236-240) analyzed the relationship between student engagement with an LMS and performance to inform guidelines for course design. They noted plans for professional development to promote the guidelines developed as a result of their research.

While the first two of these contributions focus on teacher skills, neither of the others positions teachers or learning designers (outside the development team) as users of learning analytics data. The intention for teachers and learning designers to develop critical data literacy skills is not present. It is also not clear what approaches to professional development might be applied, and whether evidence of benefits from using learning analytics or incentives for them to engage will be involved. If teachers are a minimum of one step removed from learning analytics data, which is mediated by researchers to inform the development of tools and recommendations for teacher use, the principles of capacity development will not apply. This begs the question whether gleaning actionable insights from learning analytics data is too complex a task for teachers, and expert mediators will continue to be involved. The initiative outlined in this paper assumes both pathways will be productive. We recognize the value of expertise to develop data analysis and presentation tools, and to interpret complex data. We also take on the challenge of supporting teachers to develop their own data literacy skills, to engage directly with evidence and with data use scenarios.

A learning analytics professional development initiative

The aim of the professional development initiative described here is to promote the use of ‘learning intelligence’ in course design and teaching. We acknowledge that this will require easy to use analysis and visualization tools as well as a basic level of data literacy among teachers and learning designers. We also understand that evidence of benefits and incentives for teachers to engage will be critical success factors.

As part of a scoping phase, we interviewed early adopters of learning analytics in teaching practice to explore their aims, achievements and challenges. Some of those interviewed also took part in a second phase, allowing their experience to be developed into case studies. Research team members produced further case studies based on emergent learning analytics practice at their institutions. These sources combined to offer a real sense of the challenges and opportunities facing teachers wanting to access and use learning analytics data in their institutional context at this point in time. Scenarios derived from the interview data and case studies are part of the professional development strategy. Each scenario has a different pedagogical focus and reflects a common situation that most teachers can relate to. The aim is to demonstrate how analytics data can be accessed, analyzed and applied at different stages of the course planning, teaching and review cycle (Donald, Blumenstein, McDonald, Milne, and Gunn, 2016).

We realized early on that the early adopters who participated in our study are likely to be more data literate than many in our target group. Despite this advanced starting point, we found that understanding of learning analytics concepts and terminology could still be problematic, and ran a survey to gauge how some of our target users talk about their practice. These data collection activities, a literature review and many years of relevant experience among the research team members all contributed to the design of the professional development initiative.

Scenarios reflect real world examples

Scenarios are useful professional development tools because they focus on real world situations that target users can relate to. They offer sample solutions to familiar problems that can be easily adapted for different teaching contexts. In this case, the scenarios reflect real situations encountered by early adopters, and the solutions they applied and evaluated. The learning analytics professional development scenarios demonstrate ways to:

- Support students to avoid drop out or failure
- Gain insights into (mis)conceptions and knowledge
- Explore students' disciplinary knowledge
- Give students a sense of how they are performing
- Identify and address concepts students struggle with
- Monitor online discussion to focus teaching on pertinent issues

The following example shows the format of the scenarios, and how one lecturer used analytics data to gain insight into student (mis)conceptions and knowledge, and to design learning activities and resources to address the problems identified.

Problem
- Students arrive at university with high school passes in subjects they will continue to study. This initial success builds false confidence where common misconceptions and rote learning lead to failure later on.

Strategy
- What - use analytics data to understand what students know, expose common misconceptions, and design feedback to influence deep learning strategies.
- How – schedule a test or multi-choice quiz at the start of the course with questions designed to assess prior knowledge and reveal common misconceptions. The quiz can provide constructive feedback and direct students to tutorials designed to promote deep learning and knowledge development.

Data sources used
- An analytics report with quiz scores, correct and incorrect answers, number of attempts, and use of hints and feedback
- Verbal and/or written feedback from students to clarify the interpretation of quantitative data
- Discussion posts, survey results and other forms of feedback to add a qualitative dimension

Evaluate and take action
- Understanding what students bring to a course provides focus for teaching and learning design
- Discuss quiz results with students; explain common misconceptions and pathways to successful study
- Develop online tutorials to address learning challenges, monitor use, and invite feedback on usefulness

Design implications
- Requires development of test or quiz questions and tutorials to revisit subjects previously covered
- Investment of time is small relative to the benefit of understanding what learners need

Caveats
- Misconceptions can be deeply rooted, addressing them can be a long-term process of reinforcement
- Additional strategies may be required, e.g. peer review, frequent tests, student designed questions or study resources
- Causal relationships are hard to establish from data, but higher mean grades may be indicative

Discussion and recommendations

From our initial exploration of the LAK proceedings, there is a pressing need to add professional development and strategies to engage teachers to the growing range of learning analytics initiatives. If these areas are not addressed, adoption of the quality systems and tools that are currently available or under development may remain in the domain of researchers and data analysis experts. While the distinction between analytics practitioners and users noted by Wolff & Zdrahal (2016) may or may not remain relevant, the need to increase the data literacy skills of teachers and learning designers is compelling. Scenarios are one professional development strategy that can present evidence of benefits and make it easy for teachers and learning designers to develop a basic data-driven analytics practice. They can also demonstrate the need for a critical approach to data interpretation, and thus avoid the common pitfall of basing decisions on incomplete evidence or incorrect analyses. Scenarios demonstrate ways to use available data to solve real world problems, and thus provide an obvious incentive for teachers to engage. If the use of scenarios is embedded in existing activities such as credit-bearing courses, they can also provide the opportunities for action learning and sustained engagement that contemporary professional development frameworks recommend. There are various ways that local implementations might achieve this by embedding scenarios within programmes or courses. There is high optimism and perceived potential in the field of learning analytics. It is up to the various stakeholders to be proactive in forging the connections that lead practitioners deem necessary to achieve the synergies, realize the potential and let the benefits of learning analytics flow through to teachers and learners.

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References

Alexander, S. (2001). E-learning developments and experiences. *Education + Training, 43*(4/5), 240-248.

Bamber, V. (2013). Evidencing the Value of Educational Development. Staff and Educational Development Association: London.

Clow, D. (2012). The learning analytics cycle: closing the loop effectively. Proceedings of the 2nd International Conference on Learning Analytics and Knowledge. Vancouver, British Columbia, Canada, ACM**:** 134-138.

Dede, C., Honan, J. P., & Peters, L. P. (Eds.). (2005). Scaling Up Success: Lessons Learned from Technology-based Educational Improvement: Jossey-Bass.

Donald, C., Blumenstein, M., McDonald, J., Milne, J. & Gunn, C. (2016, November 23-25). Matching the rhythms of teaching to learning analytics. Poster presented at the International Consortium of Educational Developers and the Higher Education Learning and Teaching Association of Southern Africa (ICED/HELTASA), Cape Town.

Duncan, C. (2004). Learning object economies: Barriers and drivers. Retrieved 7th July 2016 from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.125.6720&rep=rep1&type=pdf

Ferguson, R. (2012). The State Of Learning Analytics in 2012: A Review and Future Challenges. Technical Report KMI-12-01, Knowledge Media Institute, The Open University, UK.

Ferguson, R., L. Macfadyen, D. Clow, B. Tynan, S. Alexander and S. Dawson (2014). "Setting Learning Analytics in Context: Overcoming the Barriers to Large Scale Adoption." Journal of Learning Analytics **1**(3): 120-144.

Ferguson, R., & Clow, D. (2016) Learning Analytics Community Exchange: Evidence Hub. http://dl.acm.org/citation.cfm?id=2883878&CFID=810668641&CFTOKEN=50927853

Gunn, C., Woodgate, S., & O'Grady, W. (2005). Repurposing learning objects: A sustainable alternative? *ALT-J, 13*(3), 189-200.

LAK16 Proceedings (2016) http://lak16.solaresearch.org/

Mavrikis, M., Gutierrez-Santos, S., & Poulovassilis, A. (2016) Design and evaluation of teacher assistance tools for exploratory learning environments http://dl.acm.org/citation.cfm?id=2883909&CFID=810668641&CFTOKEN=50927853

Siemens, G., Dawson, S., & Lynch, G. (2013). Improving the quality and productivity of the higher education sector: Policy and strategy for systems-level deployment of learning analytics. Retrieved from http://www.olt.gov.au/system/files/resources/SoLAR_Report_2014.pdf

Wells, M., Wollenschlaeger, A., Lefevre, D., Magoulas, G., & Poulovassilis, A. (2016) Analysing engagement in an online management programme and implications for course design. http://dl.acm.org/citation.cfm?id=2883894&CFID=810668641&CFTOKEN=50927853

Wolff, A., & Zdrahal, Z. (2016). Data literacy for Learning Analytics http://events.kmi.open.ac.uk/dataliteracy4la/

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Designing a Review of the Learning Management System

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This paper outlines the design of a review of the Learning Management System (LMS) at an Australian Go8 University. From the experience of other universities undergoing this process, a series of evaluation activities were designed to ensure stakeholder engagement and user quality of experience rather than the traditional functionality comparison. The focus of the paper is to describe the methodology used with a focus on potentially transferrable learnings that other higher education institutions can use in their approach to evaluating their learning management systems.

Keywords: LMS review, evaluation, learning management system review, learning management system selection

Introduction

The Learning Management system (LMS) is one of the largest technology investments made by a higher education institution. While the ubiquitous uptake of the LMS across the education sector has provided for additional options in relation to blended and flexible learning there are many commentators that have argued the system reduces and limits teaching and learning diversity, leading to potential problems where the LMS is not selected based on the primary mission of most universities, that of education. For instance, Siemens (2006) laments that “the value of a LMS is ensconced in language of management and control” rather than learning (p4). Certainly the selection of a LMS is often focussed on management aspects including tools/ functions and cost e.g. (Kasim & Khalid, 2016). In some cases, for example (Redish A, C, Bates S, & Burns J, 2016), this focus on functionality and cost means user needs are not adequately considered; resulting in “widespread dissatisfaction with the system, in terms of availability, response time and ease of use” (p5). In this paper we discuss how one university reviewed its LMS with a focus on educational value in an attempt to deal with these issues.

Context

The University of Adelaide has used the same Learning Management system (LMS) for 14 years. As part of a regular review schedule identified in its Learning Technologies Roadmap, the choice of LMS was reviewed in 2015. While LMS satisfaction surveys indicated some increase in student and staff satisfaction with incremental enhancements to the existing LMS, they also highlighted issues (University of Adelaide, 2015) and expectations that continued to be unmet. Internal student and staff surveys also provided strong indicators that there was a level of dissatisfaction with the LMS. In addition, a new strategic plan recognised that some substantial change would be required in progressing technological advancements. This combination of factors laid the groundwork for a more in depth analysis of the options for Learning Management Systems for the University and offered the opportunity for a genuinely consultative and open-ended review process.

A Review of LMS Reviews

This was the first time that the University of Adelaide had conducted a full review of their learning management system. A search for models that other institutions have used for reviewing their systems revealed that the literature documenting the process of selecting a LMS for universities is not broadly reported, despite some university LMS project websites documenting processes incidental to outcomes (for example, a blog post at Dalhousie University (ln266505, 2015), a strategic review from California State University (LMS Strategic Review Committee 2005) and a similar document from the Queensland University of Technology (eLearning Services, 2013).

The majority of reported reviews, as Hanson & Robson (2003, p. 2) and Coates, James & Baldwin (2005) noted, approach the LMS Review process as an exercise in defining requirements and evaluating products based on their perceived ability to meet them. There is often a strong financial context to these, especially related to licence fees. There are several issues with this approach.

The first issue with a functionality and cost approach to selecting a LMS review is that once requirements are defined, it becomes clear that they are not are of equal value, nor do they meet the overall goal to an equal extent. As Winer et al (2005) from McGill University note, weighting these requirements within a matrix leads to additional complexity but not necessarily clearer decision-making. They classified the limitations with attempting this type of LMS functionality matrix decision making as:

1. Arithmetic (central tendency is not a good indicator when outliers may be very important and deal breakers can be hidden);
2. Qualitative (numbers mask qualitative differences, and not all functions are identical. Differences are not necessarily better or worse); and
3. Meaningful conclusions (what does a point score difference really mean?).

Their conclusion was to first eliminate products with deal-breakers, then evaluate the remaining alternatives via a set of use cases, which they classified as technical, business and pedagogical. Essentially, where the matrix approach concentrates on "does this functionality exist and how does it rate?" the use-case approach asks "what is the quality of experience?".

Secondly, licence fees and even total cost of ownership calculations do not necessarily represent the value of a LMS to the university. In the most obvious example, reports from educational institutions using open-source and licence-free LMS software such as Moodle which indicate that similar overall costs to vendor-hosted options are incurred. This is often due to the development expectations of the community and the need to navigate upgrades across an open-source community of developers. While cost is relatively easy to calculate, value is difficult to quantify, but potentially significantly more important for the institution as a whole. For example, how can institutions classify the reputational benefit of a modern, student-focussed LMS, or the impact of enhanced usability on uptake among teaching staff? When the emphasis is on cost, the bigger picture of the potential contribution of the LMS to achieving the goals of the organisation is diminished. MacFadyen and Dawson (2012) observed that concern with the "ease of migration" and thus its cost, dominated decision-making in selecting a new LMS, overshadowing data on current LMS use patterns and their relationship to student learning outcomes (p159).

Thirdly, functionality and cost might be congruent with the "management" aspects of a learning management system, but they have very little to do with "learning". MacFadyen and Dawson (2012) observed that LMS Review decision committees can result in senior academics "assessing the degree to which any change will burden themselves and their colleagues with the need to learn how to use complex new tools, and/or the need to change their teaching habits and practices, without offering any appreciable advantage or reward" (p160). Similarly, the involvement of Information Technology managers, who may have a smaller investment in student learning outcomes, focuses "proposals for new technology innovations from the perspective of workload and technical compatibility with existing systems" (p160). The absence of learners in the selection of their most-used University IT system seems incongruous, yet commonplace in many reviews. Benefits are often clearly focused on transfer of skills and content, integration with existing systems and reduced costs, all valuable aspects but lacking a student focus.

Although less commonly absent from LMS decision processes than students, teaching academics are not always central to LMS reviews either. As Coates, James, & Baldwin (2005) stated, "Decisions about university teaching and learning should not be restricted to checklist evaluations of technical and organisational factors… In particular, discussions about the adoption, implementation, use and review of LMS should involve ongoing iterative dialogue with the large and diverse group of academic stakeholders who are, and will increasingly be, affected by the systems." (p33). Siemens, in his summary of LMS reviews, lists many reports where "the act and process of teaching and learning are largely ignored in the pursuit of functions, features, integration and a myriad of other organisational concerns" (Siemens, 2006, p. 14). As the primary users of LMS, students and staff should be considered key to the success of a LMS implementation, and as such, would be integral to change management approaches (Kotter & Schlesinger, 1979) or innovation diffusion theories (Rogers Everett, 1995).

It was concluded from the existing literature on LMS Reviews, that there were substantial weaknesses in the processes commonly used and reported, especially from an educational context. Thus the project team decided that:

- evaluating LMS functionality alone would not be sufficient to select a LMS;
- a quality of experience approach was necessary and use cases were a realistic tool to assess this aspect;
- the key stakeholders in learning: students and their teachers, needed to be involved in all aspects of the review and represented in the governance structures;
- a balance between short-term pain of migration, from a technical perspective (consideration of ease of migration) and longer-term gain for learning and teaching goals (recognising that stakeholders whose workload would be affected by any change may be fearful of workload impact of a change) was required;
- value to the organisation and affordability was important; cost comparisons were not.

LMS Review Framework

As a review of the Learning Management System that would potentially involve all stakeholders, there was a need to ensure:

1. there were valid alternatives before we asked the community to spend their time and emotional energy considering a potential change;
2. there was going to be genuine engagement (i.e. no pre-determined outcome; reassurance that whichever choice surfaced would be accepted by senior management).

To ensure the end users of the LMS helped shape all aspects of the review and selection process, in addition to ensuring all faculties and undergraduate/ postgraduate students were represented on the project's reference group, faculty and student buy-out ensured two teaching academics and two students carried out some of the design and investigations as members of the project team.

In order to establish valid alternatives and a genuine engagement brief, it was decided that the first step should be to initiate a four month "light-touch" review first to determine if a full review of the LMS was required.

Stage 1: Light Touch

The first phase of the project was designed to answer the question, "is it worthwhile for the University of Adelaide to fully investigate alternative LMS solutions given the different options which are currently available?" and if so, which systems should be investigate in greater detail.

This involved:

1. Articulating the University's high-level system capability requirements (learning, teaching, technical and vendor relationship) in light of the University's strategy, technical roadmaps as well as findings from the extensive academic staff and student consultations and data gathering in previous LMS enhancement and student experience projects.
2. Review of literature on processes and learnings from LMS Review
3. Conducting a brief marketplace scan to longlist the alternative LMS solutions
   a. analysing market share trends
   b. interviews with current users of those LMSs, broadly evaluating them against the high-level system capability requirements.
4. Recommending either a shortlist of LMS to proceed to a more detailed review phase or that the university continue with the current system and revisit in the next 3 yearly cycle.

Very deliberately, there was no vendor involvement at this stage, and information on the LMS was sourced from university users instead. During this stage, the following eleven criteria were used:

Teaching and Learning
1. Efficiently and effectively support blended learning approaches as well as teaching fully online subjects.
2. Efficiently and effectively support group work and collaboration in the teaching and learning process
3. Efficiently and effectively support sound and innovative eAssessment, as well as the management of the assessment lifecycle (including submission, eMarking, return)
4. Readily provide analytics/ reports and/or data to students, staff and business intelligence systems to support the University's goals
5. Provide the basis for effective communications between the University and staff and students

Usability
6. Have an interface and functionality which can be engaging and is easy and efficient to use
7. Run effectively on a variety of client side platforms

Technology
8. Be reliable and secure
9. Integrate reliably and effectively with the Student Information System(SIS) as appropriate
10. Integrate reliably and effectively with other University or third party content/tool providers

Vendor Relationship
11. Vendor/support community attributes which are conducive to a positive and lasting relationship

The second main activity during the "light touch" review was a scan of Australian and international trends with regards to LMS choice and market share. This activity included research and networking with other institutions and reviewing published reports, carried out via a survey of Australian Council of Open and Distance Education members and Blackboard User Group members in August 2015 along with interviews with current users of longlisted LMS to explore elements of the eleven high-level capabilities.

At the end of this stage three LMSs were identified as suitable for the University and the decision made to move into detailed review of these shortlisted systems.

Stage 2: In-Depth Review

The objectives of this phase of the Project were to:
- collect data and evaluate the three shortlisted systems against the identified University of Adelaide requirements to ensure that the Project Board and Sponsors would have sufficient information in order to make a decision as to the best LMS into the future;
- ensure teaching and support staff and students were included in the evaluation process, and that they felt they had been sufficiently consulted in the decision- making.

Therefore, following the shortlisting from the "light-touch" review, the project team decided on the following structure for the in-depth review:

1. Establish benchmark of satisfaction - conduct an online survey to establish current satisfaction with Blackboard, designed to benchmark the status quo for future reference, and to establish the "appetite for change" among University staff and students. This would use some of the same questions from the past years so that trends could also be identified.
2. Develop future-looking "use cases" designed around the University's strategy for the vendors to showcase how their system could meet these. A description of various strategic futuristic student and teacher scenarios would be developed and vendors allowed four weeks to implement these. [12]
3. A four week pilot – the three shortlisted LMS to be implemented within existing University infrastructure and opened up for review by all interested staff and students. The pilot courses should include the "use cases" developed by the vendor as well as an existing course shown for comparison across the three platforms.
4. A survey of visitors to the pilot environments to gauge student and staff satisfaction of the three LMS options. The survey should focus on

[12] With thanks to colleagues at Auckland University of Technology for the idea.

5. Focus groups of staff and students to explore the three systems and to add qualitative data to the overall pool of information.
6. Development of detailed LMS requirements based on high level LMS capabilities so these can be reviewed in depth (again, with the intention to report outcomes in a discussion of the key differences rather than a rating against each).
7. At the end of the pilot/ review against capabilities, hold vendor demonstration and Q&A sessions
8. Conduct Transition Costs and Total Cost of Ownership estimation

Awareness-raising exercises were also designed for this phase, including School and Faculty information sessions, instructor walkthroughs, and project website and email updates.

Conclusion

The LMS review used a process that was deliberately strategic and inclusive, focusing on aspects of the LMS that represented true value to a higher education institution rather than concentrating mainly on financial, functional and technical considerations. With a student and staff focus, this process was education driven encouraging staff to think of the LMS application in their day-to-day context, avoiding rating systems and gaining experiential data from other institutions' users as well as ensuring vendors participated in the process on terms the review was using rather than conventional sales pitches. Key areas of difference to other review processes were:

- Speaking to users from other Universities rather than vendor involvement;
- Involvement of staff and students including buy-out to ensure involvement on project team;
- Vendor involvement focused on specific project needs (addressing the future-looking use cases, answering questions from students and staff);
- A focus on capabilities and overall strategic value rather than a matrix of functionality;
- A focus on describing differences and similarities and avoidance of rating systems.

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References

Coates, H., James, R., & Baldwin, G. (2005). A critical examination of the effects of learning management systems on university teaching and learning. *Tertiary education and management, 11*, 19-36.

eLearning Services. (2013). Review of QUT's Virtual Learning Environment (VLE): Final Report. QUT: QUT.

Hanson, P., & Robson, R. (2003). An evaluation framework for course management technology. *Boulder, Colo.: EDUCAUSE Center for Applied Research, Research Bulletin*(14).

Kasim, N. N. M., & Khalid, F. (2016). Choosing the Right Learning Management System (LMS) for the Higher Education Institution Context: A Systematic Review. *International Journal of Emerging Technologies in Learning (iJET), 11*(06), 55-61.

Kotter, J. P., & Schlesinger, L. A. (1979). *Choosing strategies for change*: Harvard Business Review.

LMS Strategic Review Committee (2005). Learning Management System (LMS) Strategic Review. A Next Generation Learning Management System for CSU, Chico CSU: CSU, Chico.

ln266505. (2015). Report-on-the-learning-management-system-lms-review/. Retrieved from https://blogs.dal.ca/lmsreview/2015/03/12/report-on-the-learning-management-system-lms-review/

Macfadyen, L. P., & Dawson, S. (2012). Numbers Are Not Enough. Why e-Learning Analytics Failed to Inform an Institutional Strategic Plan. *Educational Technology & Society, 15*(3), 149-163.

Redish A, C, M., Bates S, & Burns J. (2016). Next Generation Digital Learning Ecosystem. University of British Columbia.

Rogers Everett, M. (1995). Diffusion of innovations. *New York*, 12.

Siemens, G. (2006). Learning or management system? A review of learning management system reviews. *Learning Technologies Centre*.

University of Adelaide. (2015). LMS Satisfaction Survey 2015.

Winer L, Finkelstein A, Deutch M, & Masi A. (2005). *The Matrix Transformed: Achieving Better Focus and Insight in Learning Management System Selection*. Paper presented at the Educause, Orlando, Florida. http://net.educause.edu/ir/library/pdf/EDU05197.pdf

Please cite as: Heathcote, L. & Palmer, E. (2016). Designing of a review of the Learning Management System. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 261-266).

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A review of the literature on flipping the STEM classroom: Preliminary findings

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This study analyses fifty-eight peer reviewed research studies on flipped learning in the higher education STEM disciplines. The review aims to continue on from other meta-analyses and identify themes from the literature, both positive and negative, in terms of perception, engagement and achievement. Two other themes are discussed, the self-efficacy of students and the development of graduate attributes beyond discipline knowledge. The review concludes that there has been a large increase in empirical research on flipped approaches to teaching and learning in the STEM disciplines and the findings are overwhelmingly positive.

Keywords: STEM, Flipped Learning, Flipped Classroom, literature review

Introduction

From its humble beginnings in 2000 when the term 'inverted classroom' was first coined by Lage, Platt and Treglia, through its more popular embodiment based on the work of two high school chemistry teachers (Bergmann & Sams, 2007), the term Flipped Learning is now embedded in the vocabulary of the higher education landscape, with a Google Scholar search currently returning over 64,000 hits. Some academics and administrators have embraced this approach to learning, others are maintaining the status quo until enough evidence is provided to ensure such changes will bring about improvement of student learning.

> Flipped Learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter (Flipped Learning Network, 2014).

There is certainly a change from a didactic 'telling' and passive 'listening' approach to more active student-centred learning approaches and this can (and ought to) be supported by the teacher. This may mean that initial workload for the teacher is increased as they need to provide trigger materials for students to engage with, facilitate discussions, and guide groups to reach outcomes. However, "Removed from the constraints of 'providing content', instructors can add value to the classroom experience by teaching students how to reason through problems and apply information to real-life issues." (Rotellar & Cain, 2016, p. 1).

Focus on STEM

STEM (Science, Technology, Engineering and IT) has been chosen as a focus for this review due to the nature of the disciplines taught under this umbrella. Many STEM subjects contain an abundance of principles and (seemingly) abstract concepts which students need to 'know' before being able to move on to more practical, authentic applications. There is often a perceived need (by both teacher and student) for the teacher to personally deliver this content (Missildine, Fountain, Summers, & Gosselin, 2013). Bates and Galloway (2012) found that "In STEM subjects, and indeed many others, lectures are still a major component of most undergraduate courses. They are efficient but not particularly effective vehicles for promoting deep student learning" (p.1). Another misconception linked to the need to deliver content is that content needs to be removed from the curriculum in order to free up face-to-face class time to be active. Donovan and Lee (2015) found that sacrificing essential course content was not necessarily required in their food science class. Students who did not understand a concept were able to review the course in their own time and come to class prepared with questions to deepen their understanding. Li, Jiang, Li and Liu, (2016) found that more content could be covered in a flipped style of teaching (of computer-aided landscape design), as students were doing more outside the classroom. Yelmarthi and Drake (2015) also found that more content was covered in comparison to a traditional (lecture) style class in a digital circuits (engineering) course.

Current literature reviews

A number of reviews of the flipped learning (FL) and flipped classroom (FC) literature have recently been published, see for example Rotellar and Cain (2016); Seery (2015); O'Flaherty and Phillips (2015); Bishop and Verleger (2013) and Hamden, McKnight, McKnight & Arfstrom (2013). One of the first meta-studies was conducted by Bishop and Verleger (2013) who carried out a systematic survey of the literature published up to 2012. At that time the authors concluded that most research was reporting only student perceptions. Twenty-two studies were included in their review. The more current literature reviews have gone beyond perceptions to measure learning outcomes. Twenty-eight relevant papers were reviewed by O'Flaherty and Philips (2015). They concluded that little robust evidence for improved outcomes were reported. Also that there was a lack of capacity within academic staff to design good learning experiences possibly due to a lack of pedagogical understanding. Also that there are few if any conceptual frameworks being utilised in the design of the FC. This review investigates whether there is now changed evidence of improved outcomes. The review of the Chemistry FC literature conducted by Seery (2015) follows on from that of O'Flaherty and Philips by stating one of its purposes was to further investigate the issue of academics needing more guidance in designing better FC experiences. Seery (2015) also found an over reliance on content delivery through recorded lectures offered as pre-work. Table 1 outlines why this study is needed, ties the aims to other studies on this topic and details the two research questions underpinning the review of the flipped classroom literature.

Table 1: Aims and research questions of this study

Aim	Rationale	Research Question
1. whether there is significant evidence of the success of flipped learning reported specifically in the STEM literature. Success is measured in terms of evidence of improved learning outcomes.	Other meta-analyses of the literature have attempted to report on flipped learning across all disciplines or single disciplines. Previous reviews report limited evidence of improved learning outcomes.	To what extent are student learning outcomes improved, through use of a flipped learning approach?
2. whether there are any findings relevant to flipped research in STEM that differ from more generalist reviews.	Seery's (2015) review of flipped chemistry literature found an over reliance on content delivery through recorded lectures offered as pre-work.	How are the findings in the flipped STEM literature similar or different to previous reported findings?
3. Whether there are gaps or findings in the literature that can direct future research on flipped learning.		

Method

This review of the flipped literature has been guided by some of the recent meta-studies, particularly that of O'Flaherty and Philips (2015) who conducted a thorough scoping review of articles published up to October 2014. In that review, a number of inclusion and exclusion criteria were identified. This review uses similar criteria, including: time period (2012 – 2016), language (English), type of research (original article in a peer reviewed publication), study focus (students in a higher education setting studying a STEM discipline, both undergraduate and postgraduate), and literature focus (the overall theme relates to the flipped classroom approach).

In addition, for each selected article meeting the above criteria, the following was also noted: the criteria used to judge success (or not), the technologies used (if any), the country of study (Figure 1), the STEM discipline (Figure 1), the theoretical underpinning, framework or approach used in the design of the flipped classroom, and the class size. The majority of studies were conducted in subjects with smaller class sizes, less than 150 students (n=52).

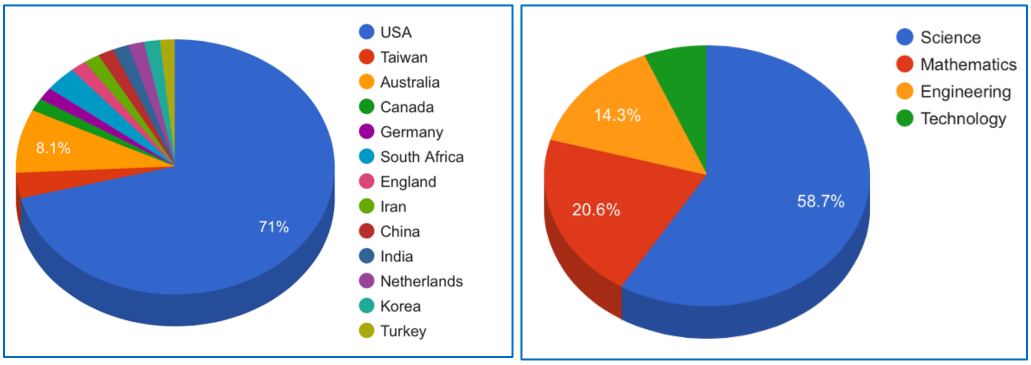

Figure 1: Distribution of studies in this review by country and by STEM discipline

Nine databases were searched in July 2016 using the criteria (flip* OR invert*) AND "higher education". The term STEM was not used as many papers did not identify to this keyword. The results were manually checked for STEM relevance and included if the discipline area was within STEM. The list is shown in Table 2 and includes information where a search may have been narrowed due to too many hits. Only full papers that were peer reviewed were deemed relevant to this study. As each relevant paper was found, it was logged in a spreadsheet with the associated criteria (as mentioned above). When papers were found that had already been listed these were not 'counted' as a relevant find. Hence the later database searches often returned nil results as all papers had already been logged. Table 2 outlines the databases in order of searching, search results and number of relevant articles recorded.

Table 2: Databases searched and relevant studies identified for this review

Database Searched	**Search narrowed**	**Hits returned**	**Relevant articles**
A+ Education		12	2
ProQuest		38	9
ERIC		63	5
British Education Index		62	0
Web of Science	'flipped' in title field only	120	27
Education Research Complete		215	3
Wiley		116	1
Academic Research Complete		50	0
Google Scholar	Included STEM but only chose top 100 results	100	11

A total of 58 articles were deemed relevant for this review, from the 776 articles found in the initial searches. The final item of note is the distribution of methods used for measurement, across the studies. Earlier reviews of the literature had noted few empirical studies had been used to measure outcomes (Bishop & Verleger, 2012 and later, O'Flaherty & Philips, 2015). This review found 15 studies used qualitative methods, eight studies used quantitative methods and 35 studies used mixed methods in their investigations and comparisons of flipped and traditional approaches.

Analysis

Each of the relevant papers was summarised and then content analysis was carried out using the manual extraction of themes (Saldana, 2013). Two cycles of coding were used, the first cycle using an Initial Coding method (Charmaz, 2014) whereby data was broken down across three categories, positive, negative and neutral. Reviewed studies tended to report findings in terms of the benefits (positive) and challenges (negative) of a flipped approach. The findings in some studies didn't identify to either positive or negative but were actually recommendations so these were grouped under the neutral category. In the second cycle, Focused Coding

(Charmaz 2014) was used whereby the codes were arranged into themes. Table 3 shows the distribution of emerging themes across the three categories. Some of these will be described in the next section.

Table 3: distribution of emerging themes across three categories

Positive		**Negative**		**Neutral / Recommendations**	
Theme	*Number of studies coded*	*Theme*	*Number of studies coded*	*Theme*	*Number of studies coded*
*Achievement	39	*Lack of self-efficacy	11	Learning design	8
*Perception	33	Increased workload	9	*Perception	5
*Engagement	20	*Perception	7	*Self-efficacy	5
*Students' self-efficacy	12	Learning design	4	Video/resources	4
Learning design	2	Technology	3		
		*Achievement	2		

*themes discussed in the Findings section

Preliminary Findings & Discussion

Perception (of Flipped versus a traditional classroom setting), engagement and achievement are common measures in previous reviews (Bormann, 2014 as cited in Sohrabi & Traj, 2016). The findings from this review found similar themes and are described below, citing examples from the pool of 58 studies where relevant. *Note: Not all articles reviewed for this study are able to be cited due to length restrictions but will be available in a forthcoming publication.*

Achievement

Thirty-nine studies reported on achievement, mostly in terms of grades awarded. A few studies discussed achievement in terms of participation, for example how pre-work engagement (n=3) and active learning (n=3) were correlated with achievement. Fifteen studies reported that students achieved deeper learning through the flipped approach (Veeramani, Madhugiri, & Chand 2015) and this theme also covered the concept of student retention (n=5) (Yelamarthi & Drake, 2015). Ten studies found no statistical difference in the results between flipped and traditional approaches (Fitzgerald & Li, 2015). Heyborne and Perrett (2016) also found that there was no statistical difference (SD) in performance gains even though there was a gain in student perception (of learning). They said their study was limited due to small sample size (n=139). Another study which found no significant change concluded "…, students who have been successful already are likely to continue being successful whether in a traditional or flipped classroom" (Hotle & Garrow, 2015, p.10).

Only one study found poorer achievement (Bossaer et al., 2016) through use of a flipped approach. That study investigated examination results using analysis of covariance with prior academic performance variables (ie. GPA) as covariates. However, the control in that study was not a traditional lecture but an interactive lecture (use of case studies in the class combined with in-class polling or student response system, not solely a didactic lecture) therefore findings are open to interpretation. Bossaer et al., (2016) concluded that the lower performance in the flipped class was due to the lack of pre-class preparation accountability. Further evidence of the importance of the need for good design and alignment of the pre-class and the in-class activities (Khanova, Roth, Rodgers & McLaughlin, 2015).

Perception

Improving perceptions is important in the STEM disciplines because "[Flipped] courses are critical gatekeepers in potential STEM career pathways and are often very influential in student decisions about whether or not to pursue a STEM-related major." (Love et al., 2013, p.323). A range of measurement techniques were used in the reviewed studies including various inventories, student feedback surveys and focus groups. Thirty-three studies reviewed for this paper found that students perceived the flipped teaching method positively. Concepts included in this theme included students taking a positive approach to learning (Long, Logan & Waugh, 2016), and ease of access to resources (Talley & Scherer, 2013). Negative perceptions were recorded in seven studies and the reasons stated varied. In some studies, students 'longed for' a return to the didactic traditional lecture and perceived they were not getting value for money unless they were receiving direct, live instruction from an expert (Mzoughi, 2015). In another study, students did not perceive any value from active learning "Students reported that the [flipped] approach required more work, and they did not seem to perceive the value of interactive learning approaches" (Missildine et al., 2013, p599). However, it must be remembered that student satisfaction is not necessarily an accurate indicator of learning (Benner et al., 2010 cited in Missildine et al., 2013). Another study that reported a decrease in initial perceptions of the flipped approach found that these perceptions changed over time of exposure to the flipped style of learning and students became more open to cooperative learning and innovative teaching methods. Initially they expressed frustration because their class time activities constantly changed and they were unprepared for this 'unknown' (Strayer, 2012). Other studies (n=7) reported a perception of increased student workload contributing to the negative perceptions towards a flipped approach (Khanova, Roth, Rodgers & McLaughlin, 2015; Hotle & Garrow, 2015).

Engagement

Twenty studies described how student engagement had improved through use of the flipped approach. Ten of these studies reported on the affordances and perceived value of interaction with peers, resources and teaching faculty which lead to increased engagement (McCallum, Schultz, Sellke & Spartz, 2015). Five studies detailed the face-to-face strategies such as in-class discussion and specifically working through problem solutions (Koo et al., 2016). However, some found that improved engagement did not always lead to improved achievement (Lucke, Dunn & Christie, 2016).

Self-efficacy

An interesting theme was identified across the three categories related to students' sense of self-efficacy. Many studies (n=12) reported that students were positive about taking control of their learning through use of preparation resources (Koo et al., 2016) and development of new, independent learning strategies (McLean et al., 2016). There was division over whether the flipped approach was good (n=8) (Veeramani, Madhugiri, & Chand, 2015) or bad (n=7) (Persky & Dupuis, 2014) for first year cohorts or introductory/foundation courses. Yelamarthi and Drake (2015) found that whilst first year students struggled in the first few weeks, if they were supported through concept reinforcement during hands-on activities and timely feedback from the instructor, then in fact they *were* able to succeed in the flipped classroom.

Graduate attributes in STEM

Whilst this is not specifically a theme that emerged across the reviewed studies, it is noted her for its importance for future-focused learning. STEM students have a lot of content knowledge to remember and understand before they can move to higher order skills such as application and analysis. In McLean et al., (2016) students reported that they developed independent learning strategies, spent more time on task, and engaged in deep and active learning through the flipped approach. Whilst attainment in terms of marks is important to gaining qualifications, the development of attributes that go beyond discipline knowledge such as independent and lifelong learning, collaboration and communication skills are greatly valued in today's workplace. "..student discomfort over the lack of in-class lecturing can give way to meaningful discussions about the nature of higher education and real progress toward guiding students to becoming self-regulating, lifelong learners" (Talbert, 2014). If the development of these attributes in STEM students is being encouraged as evidenced in this review, then this is indeed a win for this approach to learning and teaching.

Conclusions and further research

The preliminary findings of this review indicate mainly positive themes in the literature on flipped learning in the STEM disciplines. There has been an explosion of empirical studies measuring achievement of student learning outcomes in the STEM disciplines (published in 2015 and so far in 2016), the majority comparing flipped to traditional approaches to teaching. One important finding from this review indicates the importance of a flipped approach for improving students' sense of self-efficacy. This is important in the current work-place climate where skills such as life-long learning and adaption to change are highly valued.

This review has indicated a few areas for future research. The majority of peer reviewed articles that fit the review criteria came from North America which leads to a particular cultural bias. Other areas for investigation could be gender bias in flipped (Ichinose & Clinkenbeard, 2016), differences in implementation and results of flipped approaches in large classes (Khanova et al., 2015), and more focus on flipped applications in engineering and IT subjects. There was only one longitudinal study (Benade & Callaghan, 2015) found for this review and in time, further studies of this nature will allow more robust conclusions to be made on the flipped approach.

References

Bates, S., & Galloway, R. (2012). The inverted classroom in a large enrolment introductory physics course: a case study. Presented at the HEA STEM Conference, London, UK.

Benade, S., & Callaghan, R. (2015). The Value of Preparation in a Systems Engineering Masters Module: A Longitudinal Case Study. *Systems Engineering*, *18*(2), 131–145.

Bishop, J., & Verleger, M. (2013). The Flipped Classroom: A Survey of the Research. In *Frankly we do give a d*mn*. Atlanta, GA. http://www.studiesuccesho.nl/wp-content/uploads/2014/04/flipped-classroom-artikel.pdf [viewed 18 May 2016].

Bossaer, J., Panus, P., Stewart, D., Hagemeier, N., & George, J. (2016). Student Performance in a Pharmacotherapy Oncology Module Before and After Flipping the Classroom. *Pharmaceutical Education*, *80*(2), 1–6.

Charmaz, K. (2014). *Constructing Grounded Theory*. London: SAGE Publications.

Definition of Flipped Learning. (2014). Retrieved from http://flippedlearning.org/definition-of-flipped-learning/

Donovan, J., & Lee, S. (2015). How We Flipped: Student and Instructor Reflections of a Flipped-Class Model in a Sensory Evaluation Laboratory Course. *National Association of Colleges and Teachers of Agriculture (NACTA)*, *59*(4), 335–342.

Fitzgerald, N., & Li, L. (2015). Using Presentation Software To Flip an Undergraduate Analytical Chemistry Course. *Journal of Chemical Education*, *92*(9), 1559–1563.

Hamdan, N., McKnight, K., Arfstrom, K., & McKnight, P. (2013). A Review of Flipped Learning. Flipped Learning Network. http://flippedlearning.org/wp-content/uploads/2016/07/LitReview_FlippedLearning.pdf [viewed 13 Mar 2016].

Heyborne, W., & Perrett, J. (2016). To Flip or Not to Flip? Analysis of a Flipped Classroom Pedagogy in a General Biology Course. *Journal of College Science Teaching*, *45*(4), 31–37.

Hotte, S., & Garrow, L. (2016). Effects of the Traditional and Flipped Classrooms on Undergraduate Student Opinions and Success. *Journal of Professional Issues in Engineering Education and Practice*, *142*(1), 05015005.

Ichinose, C., & Clinkenbeard, J. (2016). Flipping College Algebra: Effects on Student Engagement and Achievement. *Learning Assistance Review (TLAR)*, *21*(1), 115–129.

Khanova, J., Roth, M.T., Rodgers, J. E., & McLaughlin, J.E. (2015). Student experiences across multiple flipped courses in a single curriculum. *Medical Education*, *49*(10), 1038–1048.

Koo, C., Demps, E., Farris, C., Bowman, J., Panahi, L., & Boyle, P. (2016). Impact of Flipped Classroom Design on Student Performance and Perceptions in a Pharmacotherapy Course. *American Journal of Pharmaceutical Education*, *80*(2), 33. http://doi.org/10.5688/ajpe80233

Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *Journal of Economic Education*, *3*(1), 30–43.

Li, D.-H., Jiang, B.-S., Li, H.-Y., & Liu, X.-P. (2016). Design of experiment course “Computer-aided landscape design” based on flipped classroom. *Computer Applications in Engineering Education*, *24*(2), 234–240.

Long, T., Logan, J., & Waugh, M. (2016). Students’ Perceptions of the Value of Using Videos as a Pre-Class Learning Experience in the Flipped Classroom. *TechTrends:Linking Research & Practice to Improve Learning*, *60*(3), 245–252.

Love, B., Hodge, A., Grandgenett, N., & Swift, A. (2014). Student learning and perceptions in a flipped linear algebra course. *International Journal of Mathematical Education in Science and Technology*, *45*(3), 317–324.

Lucke, T., Dunn, P. K., & Christie, M. (2016). Activating learning in engineering education using ICT and the concept of “Flipping the classroom.” *European Journal of Engineering Education*, 1–13. http://doi.org/10.1080/03043797.2016.1201460

McCallum, S., Schultz, J., Selke, K., & Spartz, J. (2015). An Examination of the Flipped Classroom Approach on College Student Academic Involvement. *International Journal of Teaching and Learning in Higher Education*, *27*(1), 42–55.

McLean, S., Attardi, S., Faden, L., & Goldszmidt, M. (2016). Flipped classrooms and student learning: not just surface gains. *Advances in Physiology Education*, *40*(1), 47–55.

Missildine, K., Fountain, R., Sumers, L., & Gosselin, K. (2013). Flipping the Classroom to Improve Student Performance and Satisfaction. *Journal of Nursing Education*, *52*(10), 597–599.

Mzoughi, T. (2015). An Investigation of Student Web Activity in a “flipped” Introductory Physics Class. *Procedia - Social and Behavioral Sciences*, *191*, 235–240. http://doi.org/10.1016/j.sbspro.2015.04.558

O’Flaherty, J., & Philips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education*, *27*(October 2015), 90. http://doi.org/0.1016/j.iheduc.2015.02.002

Persky, A., & Dupuis, R. (2014). An Eight-year Retrospective Study in “Flipped” Pharmacokinetics Courses. *American Journal of Pharmaceutical Education*, *78*(10), 1–7.

Rotellar, C., & Cain, J. (2016). Research, Perspectives, and Recommendations on Implementing the Flipped Classroom. *American Journal of Pharmaceutical Education*, *80*(2), 1–9.

Saldana, J. (2013). *The Coding Manual for Qualitative Researchers* (2nd ed.). London: SAGE.

Seery, M. (2015). Flipped learning in higher education chemistry: emerging trends and potential directions. *Chemistry Education Research and Practice*, *2015*(16), 758–768. http://doi.org/10.1039/C5RP00136F
Sohrabi, B., & Traj, H. (2016). Implementing flipped classroom using digital media: A comparison of two demographically different groups perceptions. *Computers in Human Behaviour*, *60*, 514–524.
Strayer, J. (2012). How Learning in an Inverted Classroom Influences Cooperation, Innovation and Task Orientation. *Learning Environments Research*, *15*(2), 171–193.
Talbert, R. (2014). Inverting the Linear Algebra Classroom. *PRIMUS*, *24*(5), 361–374. http://doi.org/10.1080/10511970.2014.883457
Talley, C., & Scherer, S. (2013). The Enhanced Flipped Classroom: Increasing Academic Performance with Student-recorded Lectures and Practice Testing in a “Flipped” STEM Course. *The Journal of Negro Education*, *82*(3), 339–347.
Veeramani, R., Madhugiri, V., & Chand, P. (2015). Perception of MBBS students to “flipped class room” approach in neuroanatomy module. *Anatomy & Cell Biology*, *48*(2), 138–143.
Wilson, S. (2013). The Flipped Class: A Method to Address the Challenges of an Undergraduate Statistics Course. *Teaching of Psychology*, *40*(3), 193–199.
Yelmarthi, K., & Drake, E. (2015). Flipped First-Year Digital Circuits Course for Engineering and Technology Students. *IEEE Transactions on Education*, *58*(3), 179–186.

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Moving forward with Digital Badges

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This symposium is based on a recently published edited volume “Foundations of Digital Badges and Micro-Credentials” which aims to provide insight into how digital badges may enhance formal and informal education by focusing on technical design issues including organizational requirements, instructional design, and deployment. All panel members are contributors to the edited volume and will share their perspectives on (1) digital badges’ impact on learning and assessment, (2) digital badges within instructional design and technological frameworks, and (3) the importance of stakeholders for the implementation of digital badges.

Keywords: Digital badges, learning design, technology integration, micro-credential, assessment

Digital Badges in Education

Digital Badges represent a valid indicator of specific achievements, knowledge, skills, and competencies that can be earned in formal and informal learning environments. They are an opportunity to recognize such achievements through credible organizations that can be integrated in traditional educational programs but can also represent experience in informal contexts or community engagement. Digital Badges are a relatively new technology and therefore acceptance depends on the reputation of the issuer, the level of quality control, and the design and implementation in learning environments. They offer a form of recognition of learning, with a focus on qualifications like problem-solving, self-management. They are flexible, which supports individual learning achievements and they can provide information to relevant stakeholders when they are digitally linked with user profiles or shared in social networks. But implementing digital badges in learning environments can be challenging, because different forms of assessment and awards processes require new forms of instruction and a clear understanding of learning outcomes.

Format, Strategies, Audience

This symposium is based on a recently published edited volume “Foundations of Digital Badges and Micro-Credentials” (Ifenthaler, Bellin-Mularski, & Mah, 2016) which aims to provide insight into how digital badges may enhance formal and informal education by focusing on technical design issues including organizational requirements, instructional design, and deployment. All panel members (see below) are contributors to the edited volume and will share their perspectives on (1) digital badges’ impact on learning and assessment, (2) digital badges within instructional design and technological frameworks, and (3) the importance of stakeholders for the implementation of digital badges. The audience will be invited to contribute to the discussion toward future research initiatives. Dirk Ifenthaler will provide an overview on the four major parts of the edited volume: (I) Theoretical Foundation of Digital Badges, (II) Technological Frameworks and Implementation, (III) Learning and Instructional Design Considerations, and (IV) Case Studies: Practices and Experience (Ifenthaler et al., 2016). Melinda Lewis will offer a philosophical look at the place of digital badges in professional learning degrees, in the contemporary, globalised university and for graduates entering a complex, uncertain world of work (Lewis & Lodge, 2016). We focus on the potential paradox of micro-credentialing higher-order qualities of professional becoming, informed by Jason Lodge’s research in the Science of Learning Research Centre, at the University of Melbourne. A summary of use cases which has been developed by Deborah West and Alison Lockley will be used to prompt discussion and ideas related to potential applications (West & Lockley, 2016). The impact on learning and assessment will differ considerably according to the way digital badges are used which can vary considerably from focusing on a task or concept within a unit of study through to the program level and well beyond to non-accredited/extra-curricular activities. David Gibson, presenting collaborative research with Kathryn Coleman and Leah Irving, will outline three primary roles of digital badges for supporting learning journeys in higher education: bringing *visibility and transparency* to learning, teaching and assessment; *revealing meaningful, identifiable and detailed aspects of learning* for all stakeholders; and providing *a new mechanism to recognize skills, experience and knowledge* through an open, transferable, stackable technology framework (Gibson, Coleman, & Irving, 2016).

Biographies of Panel Members

David Gibson 	Associate Professor David Gibson (david.c.gibson@curtin.edu.au), Curtin University's Director Learning Futures, is an educational researcher, professor, learning scientist and technology innovator. His research focuses on learning analytics, complex systems, web applications and the future of learning, and the use of technology to personalize education via cognitive modeling, design and implementation. He is creator of simSchool, a classroom flight simulator for preparing educators, and eFolio an online performance-based assessment system. He provides vision and sponsorship for Curtin University's Challenge, a mobile, game-based learning platform.
Dirk Ifenthaler 	Professor Ifenthaler's (dirk@ifenthaler.info) research focuses on the intersection of cognitive psychology, educational technology, learning science, data analytics, and computer science. His research outcomes include numerous co-authored books, book series, book chapters, journal articles, and international conference papers, as well as successful grant funding in Australia, Germany, and the USA – see Dirk's website for a full list of scholarly outcomes at www.ifenthaler.info. He is editor-in-chief of the Springer journal *Technology, Knowledge and Learning* (www.springer.com/10758).
Melinda Lewis 	Melinda Lewis (melinda.lewis@sydney.edu.au) is an academic developer in the Educational Innovation team at the University of Sydney. Her work has centered on the design, development and evaluation of health professional learning degrees, informed by health information science, the learning sciences and the sociology of education. Melinda currently coordinates projects supporting a university-wide strategy to connect cultural competence to curriculum.
Deborah West 	Associate Professor Deborah West (Deborah.West@cdu.edu.au) BA, MSW, PhD) is the Director of Learning and Teaching at Charles Darwin University. She has over 20 years of experience in higher education in a variety of roles prior to her current position including as a lecturer, Head of School and Associate Dean Learning and Teaching. In recent years her research work has been in the areas of technology mediated learning, learning analytics and academic leadership with numerous publications and nationally funded research projects.

References

Gibson, D. C., Coleman, K., & Irving, L. (2016). Learning journeys in higher education: designing digital pathways badges for learning, motivation and assessment. In D. Ifenthaler, N. Bellin-Mularski, & D.-K. Mah (Eds.), *Foundations of digital badges and micro-credentials* (pp. 115–138). New York, NY: Springer.

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (Eds.). (2016). *Foundations of digital badges and micro-credentials*. New York, NY: Springer.

Lewis, M. J., & Lodge, J. M. (2016). Keep calm and credential on: linking learning, life and work practices in a complex world. In D. Ifenthaler, N. Bellin-Mularski, & D.-K. Mah (Eds.), *Foundations of digital badges and micro-credentials* (pp. 41–54). New York, NY: Springer.

West, D., & Lockley, A. (2016). Implementing digital badges in Australia: the importance of institutional context. In D. Ifenthaler, N. Bellin-Mularski, & D.-K. Mah (Eds.), *Foundations of digital badges and micro-credentials* (pp. 467–482). New York, NY: Springer.

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Refocusing institutional TEL provision on the learner: drivers for change in UK higher education

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UK higher education institutions have invested significantly in technology-enhanced learning (TEL) services over the last 15 years. The UCISA TEL surveys have shown how this investment has focused on establishing core infrastructure and services to students to satisfy consumer expectations, supporting greater efficiencies in the management and control of learning processes. However, new developments in UK government policy may encourage UK Higher Education Institutions (HEIs) to refocus their attention on the impact of TEL on student learning, with a greater emphasis on evidence-based practice in the use of TEL tools. This paper discusses the prospects for change in the use of TEL tools and services to support this new agenda.

Keywords: technology-enhanced learning, UK Higher Education

Introduction

The UK Government's Higher Education White Paper (Department of Business, Innovation and Skills, 2016) proposes the introduction of the Teaching Excellence Framework (TEF) which will introduce major changes to the ways in which the quality of higher education is measured and assessed.
The TEF (see THE, 2016 for more information) will provide a series of metrics to monitor the quality of teaching in English universities, with a successful outcome enabling institutions to charge premium tuition fees. The TEF is also viewed as a means of promoting teaching, redressing the balance with research and providing a greater degree of openness to students in terms of the release of information on their learning progress.

This promises major changes to the ways in which TEL services are leveraged by universities to support student learning. Investment in TEL provision has been directed to the provision of institution-wide services such as lecture capture and learning management systems, which complement campus-based learning and satisfy consumer expectations - a significant concern given the more competitive marketplace for student recruitment that has emerged across the sector. Institutions have also focused on the efficiencies that enterprise-wide systems can offer in managing and controlling learning processes, with limited attention paid to evidence-based practice for the use of TEL tools in supporting learning outcomes (Walker, Voce & Jenkins, 2013).

Drawing on the data from the Universities and Colleges Information Systems Association (UCISA) TEL biennial surveys, this paper considers the progress that institutions have made to date in establishing TEL services and the prospects for change in directing these services to support a learner-centred agenda.

The UCISA Surveys

The UCISA TEL surveys have been monitoring the management and implementation of technology-enhanced learning across the UK HE sector since 2001. The surveys have been completed by institutional heads of e-learning with responsibility for the delivery of learning and teaching services and have served a dual purpose in tracking longitudinal perspective of technology-enhanced learning (TEL) developments across the sector, whilst capturing new trends and developments through an evolving question-set. The most recent survey report (Walker et al., 2016) represents the eighth survey in the series.

Overview: the 2016 story

The 2016 TEL Survey presents the current picture of institutional TEL investment across the sector, showing that universities have made considerable progress in embedding the use of core technologies within their course delivery. Table 1 reveals that learning management and e-assessment systems are most commonly deployed across institutions, forming components of a digitally-enabled baseline provision to students, encompassing learning resources and support for course administration activities. In contrast, student-focused tools enabling active learning and interactive study approaches have attracted much less usage across institutions and do not feature in the list of leading tools.

Table 1: Percentage of institutional courses using TEL tools within the UK HE sector

Top 5 Tools	100%	75%-99%	50%-74%	25%-49%	5%-24%	1%-4%	0%	Don't Know
Learning Management System (LMS)	42%	50%	1%	0%	0%	1%	0%	5%
e-Submission tools (assignments)	20%	38%	20%	8%	3%	0%	2%	8%
Text matching tools (e.g. SafeAssign, Turnitin, Urkund)	16%	42%	19%	8%	5%	0%	3%	6%
Content management systems	11%	9%	2%	8%	12%	15%	14%	29%
Reading list management software	9%	21%	12%	13%	7%	7%	11%	20%

Source: 2016 UCISA Technology Enhanced Learning Survey (Walker et al, 2016)

The emphasis on baseline provision of digital services to students – the standardisation of student learning and consistency in the learner experience across study programmes – has gained traction across the sector with TEL services now commonly used to supplement traditional course delivery (Reed & Watmough, 2015). Indeed, the provision of supplementary learning resources remains the most common use of TEL, with active learning design in the use of TEL tools representing more a feature of departmental teaching approaches, rather than an institution-wide practice. Figure 1 presents an overview of TEL use across UK HE based on the 2016 survey data (Walker, et al, 2016) based on the following course delivery modes and their adoption within institutions:

1. **Blended learning**: lecture notes and supplementary resources for courses studied in class are available;
2. **Blended learning**: parts of the course are studied in class and other parts require students to engage in active learning online (e.g. engaging in collaborative or assessed tasks);
3. **Fully online courses**;
4. **Open online learning courses for all students at your institution:** internal access only;
5. **Open online boundary courses**: free external access to the course materials for the public, but assessment restricted to students registered at your institution only;
6. **Open online learning courses for public:** free external access.

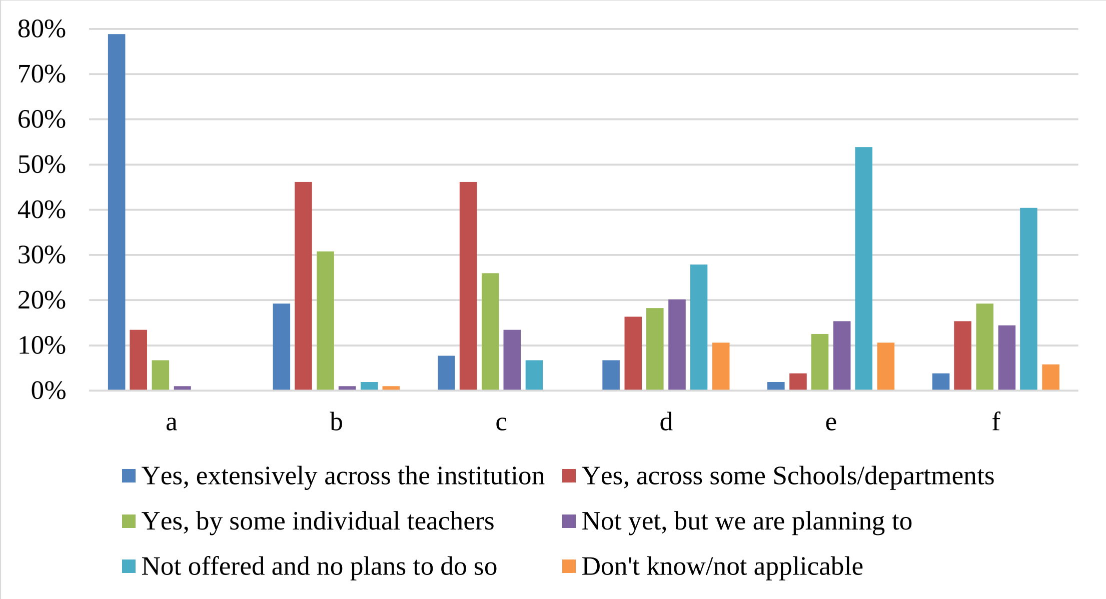

Fig 1: Proportion of all modules or units of study in the TEL environment in use

Meeting expectations

Arguably the scope and nature of institutional TEL investment over recent years has been strongly aligned to student expectations. Figure 2 below shows the top ranked drivers for institutional TEL investment and how they have changed over the period of the surveys; the data reveals the enduring influence of learning and teaching concerns as the primary driver for institutional investment in TEL services.

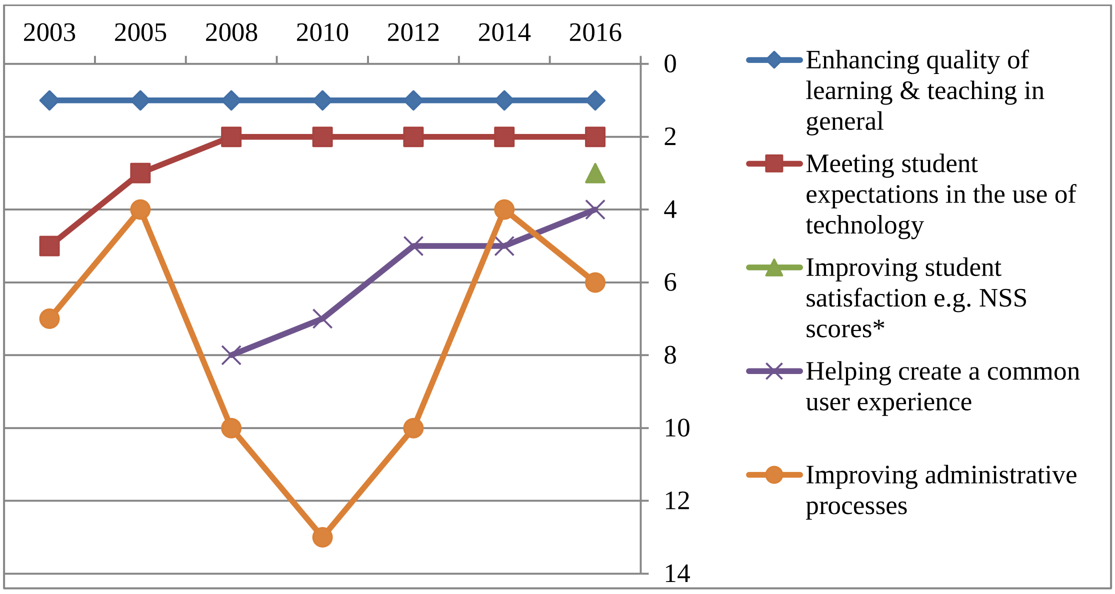

Fig 2: Driving factors for TEL development (rankings)

The data also reveals that feedback from students is one of the leading factors encouraging the development of TEL services. Feedback has been captured through instruments such as the National Student Survey (NSS) to measure levels of student satisfaction with teaching and learning delivery. Indeed, students have campaigned to exercise a greater influence over the development of TEL services that support learning and teaching activities and be seen as partners in educational design and delivery (Wenstone, 2013).

Show me the learning

And yet when reviewing UCISA data on institutional activity in evaluating the impact of TEL tools on student learning, we may observe a different picture of engagement with learning and pedagogic concerns. Figure 3 shows the level of institution-wide evaluation activity on the impact of TEL, focusing on the *student learning experience* and on *pedagogic practices*.

Studies on the impact of TEL on the *student learning experience* have tended to focus on 'hygiene' factors such as levels of student satisfaction and take-up of core TEL services, as opposed to studies of effective course design methods with technology. Commonly the focus of evaluations has been on studies of core systems such as the LMS or e-assessment provision, rather than on the impact of tools and applications on active student learning and the learning outcomes arising through the use of learning technologies in study activities. The focus on standardisation and consistency in the learner experience comes through strongly in the evaluations that have been conducted, indicating that consistency of provision and *creating a common user experience* are key concerns for UK institutions.

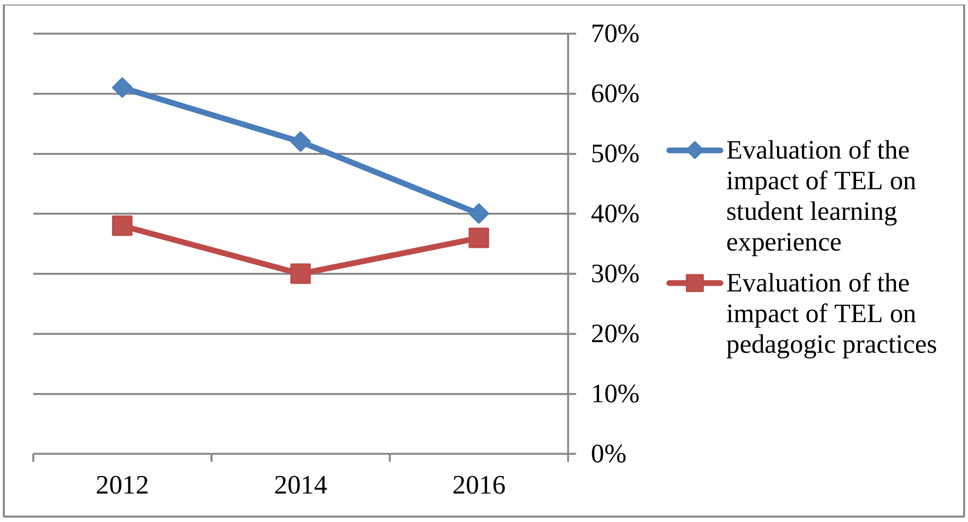

Fig 3: Percentage of institutions undertaking evaluation of the impact of TEL

On the impact on pedagogic practices, determining *take-up of TEL tools and usage across an institution* (*adoption*) was the most widely reported purpose for the evaluation. Surprisingly the 2016 survey findings revealed a reduction in the percentage of institutions (from 44% in 2014 to 17% in 2016) selecting *Assess value of TEL tools in relation to student performance (learning analytics)* as the purpose of their evaluation activity. Learner analytics was a new focus for the 2016 survey, with additional questions added in response to interest in the sector (Newland, Martin & Ringan, 2015). Yet the UCISA survey indicates that *learning analytics* appears not to be well established across the sector, with only 19% of universities currently supporting an institutional service. Over 40% of institutions do expect to review these services over the next two years. (See Walker, 2016, for further discussion on these findings.)

The growing interest by HE providers in metrics for tracking the quality of learning no doubt is partly connected to discussions around the Teaching Excellence Framework (TEF) and its impending introduction to the English HE sector. The TEF will provide a quality assessment of teaching and learning based on a range of metrics, a good rating being linked to an institution's ability to raise the threshold of their tuition fees. This may offer the greatest driver to investigating the impact of TEL tools on student learning and the achievement of learning outcomes.

Conclusions

The use of TEL is widely recognised as an important factor in UK HE and features strongly in institutional strategies. However, the UCISA surveys indicate that investment in TEL has been driven by a 'student as consumer' focus, rather than being widely based on evidence informed practice. UK HE is now facing two significant changes which will place greater emphasis on using big data; the TEF and growing interest in learning analytics. Jisc is currently working with more than 50 UK universities and colleges to support the development of a sector-wide learning analytics service, with the project due to be completed by the end of July 2017[13]. Early indications are that the TEF is already making institutions consider how they will gather the metrics required and learning technologies will play an important part in this endeavour (ALT, 2016). Higher education institutions are therefore likely to have to consider how their existing infrastructure can evidence their teaching and learning practice and its impact on student achievement - in this way creating an opportunity for those engaged in supporting the use of TEL to help 'show them the learning'.

References

ALT (2016) ALT responds to inquiry into assessing quality in Higher Education https://www.alt.ac.uk/news/all_news/alt-responds-inquiry-assessing-quality-higher-education

Department of Business, Innovation and Skills (2016) *Success as a knowledge economy: teaching excellence, social mobility and student choice*. Higher Education White Paper. BIS/Crown. https://www.gov.uk/government/publications/higher-education-success-as-a-knowledge-economy-white-paper

Newland, B., Martin, L. & Ringan, N. (2015). Learning Analytics in UK HE 2015. A HeLF Survey Report. http://tinyurl.com/HeLF-learning-analytics

Reed, P. & Watmough, S. (2015) *Hygiene factors: Using VLE minimum standards to avoid student dissatisfaction. E-Learning and Digital Media, 12* (1), pp.68 - 89.

THE (Times Higher Education) (2016) *The Teaching Excellence Framework: everything you need to know*, THE. https://www.timeshighereducation.com/news/teaching-excellence-framework-tef-everything-you-need-to-know

Walker, R., Voce, J. & Jenkins, M. (2013). Charting the development of technology-enhanced learning developments across the UK higher education sector: a longitudinal perspective (2001-2012), *Interactive Learning Environments*, Routledge: London. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/10494820.2013.867888

Walker, R., Voce, J., Swift, E., Ahmed, J., Jenkins, M., & Vincent, P. (2016). 2016 Survey of Technology Enhanced Learning for higher education in the UK. Universities and Colleges Information Systems Association, Oxford, UK.

Walker, R. (2016). *2016 UCISA TEL Survey: Spotlight on learning analytics*. Retrieved from: http://tinyurl.com/learning-analytics-summary

Wenstone, R. (2013) It's all about the learner. Keynote speech at ALT-C 2013, Nottingham, UK. 10-12 September 2013. Retrieved from: http://www.youtube.com/watch?v=cjINstTYw9U

Please cite as: Jenkins, M., Walker, R., Voce, J., Ahmed, J., Swift, E., & Vincent, P. (2016). Refocusing institutional TEL provision on the learner: drivers for change in UK higher education. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 278-282).

[13] Jisc project (2015-2017): Effective learning analytics. https://www.jisc.ac.uk/rd/projects/effective-learning-analytics

Proudly Pragmatic: Steps to Online Curriculum Transformation

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Students of today 'live' in a world shaped by the World Wide Web with its instant access to information and resources and range of technologies and social media. Following the University's digital strategy, this case study explores the choice of online learning tools that transformed its previously face to face class teacher focused layout to an engaging digital format. This case study outlines how the online tools and processes were chosen to meet the needs of the mature adult learners who are completing subjects in the Masters of Project Management (MPM). The curriculum transformation work required the development of digital learning resources, information communication technologies and new teaching strategies, to provide a more digital and responsive learning environment for students enrolled in the online course. The focus was on not only retaining students, but also ensuring that we were using technology to creating value and relevancy to our users.

Keywords: Adult learners, asynchronistic learners; curriculum transformation, online learning

Introduction

Students of today 'live' in a world shaped by the World Wide Web with its instant access to information and resources and range of technologies and social media. With the advent of the internet and advances in technology, *'traditional approaches to learning are no longer capable of coping with this constantly changing world'* (Thomas and Brown 2011, cited in O'Connell 2014, p201). They are creating a new culture of learning with an active and participatory learning environment, which as Moulton et al. (2016) outline, is being reshaped in terms of content and 'location' and by the participation of both the lecturers and students. This new learning environment means universities need to review their current curriculum and that lecturers/tutors need a set of professional competencies to deliver this curriculum via new pedagogy.

UniSA, like most higher education institutions, needs to be competitive and the UniSA's Strategic Plan, 'Horizon 2020' (UniSA 2010), and accompanying five year (2013-2018) Strategic Action Plan 'Crossing the Horizon 2013-2018' (UniSA 2013), were developed to respond to the need to design and deliver a curriculum for this new learning environment, one which repositions the students as active within their education, thus addressing the needs identified above. UniSA's adoption of technology and the digital learning opportunities it offers students, is enacted in its 'Digital Learning Strategy 2015-2020', which is shaping the direction of curriculum design, innovation and staff renewal in digital learning. It is a responsive document which aims to address the needs of current students who are increasingly mobile, both in terms of programs of study and location, who have access to information and technologies and who want flexible learning opportunities (Dawson 2015). These are the very students that are enrolled in the MPM program. The leadership of this program has embarked on its curriculum transformation over the last 3 years, primarily in response to their desire to provide students with a relevant quality curriculum that will enable them to apply it to their work as Project Managers. Consideration of the potential of falling enrolments as more higher education institutions began to offer these programs online, was an added consideration for our curriculum transformation process. The course offerings had been taught as face to face classes or online, both with pedagogy that was very facilitator centered, rather than student centered. The early online courses were 'static', with limited reproduction of on-campus course videoed lectures and PowerPoint slides. They were used as information repositories (Merrill 2003) with little or no interaction, and a traditional one-way lecture focused delivery. The new definition of 'digital learning' guiding this curriculum work is very different in that it sees courses as a pedagogical practice which incorporates the use of technology to support the learning process and with delivery being online, blended, a hybrid of both and also incorporating the use of mobile devices (Dawson 2015).

The curriculum transformation work required the development of digital learning resources, information communication technologies and new teaching methodologies, in order for us to provide a more digital and responsive learning environment for students enrolled in the online courses. These courses are located and accessed via the *learnonline* learning management system of UniSA, which provides an integrated suite of tools, management and support systems that encapsulates the teaching and learning environment at UniSA. Work on this curriculum transformation program is addressing the requirements of the 'Digital Learning Strategy 2015-2020' with its focus on digital learning innovation, specifically Strategic Priority #1 'Delivering an engaging and digitally enriched curriculum' (University SA 2010) and reflects O'Connell's (2014, p.209) conclusion:

> Learning in a digital age requires practitioners who understand education imperatives in local and global settings, and who can demonstrate an agile response to novel technologies that may catalyze learning. Both technical and pedagogical innovation should be hallmarks of the best learning environments we can create, and which incorporate a wide variety of pedagogical approaches, learning tools, methods and practices to support students' diverse learning modes.

Lessons Learnt from the Literature

Learning from other developers of online courses and the researchers provides a good insight into what makes a successful online higher education. The success of an online course can be measured in many ways. Retention rates were originally considered a key indicator of the success of an online course, while other researchers have investigated the depth of learning or its quality, or they have focused on the need for online courses to be relevant to the needs of participants and the level of learning required. Below is some of the learning we have gathered:

Retaining Students
A higher number of students participating in online courses dropout than those studying in a face to face situation (Dietz-Uhler 2007). Research into why adult learners drop out of online courses has been a common theme over several decades starting with Bean and Metzner's student attrition model (1985) stressed external environmental factors as the reasons for nontraditional students drop out). Tinto's student integration model (1993) identifying the interactions of the student and his/her educational environment, that is, both social and academic integration, as key factors affecting the decision to drop out. Rovai's (2003) persistence model was informed by a review of previous frameworks and identified prior-to-admission factors and after-admission variables. Park (2007) revised Rovai's model and suggested that, '*factors such as course design strategies and learners' motivation should be prioritised at the course development stage in order to make the course participatory and interesting and keep learners engaged*" (Park and Choi 2009, p215), and the application of technology is a key part of this.The more recent studies such as Khalil & Ebner (2013) highlight the high dropout rates in the Massive Open Online Courses (MOOCs) and through their literature review of contemporary articles, suggested: providing students with more flexible timetables; promoting the student completions; enhancing "student to student "and "student to instructor" interaction; and increasing student online learning skills, would improve retention rates. These support strategies to assist students in their study were also identified by Anderson *et al.* (2011) in their study of identifying dissonance in distance learners.

Not Technology for Technology Sake
'*The evidence is that technologies and social media platforms are driving an unprecedented reorganisation of the learning environment in and beyond schools and tertiary environments'* (O'Connell 2014, p202). Billings (2005) examined the differences in student perceptions of the use of technology, educational practices, and outcomes between undergraduate and graduate students enrolled in Web-based courses. This study provided five recommendations: a need for better understanding of the differences between generations- the Gen-Xers, Millennials, and the next generation to come; understanding of students' expectations of eLearning; that developers need to accommodate a variety of instructional strategies in order to meet the different needs; there is a continual search for best practice and need to identify factors that facilitate the development of asynchronous learning communities. Recent studies have shown that students involved in asynchronous learning, supported by a familiar tool, resulted in greater engagement and academic outcomes (Northey 2015) while Gaumer et. al. (2010) found that adult learners potentially need additional technical support initially and structure in their digital interaction.

It is educational purposes and pedagogy, not technologies, that must guide the students understanding (Kirkwood 2005). The application of technologies to face to face teaching or static web-based teaching, should not be an 'additive approach' because the technology is available (Simpson 2008), rather the application of technologies should change the teaching experience for the better. Knowing about students' use of media, as well as their attitudes and experiences, can help teachers and instructional designers develop better courses and ensure students are provided a high quality and digitally rich learning environment. The use of the technology needs to meet the needs of the students in terms of their forthcoming professional needs, their profile as learners, their accessibility to the technology/internet, rather than the technological tool being the determinant of use.

Quality Matters
Design quality is increasing the focus of determining the success of a program using sound principles of instruction (Waugh 2011). Design strategies are considered important at the course development stage, with the making of the course participatory and interesting in order to keep the learner engaged (Merrill 2003; Park & Choi 2009). Dietz-Uhler (2007) took a different focus in their 2007 study looking at quality provided by rich interactive and engaging online learning experiences. This study nominated the following as essential for a quality course: Course overview and introduction; Clear learning Objectives and Competencies; Relevant assessment and measurement including self-assessment; Comprehensive material using video tutorials, slides etc.; Frequent learner interaction formally and informally; Sophisticated learning management systems; Effective learner support which is also accessible to students with disabilities, who are often overlooked by instructional designers (Merrill 2003).

Relevance
Some students adapt better to online learning than others, the success appears to differ depending on the subject areas and the type of student (Xu 2013). Wallace (2016) found that gender related factors impacted on the relevance of online course material to participants. 'Relevance' as a key variable for the online mature student, this includes the internal motivation encouraging the individual to remain in the course and '*can be achieved by designing a course that contains learning materials and cases closely related to learners' interests, experiences, goals'* (Park & Choi 2009, p215). This point demonstrated more recently and locally, by the University of New South Wales, 6th Guideline on Learning, which states: '*Relevance-: Students become more engaged in the learning process if they can see the relevance of their studies to professional, disciplinary and/or personal contexts, for example through linking learning experiences to the workplace or wider community'* (University of New South Wales 2015). Relevance also includes the mode of delivery, which should match the needs and learning requirements of the students. Students are increasingly time poor (Stafford 2011), with mature-age students often sandwiching their studies between work and family commitments. To balance these demands, they tend to make deliberate choices that consciously reduce their involvement and engagement to critical assessment-relevant activities, even if these decisions reduce their learning opportunities. The like to fit their learning between their other work/life and so prefer asynchronistic learning, but online learning is more than a means to just accessing information (Garrison 2003).

Learning Community
We are social animals and we often learn best from and with others. Course development aimed at an asynchronous online learning cohort, needs to also provide a collaborative learning experience, at the convenience of the individual. That is, the student wants to be both interactive and independent. Definitions of 'engagement' have evolved over time, the authors of this paper use the definition provided by Northey (2015) as a 'personal-level, behavioural engagement'. A sense of community, where students work collaboratively to solve problems and gain an understanding of course concepts, this is important for online learners and assists a rewarding learning experience. Prior research has indicated community interactions reduce feelings of isolation in online courses and promote positive student outcomes (Schwiebert 2008; Thomas & Mengel 2008). The use of group work and open discussion forums are considered a critical feature of any online course. Figure 1 provides a visual representation of our thinking on which we based our transformational approach.

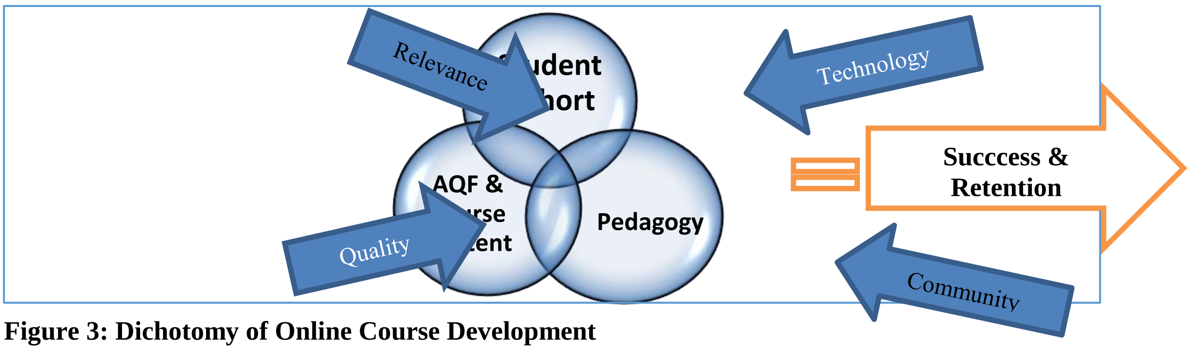

Figure 3: Dichotomy of Online Course Development

Our Students

Given the lessons learnt above, our aim was to provide a quality education experience with careful attention to course design and delivery so as to achieve the desired high level learning outcomes and meet the needs of adult learners in the online learning environment. In summary the MPM curriculum redevelopment process therefore was to engage students in their learning, increase their success and minimise withdrawal by:

1. Designing a *quality* MPM course incorporating the essential elements nominated by Dietz-Uhler (2007) and which develops their academic and research skills.
2. Ensuring the curriculum meets the AQF Level 8 & 9 standards and is more *relevant* and applicable to contemporary Project Management (PM) adult online students through both content and assessment which recognizes the characteristics of the learners: asynchronistic, mature/experienced adult learners, time poor and familiar technology.
3. Developing and using a range of *digital learning technologies and strategies* to enrich the curriculum and enhance relevance and to engage the learner (Hendel-Giller 2001)
4. *Developing a learning community* by providing opportunities for them to express their experience and relate it to the curriculum material, their peer group experience and knowledge.

The intention was to shift learning from the locus of responsibility of the course coordinator/lecturer towards the student. The student then takes on more of the responsibility for their own learning while the course coordinator/lecturer provides the boundaries of knowledge from which they can draw. Recognising the importance of course design and student motivation, we endeavoured to create an effective online learning course and platform for our students using a range of digital learning resources and organisational (including technical) support, in order to '*make the course participatory, interesting and keep learners engaged'* (Park & Choi 2009, p215). To do this we needed to include in the picture a good understanding of our student cohort and what made them unique, what was relevant and what level of academic content was required.

Australian Qualification Framework (AQF) and Course Content

Our courses and their content have also to meet academic requirements of the AQF and the industry professional associations and employers. PM education is criticised on two fronts: firstly, quality of education provided and secondly a lack of appropriate education to meet the complexity faced by project managers. Berggren (2008) suggested that better experimental learning was required by PM students and could be done by the use of more reflective reports, more exposure to research findings and by improving integration of actual practice into courses. Graduates at the masters level of study are required to 'have specialised knowledge and skills for research and/or professional practice and/for further learning.' (AQF 2ed. January 2013, p9). These courses are at AQF level 8 & 9 and graduates are expected to develop; specialised knowledge and skills; advanced and integrated understanding and expert, specialised cognitive and technical skills in a body of knowledge or practice; demonstrate autonomy, expert judgment, adaptability and responsibility. In terms of Bloom's Taxonomy, these higher level case studies will be used to 'Analyse', 'Synthesis' and 'Evaluate' real PM scenarios (Krathwohl 2002).

Characteristics of MPM Student Cohort

The students come from a diverse range of industries bringing with them extensive professional experience and skills in a specific area. PM at the post graduate level attracts students with an existing professional undergraduate qualification, including, but not limited to, construction, health, defense, facilities management, resources, humanitarian or event management. PM also attracts students who have extensive PM experience but who have no formal qualifications in the area and are now seeking to gain their credentials through online learning. This makes it difficult to engage both spectrums of students without patronizing either group. There is a greater diversity in the online student body of today than ever before with universal access to the internet and the development of on-line material. This diversity includes when work is done (Fly in Fly out; shift work, open business hours etc.), the location of that work and the time zone occupied. Of the 2015 UniSA MPM program student cohort, only 5% were from overseas; the remaining students were from different states of Australia. A large proportion of the students worked remotely or overseas. This means different time zones as well as different work schedules, different band widths and internet access. Asynchronous online learning offers a unique environment in which students differing learning styles need to be considered and managed (Clark 2012) and any learning tools used for synchronistic learning cannot be used, so learning tools need to meet the needs of asynchronous learning.

Pedagogy for MPM Students

The group of students targeted for this redevelopment of online MPM courses are typically over 40, therefore falling clearly into the category of adult learners and 'non-traditional' (Park & Choi 2009; Milman 2016). It is this demographic that the post- graduate studies attract as indicated in the Figure 2.

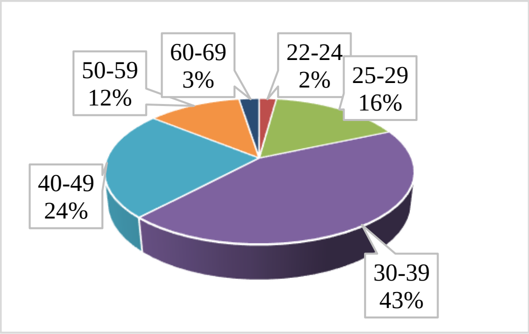

Figure 2: MPM Enrolment data 2015

Knowles (1980) developed the term 'Andragogy' to identify adult education and pedagogy. Providing direction on how to teach adults effectively, Knowles (1984) suggested the following:

- Adults are most interested in learning subjects that have immediate relevance and impact to their job or personal life
- Adult learning is problem centered, rather than content orientated
- There is a need to explain the reasons specific things are being taught (e.g. certain commands, functions, operations)
- Instruction should not be about memorization but instead task-oriented. Learning activities ought to be in the context of common tasks to be performed by the others.
- Instruction should take into account the different backgrounds of learners. Learning materials and activities should allow for different types/levels of previous experience with computers.
- Since adults are self-directed, they obtain knowledge without depending on people thus instruction should allow learners to discover things. Adult learners should be provided guidance and additional help when mistakes are made.

To these adult learning premises, the team undertaking the curriculum redevelopment drew on the following learning theories:

- *Constructivist learning* theory, which places the learner as an active agent in the construction of their own learning/knowledge (Kelly, 2012; SACSA, 2001). Learning is seen as an active process, so students need learning activities that ask them to apply the theory/concepts/knowledge, that encourage problem solving, exploration, the use of higher order thinking skills, as well as structures/ opportunities to develop reflection/ awareness of their own learning/progress (Atherton,2013). In addition, cooperative learning, problem-based learning and the use of case methods and simulations are approaches that promote active learning (Reidsema & Kavanagh, 2014).
- Neuroscience learning theories, which encompass, cognitive science and psychology have provided insights into how the brain works. These learning principles and strategies provide educators with the knowledge and skills to engage and motivate students and assist in their learning and retention (Hendel-Giller et al. 2010).

Application to our Case Study

The developers therefore wanted to develop new technological approaches, learning materials and activities related to the learners' interests and experiences including the use of visuals, stories, novelty and humour, with a view to creating the emotional pull that Hendel-Giller (2001) identify as an effective strategy to engage the learner with the content. *O'Connell asserts that the 'digital information environment demands a new knowledge flow between content and digital connections … (and) educators (need) to understand information seeking and engagement within connected multimedia contexts' (O'Connell 2014, p202).* Our approach to curriculum design also acknowledged that our students are from industry in technical and operational areas, learn best through applied learning and are resistant to heavily text-based learning methods and academic research.

Student engagement is a focus for educators as there is a well-documented association with deep learning and educational outcomes. Each course presents its own challenges and issues but it is hoped that the course design we have adopted across the program in our redevelopment with will meet the diversity of the MPM student cohort, their technological learning needs and skills of the range of generations, while the asynchronous delivery and flexible timetables will result in greater student engagement and academic outcomes as identified by Billings (2005); Northey (2015); Garrison (2003) and Khalil and Ebner (2013). The 'organizational support' seen by Park and Choi (2009) and Merrill (2003) as a significant factor in the retention of their mature online learners' is provided in each course with clear learning Objectives and Competencies; relevant assessment; comprehensive material using videos tutorials, slides; frequent learner interaction formally and informally via weekly Discussion Forums promoting a sense of student community; sophisticated learning management systems, the Learnonline system which can be accessed by the student as required and ebooks which allow for regular updates and posting of new links and provide structure to the learning experience and the students' digital interaction (Gaumer et al. 2010). These elements have been designed and included in order to provide effective learner support and address what Dietz-Uhler (2007) identified earlier as essential for a quality, interactive and engaging online course.

The MPM courses are being transformed by extending the suite of tools that currently support teaching and learning at UniSA in learnonline in the existing MPM courses with the aim of increasing students' motivation. In addition, new digital learning resources and material, other interactive tools and techniques (Ispring, Videoscribe, Articulate Storyline, interactive surveys etc), are being used to develop to present contemporary project events and situations, through the development of scenario case studies and demonstrations, often using 'gamification' elements. This is a process of continual improvement, with new digital resources being developed as the curriculum transformation process continues. New tools are constantly being created, old interviews will be superseded, and topics of interest will change as we keep up to date with the academic developments in the area. The process of enhancing digital material requires a collaborate approach. The course coordinators as subject experts are vital in ensuring the courses are relevant meet the level of the academic quality required, but they also have to radically alter their skill mix and practice. This has required them to adapt to the new formats and approaches, and they have s willingly committed their time to work with educationalists and a range technical people to develop these digital learning tools and develop their teaching skills for their delivery.

1. ***Structured and visually appealing format with a consistent structure across all subjects including: Course overview and introduction; Clear learning Objectives and Competencies***
   The first step of the digital transformation was to enhance the appearance and professionalism of the course websites. There were several stages of this process. Firstly, we employed a graphic designer and educational designer to develop a visually appealing and professional appearance for the course. This template was developed across all courses and was varied slightly to signify that a course was at what level in the program: Graduate Certificate, Graduate Diploma or Masters. Not only was this template better structured, more visually appealing and engaging, it also enabled students to become familiar with the program structure, so that as they moved from one course to the next there was less uncertainty and confusion. The second stage involved working with course coordinators on developing appropriate academic objectives for each week to ensure that there was appropriate scaffolding of the learning throughout the course and that the appropriate level of learning was achieved as per the AQF. Short 5 minute video clips were developed for each week to inform the students of the learning outcomes and activities for the week. This also enabled students to put a face to their lecturer, thus making the course less impersonal.

2. ***Scenario Video Case Study and Discussion***
   It was decided to develop a new digital learning resource for this important foundation course in the Master's degree, 'Principles of Project Management'. This consisted of a 13 episode case study comprising a series of videos, along with supportive learning materials, based on the relocation of a fictitious zoo (Mawson Zoo). This course provided a learning environment where the project could evolve over each video episode, demonstrating the application of PM methodology with reference to the PMBOK Manual, which was then tied into the learning outcomes for the course and the assessment tasks. Accompanying each episode is a set of discussion questions based around the scenario and exemplifying the material covered for that session. To support the episodes, forum questions and authentic learning materials have been developed so that the student can interpret and apply their learning. These materials include: scoping documents, standardised PM templates, and a strategic plan. Online discussion forums provide a way for students to converse and demonstrate their own understanding of content and how PM methodology can be applied. A key element of the development of these learning resources, was the involvement of a diverse team of academic, professional and technical staff who each provided important contributions to the project's success. These included academic staff with content expertise, professional staff with teaching and learning pedagogy expertise, technical staff with extensive video production experience and a team of volunteers that comprised academics, adjunct staff, PhD students and researchers. The project was exceptionally collaborative and generated significant "buy in".

3. ***Interviews with Industry Experts***
   The intention here was to provide relevant examples and topical issues that would create interest and assist learning. A number of video interviews were developed; including those of experienced project manages on different topics such as: executives making explanations of their decision making and leadership style, project managers on project sites explaining work experience and recent graduate reflections. Most of these were short vinaigrettes with students being asked to either reflect on some aspect of the video as it related to their course work, or respond to a question. These provide contemporary examples of what is happening in industry and why the course material is relevant to their future as project managers.

4. ***Demonstrations with Gamification Elements***
The UK Association for Project Managers (APM, 2014) describes gamification as, "…*the use of game design element, game thinking and game mechanics to enhance non-game contexts*" (APM 2014, p 9). Davis (2014) describes it as "*applying typical elements of game playing (e.g., point scoring, competition with others, rules of play) to other areas of activity*, to engage and motivate learners to help them achieve their goals. Research undertaken by eLearninginfographics.com (2014) identified the most effective uses of gamification in Learning as: illustrating progress; increasing engagement; creating challenges and instilling a sense of accomplishment. Games have the capacity to be a learning strategy which enact experiential, constructivist and social learning theories, as well as supporting what we know about learning from neuroscience, especially creating engagement and heightened emotion (APM, 2014; Pandey 2015). They use the same mechanics that bring out people's natural desires for competition, achievement, status, self-expression, altruism and closure when faced with a real-life situation in the form of a game (wired.com, 2014). Games provide opportunities for experiential learning and Pandey (2015) believes gamification aids learning and retention through repetition of content, engagement and the opportunity to learn the content and skills required for the job within a safe environment through real-life situations and challenge. However, the UK APM Guide suggests that when designing the use of gamification in an educational course, that consideration is needed as to which elements are transferable and appropriate.

The second course in the foundation level of the MPM, is 'Project Control Methods'. Online game development can be very expensive, so due to funding availability and the skill level of the course developers, we chose to incorporate gamification elements into the demonstration of the key concept of "The Critical Path Method', a topic within this course, rather than develop a full on game. The existing set of PowerPoint slides were transformed into an interactive learning demonstration using Articulate Storyline software and elements of gamification, with the 'commentary' as a voice over. The developer opted for Pandey's Approach 2 (2015) as we integrated game mechanics into the content of the demonstration session with students being required to undertake in-session activities using 'drop and drag' technology to solve the problems and discover how to construct a Critical Path for a project and accompanying timeframes. It was hoped that these gamification elements would encourage students to continue through the content because it motivated them (Pandey, 2015). This learning was then applied to a real-life project and problem (relevance), the building of a velodrome, thus meeting the needs of both PM students and adult learners (Knowles 1984) and is an application of constructivist learning theory (Kelly, 2012; SACSA 2001). The course was delivered for the first time in the current Study Period, so evaluation data is limited at this present time. Plans are also underway to develop further serious game activities.

5. ***YouTube clips and other online examples***
In addition, access to publically available videos/demonstrations/simulations were sourced from either the WWW or via commercial academic sources. Speeches by leading thinkers in their field such as Michael Porter, or topical cases that appeared in the media, such as News Reports Census 2016 (in Project Risk management) were added appropriately to provide contemporary and topical interest. These resources were added to all courses to create interest and again to demonstrate application of course content to the 'real world'.

6. ***Quiz***
Quizzes are often used to test student understanding of content, and if used extensively, are appropriate to also assess understanding of specific content and skills, thereby providing information to the course coordinator of how effective the course is. In this post graduate course quizzes were used more as a tool of revision or as a mechanism to reinforce key learning. They also created some variation and interest to the course.

7. ***Open Discussions Forums***
Mature aged students like to give their opinions, this was encouraged in all courses. In true academic fashion, these courses sought to make students substantiate their opinions and validate their interpretations with references and supporting documents via the discussion forums. The forums in our courses were often based on topical questions or examples of contemporary issues in the field of PM that created conflict and argument, and lead students to make their comments based on the literature/ readings within their topic/course. This resulted in large amounts of forum postings from the students and quality discussions which had previously been missing from these courses.

8. ***Weekly/topic Ebooks / s***
Electronic books were developed to provide a student study guide, as well as to provide the boundary for learning for each week. These books were well presented and desktop published and were available for printing. In addition, notes linking to topical and interesting sites were provided to demonstrate contemporary issues and provide a context for the weekly content.

9. ***Supporting Systems: Library and On Line help***
As many of these adult students have entered this program after a long gap working in industry or have minimal formal academic skills, the support services provided by the university have proved critical to student success. Writing skill support was particularly relevant to student s who has not undertaken tertiary study before, for those from technical backgrounds. The course websites were designed to connect to the university support systems for students, with resources and courses to assist students in learning to undertake academic writing, referencing, IT help or their wellbeing. These online services are being used extensively in the initial stages of the students' academic career.

Evaluation

Evaluation of the success can be measures in a number of ways. Data on rates of retention and the number of students who decide to continue their studies to a higher award are still being collected but initial findings indicate that both of these are moving in the right direction. Typically, in 10% more students to withdraw this rate appears to be dropping to less than 5% and lectures report better student engagement. It is difficult to assess the success of the application of the new digital learning tools and strategies via student response to surveys as student opinions of the course is influenced by a large number of things including their interaction with the lecturer and other factors relating to the student themselves (e.g. their abilities, time pressures, expectations). However, the following question was asked of students in the university student evaluation survey MyCourseExperience '*Overall, I was satisfied with the quality of this course'* which provided the following:

Table 1: MyCourseExperience Ratings

Course	Mean Value Before	Mean Value After	Typical Comments
MPM 418	-8.33	62.5	This unit was awesome.... Weekly lecture information, particularly links to TED talks, were very useful for me. Very interesting topics and utilised current world events Overall the intensity in which the content was delivery. It was fast paced, the workload was intense and kept you highly engaged at all times. This was a course that was well researched and delivered.
MPM 417	28.12	50	Variety of course material - videos etc. Lots of good notes and scope to make assessment submissions own. I think this course has been excellent in my development as I was able to relate it to real life situations and to the behaviours of management at the workplace.
MPM 411	48.33	63.64%	The course structure was designed well and intuitive. I found the weekly tasks challenging and useful.
MPM 414	7.14	33.33	Fantastic variety of questions with emphasis on demonstrating ability to apply the theory, not necessarily regurgitating the theory itself. Variety of content (videos, reading, application) available Very good, good solid learning material.
MPM 413	48.15	73.08	Well-presented and excellent content. I totally enjoyed the course. The content clearly reflected the required outcomes and deliverables of the course. The tools and techniques will be very helpful in the future and I look forward to implementing the learned processes into future projects.

Qualitative comments by students have also provided some good insight into the success of the transformation. The 'Scenario Video Case Study and Discussion', was introduced in 2016. The success can be assessed via improvements in the now familiar comments of student statements in MyCourseExperience such as:

- 'The Principles' subject with the Mawson Zoo videos is a fantastic introductory subject. The forum exercises were practical and helped to contextualise the coursework in a project context that was very relatable. The effort put into this production was well worth it.
- The Mawson Zoo videos were fantastic. The forum questions were relevant and practical and assisted with learning.
- Using the "Zoo" as a live example with the video clips made the course very real. I thought the actors were brilliant. Stepping through the various stages of the project and working through exercises as we went helped to consolidate the concepts
- I really enjoyed this course and I thought that the format of online delivery was really effective and made it so flexible and easy to learn at my own pace and timetable. I thought that the weekly activities were really good, but I would have preferred if they weren't all assessable every week.
- The weekly film clips were very, very helpful, very professional and helped an enormous amount to put the weekly readings into context.

- I believe the weekly units covering a project from a real world perspective were of great assistance when comparing them to my own experiences professionally. It made it simple to relate the process to my current role.
- The weekly video scenarios helped very much to provide context to what would otherwise have been very academic material.

Further evaluation is continuing in successive deliveries of the course and plans are being developed to extend these foundation course digital learning resources to subsequent courses in the program.

Conclusion

The course developers firmly believe that the use of online technology cannot ensure that effective and appropriate learning outcomes are achieved and that the students engaged as a *community of learners.* Rather, the use of the technology needs to meet the needs of the students in terms of their forthcoming professional needs, their profile as learners, their accessibility to the technology/internet, rather than the technological tool being the determinant of use. In our attempt to design quality courses these we followed Waugh's (2011) 'principles of instruction' and incorporated many of the elements Dietz-Uhler (2007) determined as essential for a *quality digitally enriched*, interactive and engaging online course, thereby supporting Kirkwood's (2005) belief that educational purposes and pedagogy, not technologies, must guide the students' understanding (Kirkwood 2005). These redeveloped courses make '*relevance*' and '*application*' key features of the online learning activities and assessment tasks, with the focus on experimental learning through the integration of actual practice into courses, thus improving existing MPM courses, as suggested by Berggren (2008), encouraging learner motivation and hopefully reducing their dropping out (Park & Choi, 2009; UNSW 2015) and meeting the standards of Level 8 and 9 AQF courses of study. The students enrolled in this MPM program are mature-aged, problem-based learners, professionals who are time poor due to work and family commitments and require learning to be asynchronistic, thought-provoking and relevant. The application of *digital tools and software* can work well with this unique group as recent developments in digital technology impact on the work and personal lives of students today. We will continue to focus on what suits our students, their learning needs and the industry and best practice (Billings 2005), as we redevelop the remaining suite of courses within the MPM program of study. As our own knowledge, skills, confidence and professional competencies with digital technology grow, so too will the range of digital learning strategies we may consider and use in our courses, in order to meet the needs of our learners and the curriculum within program.

References

Anderson, B., Lee, S., Simpson, M., & Stein, S. (2011). Study orchestrations in distance learning: Identifying dissonance and its implications for distance educators. *The International Review of Research In Open And Distance Learning*, 12(5), 1-17. http://www.irrodl.org/index.php/irrodl/article/view/977/1854

Association for Project Management (UK) *Introduction to Gamification.* (2014) https://www.apm.org.uk/emerging-trends

Atherton, J. S. (2013). Learning and Teaching; Constructivism in learning. http://www.learningandteaching.info/learning/constructivism.htm

Australian Qualifications Framework Implementation Strategy for Coursework Programs Approved by Academic Board September (2012) University of South Australia Approved by Academic board September 2012 http://w3.unisa.edu.au/teachinglearning/AQF/AQF_Implementation_Plan.pdf downloaded 15/07/2016.

Berggren, C & Söderlund, J (2008), 'Rethinking project management education: Social twists and knowledge co-production', International Journal of Project Management, vol. 26, no. 3, 286-296.

Bean, J. P., & Metzner, B. S. (1985). A conceptual model of nontraditional undergraduate student attrition. Review of educational Research, 55(4), 485-540.

Billings, Diane M., Diane J. Skiba, and Helen R. Connors. (2005) "Best practices in web-based courses: Generational differences across undergraduate and graduate nursing students." *Journal of Professional Nursing* 21.2: 126-133.

Dietz-Uhler, Beth, Amy Fisher, and Andrea Han. (2007) "Designing online courses to promote student retention." *Journal of Educational Technology Systems* 36.1: 105-112.

Clark, Caitlin Corinne, (2012), "Student Growth in Asynchronous Online Environments: Learning Styles and Cognitive Development." Journal of the Indiana University Student Personnel Association pp. 37-46.

Davis, V. A (2014) Guide to Game-Based Learning, http://www.edutopia.org/blog/guide-to-game-based-learning-vicki-davis October 13, 2014 (viewed 17/12/14)

Dawson, S (2015), "Discussion paper: Developing UniSA's Digital Learning Strategy" accessed 20/7/16 www.**unisa**.edu.au/PageFiles/171878/Backgroundpaper-DevelopingUniSA'sDigitalLearningStrategy.pdf

Elearninginfographics.com (2014).*30 Facts about Gamification in eLearning Infographic* http://elearninginfographics.com/gamification-in-elearning-infographic, Posted July 30, viewed 4/12/15

Elearningindustry.com, http://elearningindustry.com/gamification-game-based-learning-two-different-things , viewed 18/1/16
Garrison, D. Randy. (2003) "Cognitive presence for effective asynchronous online learning: The role of reflective inquiry, self-direction and metacognition." Elements of quality online education: Practice and direction 4:47-58
Gaumer, EA & Noonan, P (2010), 'Late-Career Adults in Online Education: A Rewarding Experience for Individuals Aged 50 to 65', *Journal of Online Learning and Teaching*, vol. 6, no. 2, pp. 388
Hendel-Giller, R, Hollenback, C, Marshall, D, Oughton, K, Pickthorn, T, Schilling, M & Versiglia, G (2010), *The Neuroscience of Learning: A New Paradigm for Corporate Education*, viewed 30 November 2015, http://www.themaritzinstitute.com/Perspectives/~/media/Files/MaritzInstitute/White-Papers/The-Neuroscience-of-Learning-The-Maritz-Institute.pdf
Kearsley, G. (2010) Andragogy (M.Knowles). 1984 The theory into practice database. Retrieved from http://tip.psychology.org
Kearsley, G. 2010. Andragogy (M.Knowles). 1984 The theory Into practice database. Retrieved from http://tip.psychology.org
Kelly, C. (2012). Constructivism. http://www.slideshare.net/ckellly/constructivism-powerpoint
Khalil, H., & Ebner, M. (2014). MOOCs completion rates and possible methods to improve retention-A literature review. In World Conference on Educational Multimedia, Hypermedia and Telecommunications (No. 1, pp. 1305-1313).
Kirkwood, A., Price, (2005) Learners and learning in the twenty-first century: What do we know about students' attitudes towards and experiences of information and communication technologies that will help us design courses? Studies in higher Education 138
Knowles, MS (1980), The modern practice of adult education : from pedagogy to andragogy, Rev. and Updated.., Association Press ; Follett Pub. Co, [Wilton, Conn]: Chicago.
Knowles, M. (1984). The Adult Learner: A Neglected Species (3rd Ed.). Houston, TX: Gulf Publishing.
Krathwohl, David R. (2002), "A revision of Bloom's taxonomy: An overview". Theory Into Practice (Routledge) 41 (4): 212–218.
Laufer, A, Hoffman, EJ, Russell, JS & Cameron, WS, (2015), 'What successful project managers do', Engineering Management Review, IEEE, vol. 43, no. 2, 77-84.
Lee, Y, Choi, J & Kim, T . (2013). Discriminating factors between completers of and dropouts from online learning courses. British Journal of Educational Technology, 44 (2), 328-337
Merriam, S. B. (2001). *Andragogy and self-directed learning: Pillars of adult learning theory*. New Directions for Adult & Continuing Education, v. 89, 3-14.
Merrill, Henry S. (2003) 'Best Practices for Online Facilitation, *Adult Learning*, March 20, 2003, vol. 14, 2: pp.13 (http://online.sagepub.com/search/results?submit=yes&src=hw&andorexactfulltext=and&fulltext=Merrill+Best+Practices+for+Online+Learners&x=0&y=0 viewed 20/7/160
Milman, N (2016), '*Resources and Factors to Consider When Designing New Online Programs*', Distance Learning, vol. 13, no. 145-48.
Moulton, D, ,Corcoran, P, James, P & Rathore, P (2016) 'Chapter 47: A Community of Practice for Blended Science and Engineering Learning at University of South Australia' in forthcoming 'Communities of Practice - Facilitating Social Learning in Higher Education' (e-Springer, forthcoming publication)
Northey, G, Bucic, T, Chylinski, M & Govind, R (2015), '*Increasing Student Engagement Using Asynchronous Learning*', Journal of Marketing Education, SAGE 1-10, 0273475315589814.
O'Connell, J. (2014). *A multidisciplinary focus on 21st century digital learning environments: new program at CSU*. In B. Hegarty, J. McDonald, & S.-K. Loke (Eds.), (2014), Rhetoric and Reality: Critical perspectives on educational technology. Proceedings ascilite Dunedin 201-210.
Park, J & Wentling, T (2007), '*Factors associated with transfer of training in workplace e-learning*', *Journal of Workplace Learning*, vol. 19, no. 5, 311-329.
Park, J. H., & Choi, H. J. (2009). *Factors Influencing Adult Learners' Decision to Drop Out or Persist in Online Learning*. Educational Technology & Society, 12(4), 207-217.
Pandy, A. 'Gamification For Serious Learning: 5 Facts That Will Impress Your Boss' 2 December 2015 http://elearningindustry.com/gamification-for-serious-learning-5-facts-will-impress-boss, viewed 18/1/16
Prensky Marc, On the Horizon (2001), MCB University Press, Vol. 9 No. 5, October
Phipps, R., & Merisotis, J. (1999). *What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education*. Washington, DC: Institute for Higher Education Policy. Retrieved 18/09/16, from http://www.ihep.com/Pubs/ PDF/Difference.pdf.
Rovai, A. P. (2003). *In search of higher persistence rates in distance education online programs*. Internet and Higher Education, 6, 1–16.
Reidsema, C and Kavanagh, D. http://www.uq.edu.au/tediteach/flipped-classroom/active-learning.html viewed 2/7/16
University of Michigan 'Active Learning', http://www.crlt.umich.edu/tstrategies/tsal
Schwiebert, R.L. (2008), *The impact of a community-building component on student performance, learning depth, and student satisfaction in online courses*, Western Carolina University.

Simpson, M. (2008). *Attempting to realise the potential of blended learning: An initial teacher education case study*. In Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008. http://www.ascilite.org.au/conferences/melbourne08/procs/simpson.pdf.
South Australian Curriculum Standards and Accountability (SACSA), (2001). Learners and Learning, Department of Education, Training and Employment, South Australia. http://www.sacsa.sa.edu.au/index_fsrc.asp?t=LL.
Stafford, G. (2011). *The unexpected transformations of Chinese international students in Australia* (Doctoral dissertation). University of Adelaide, Adelaide, South Australia, Australia.
Thomas, J & Mengel, T 2008, '*Preparing project managers to deal with complexity – Advanced project management education*', International Journal of Project Management, vol. 26, no. 3, 304-315.
Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago, IL: University of Chicago Press.
University of New South Wales (2015), '*Guidelines on Learning that that Inform Teaching*', viewed 25 November 2015, http://www.guidelinesonlearning.com/guideline-six
University of South Australia, Horizon 2020 (2010). http://www.unisa.edu.au/About-UniSA/Strategic-action-plan-2013-2018/Horizon-2020.
University of South Australia (2014) '*Crossing the Horizon Our Strategic Action Plan 2013-2018*' http://www.unisa.edu.au/pagefiles/64561/strategic-plan.pdf
University of South Australia (2015), *Digital Learning Strategy 2015-2020*, viewed 30 November 2015, http://unisa.edu.au/digitallearning
Waugh, M., & Su, J. (2011). *A comparison of successful and unsuccessful online students: Implications for reducing student attrition*. In Proceedings of the 34th annual meeting of the Association for Educational Communications and Technology 247-255.
Wired.com. *Winning the talent game: how gamification is impacting on business and HR* http://www.wired.com/insights/2014/01/winning-talent-game-gamification-impacting-business-hr/ (viewed 4/12/15)
Xu, D., & Jaggars, S. S. (2013). Adaptability to Online Learning: Differences across Types of Students and Academic Subject Areas. CCRC Working Paper No. 54. Community College Research Center, Columbia University.

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Using digital tools in WIL to enable student journalists' real world learning

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This paper explores how student journalists' adoption of digital technology, during real world work-integrated learning (WIL) reporting projects, enabled authentic learning. Student journalists at a regional Queensland university interviewed the candidates for each of the four-yearly local government area elections, from 2008 to 2016, in Australia's second largest inland city and its surrounds. They published their multimedia stories on the *Radio Journalism Online* blog. This study considers the importance, when framing WIL projects for student journalists, of embracing the traditional and new technical skills and digital literacies that graduates will need to be job ready for multimedia newsrooms. It also considers the impact of recording and telling stories in the talents' or actors' own words on the students' perceptions of the accuracy and reliability of their election reports.

Keywords: digital technology; multimedia; journalism education; work-integrated learning

Introduction

Local government is a vital source of information for Australia's news media, particularly in regional areas. More than 570 local councils serve a diverse range of communities and spend about $32 billion each year to provide a broad range of infrastructure, economic and community services to residents (ALGA, 2016). A local council news round can be a stepping stone to becoming a state or federal political reporter (Lamble, 2013). For inexperienced journalists, however, reporting on local government can be a daunting task. Ideally, university undergraduate and postgraduate program courses on council reporting would be aimed at equipping student journalists with the knowledge and skills required for best practice in the digital age. They should include information on the procedures and protocols of the level of government that is closest to the people because most council news stories centre on direct reporting of the debates and decisions that happen during council meetings, or on issues that affect ratepayers (Sissons, 2006).

Student journalists preparing to enter the highly contested, tight job market in Australia (Christensen, 2012) need a competitive edge and the knowledge and skills to enable "a smooth transition from university into the world of work" (Wolfe, 2014, p. 38). Requisite core skills include research, writing, grammar, technical competency in digital and social media and video, communication and teamwork skills (Cullen, 2015) and, increasingly, experiential learning (Wolfe, 2014). Clearly, there is an onus on academic institutions to help students to make the transition. However, few case studies exist that illustrate innovative ways to insert student media experiences into the journalism curriculum (Royal, 2015). A perceived need to support students' development of the skills associated with entry-level journalists in the contemporary digital environment drove the work-integrated learning (WIL) projects that are the focus of this study. The four-yearly Queensland local government elections, in particular the Toowoomba Regional Council (TRC) polls, provided the chance for student journalists from the University of Southern Queensland (USQ) to cover this facet of local democracy – and, thus, practise digital newsgathering and multimedia reporting and writing skills outside the classroom.

Literature review

Since the mid-1990s, studies in the United States have explored issues surrounding media industry changes and their impact on tertiary journalism education. In Australia, research into convergent journalism curricula has looked at the implementation of skills in blogging and podcasting, as well as the introduction of convergent concepts in a newsroom setting (Cullen et al., 2014). There is broad agreement that convergent skills in the curriculum should be "pegged to industry demands and adopted without compromising basic journalism competencies" (2014, p. 3). Royal (2015, p. 22) has noted how web and social media tools provide a "larger news hole" for more extensive coverage of events. Hyperlinks designate which sources should be given public attention and to what degree – a function "that maps onto journalistic values well" because "links can help reinforce a report's facticity by connecting readers directly with sources and showing readers how journalists know what they know” (Coddington, 2014, p. 141). Blogs offer efficient and cost-effective ways to engage students, allow them to publish their work and provide a permanent archive of their activities (Royal, 2015). Both the news media and local government are “central to a healthy democracy, but the relationship is not always an easy one” (Waller & Hess, 2014, p. 246). The news media, as part of its celebrated fourth estate function, is said to play an important watchdog role in keeping local government accountable. At the same time, shrinking newsrooms and changed commercial imperatives pose a threat to local democracy because local politicians are not being held to account; voters are not being given a range of views; and voters are deprived of information they require to make judgments when voting in elections (Ramsay & Moore, 2016). While the local newspaper remains the main source of council election news and information, a substantial number of voters have shown they are willing to bypass the local mainstream media (Jones & Feldman, 2006). Their preferred, alternative sources of political information include the Internet. Voters who perceive bias in council election coverage said that the local news media fails to provide enough information to allow them to make informed choices (Jones, 2011). The same voters said the local news media has no influence on their vote. The perceived lack of diversity of news and views available to voters was another catalyst for the successive TRC local council election reporting projects that I designed and developed as WIL opportunities for my student journalists.

The idea that people learn by doing is more than 2000 years old and is embodied in this proverb attributed to the Confucian philosopher, Xunzi: “I hear and I forget; I see and I remember; I do and I understand” (Newton, 2013). Much later, the American philosopher John Dewey argued that the only adequate training for occupations was by engaging in the occupations themselves (Forde & Meadows, 2011). He said: “Nothing takes root in the mind when there is no balance between doing and receiving” (Furlan, 2007, p. 124). As the demand for graduates to be work-ready has grown in recent years, WIL has proliferated in Australian universities. The integration of work and tertiary study is seen as a means of improving work readiness (McNamara et al., 2011). Increasing numbers of students are being “placed in ‘real world’ workplace situations for credit towards their degrees” (Stewart et al., 2010, p. 60). WIL is not simply work experience, however, although it can include this as an element. Billett (2008, cited in Stewart et al., 2010, p. 60) said WIL is a much more structured consideration of the “relational interdependence between the affordance of the workplace and the engagement of workers”, placing an emphasis on the processes involved in learning in a workplace setting and enhancing opportunities for them to occur. Forde and Meadows (2010) wrote that early research on journalism students’ experiences of WIL suggests that they learn as much about themselves as they do about the media industry in which they undertake an internship or placement. The same writers have also identified the importance of maintaining an active relationship between stakeholders – producers (that is, the student journalists), media industries and education institutions – in terms of curriculum design and students’ personal development (Forde & Meadows, 2010; Stewart et al., 2010).

The TRC projects undertaken from 2008 to 2016 aimed to model professional, quality journalism in coverage of the local government news round, specifically the council elections; to provide opportunities for WIL; and to generate authentic learning outcomes for the students, such as portfolios of published cross-platform work, produced by technology-savvy personnel and valued by employers (Jones, 2005; Furlan, 2007). Elements of these projects resonate with features of best-practice WIL scenarios (McIlveen et al., 2008). They include:

- Linking theory and practice, underpinned with appropriate professional knowledge and reflective practice
- Providing identifiable learning in a work environment, which enhances on-campus programs and courses, and which can be assessed
- The objectives of such placements meeting the needs of students, university courses and the workplace
- Skills that may be discipline specific and/or globally transferable, and that are relevant to lifelong learning requirements, such as critical thinking, written and oral communication, teamwork, problem-solving, managing and organising.

The method employed by these projects is case study. I have assessed the projects with the following questions:

- What were the student journalists’ impressions of their real-world learning?
- To what extent did the student journalists feel prepared for work in a contemporary digital environment?

The TRC projects, 2008 to 2016

Since 2008, on-campus student journalists in the undergraduate Bachelor of Mass Communication, Bachelor of Communication or Bachelor of Arts at USQ, in Toowoomba, have come together to report on the candidates running in the TRC elections. More than 20 students have now reported for these projects. In 2008 and 2012, all of the students were enrolled in *Radio Journalism*, and so had working knowledge of digital audio recorders and "Audacity" editing software. The course offerings originally coincided with the Queensland local government elections in March. In 2016, *Radio Journalism* had moved to second semester, and the team's make-up was quite different. It comprised first and second year students yet to study *Radio Journalism*, and three, third year students who had completed the course. As a result, "Team 2016" contained several student reporters with little expertise in print and none in radio or audio journalism.

A fortnight before our publication deadline, I held a series of intensive workshops to cater for these disparate backgrounds and to ensure that all students achieved a minimum standard of expertise (Furlan, 2007). The students were immersed in the techniques of online research using social networking sites (Facebook), broadcast interviewing and digital audio recording, both in the field and over the telephone, as well as digital audio editing, broadcast reporting and writing conventions and story structure. They were given examples of scripts from previous online stories. To help the student journalists to achieve professional competence, they experienced the process of election news production and publication through simulated news desks (Hodgson & Wong, 2011). A WordPress blog was selected to "promote interactions between peers, echoing authentic newsroom experiences where students complete tasks while receiving meaningful feedback on their actions" (2011, p. 198). As a result, they could reflect on and adapt their actions accordingly. This is a useful tool for teaching students about audio and online journalism. News stories posted by subscribing authors can be published instantly, in reverse chronological order, and with easy navigation and audio replay capability for the target audience. Some of the students had already completed a second-year print reporting course about the local government round, but none of the team had previously covered an election. I briefed them on the 2016 project's antecedents, with their beginnings in my "Local media, local democracy" research projects that interrogated voters' sources of election information (Jones & Feldman, 2006) and candidates' use of media in election campaigns (Jones, 2011). To help the students develop subject expertise in the processes of a local government election, and because "it helps to know something about the news you're reporting" (Newton, 2013, p. 1), I utilised resources from my course on specialty reporting. I described the purpose of rounds coverage and elections reporting, stressing the need for voters to have access to a variety of information about the candidates and their policies. These meetings also helped to frame the rules for the day-to-day running of the project.

Another feature that sets "Team 2016" apart from previous years was the participation of industry, on two different levels: first, in the production of the stories for publication online on our blog site; and second, in the dissemination of those stories on an additional platform – their broadcast in prime time on a top rating, local commercial radio station. With three levels of experience in the eight-person reporting team, the "seasoned" third years, or senior student reporters, were on hand to mentor their less experienced colleagues. In addition, I engaged two industry professionals, echoing Newton's (2013) concept of a clinic in the "teaching hospital" model for journalism education where students gain practical experience as an integral part of their education, and students, teachers and professionals work together for the benefit of the community. This also replicates the realistic conditions of a working newsroom (Furlan 2007): one professional oversaw the student reporters and the assignment of interviewees (the role of Chief of Staff or CoS), and the second professional (the technical producer) ensured quality control of the audio recordings and online content. The CoS was a former ABC journalist who, coincidentally, was one of the original student journalists on the 2008 project. A USQ Media Services producer ran the audio recording and editing workshops and managed all technical production.

We set up our newsroom in the USQ journalism laboratory and the adjacent radio studio. Our first full "Team 2016" editorial meeting started with a reminder to the student journalists of the media's role in "initiating conversations about civic affairs among publics" (Waller & Hess, 2014, p. 246). The team refined the focus of its election coverage and, led by the CoS, the reporters decided to ask each candidate the same key questions. They settled on issues and topics of interest to young, first-time voters and to the broader community. The CoS and I assigned the candidates to the reporters who then began their research, and arranged interview times and locations. In the newsroom, as interviews were completed, grabs selected and stories written, submitted and subbed, the running log on the whiteboard showed our progress towards deadline. Just two weeks after the students received their reporting assignments, we went live on *Radio Journalism Online* with their stories about the mayoral and councillor candidates. In the next fortnight, every story was also broadcast on Toowoomba's leading commercial radio station, 4GR. By election eve, the blog had more than 11,200 views and an industry survey showed a listening audience of 60,000 for the students' interviews (G. Healy, 4GR, pers. comm., 2016).

Digital technologies: Their contribution to students' learning

The students' work was not evaluated. These WIL projects were not housed within a formal course in the USQ undergraduate journalism major and, thus, were not treated as items of assessment. The students did reflect on their experiences, however, in personal communication to me and in post-project interviews and published journalistic writing. Their impressions confirm my belief, and that of writers such as Tanner, Green and Burns (2012, p. 123), that journalism education is "best taught in a hands-on environment". The students recognised that using digital technology allowed them to undertake various phases of online research, writing and publication, from producing contextual reporting via the technological affordance of hyperlinking, to publishing audio (with professional oversight and to high industry standards) and self-promoting their work on social media. "Not sure who to vote for in the Toowoomba Regional Council election on March 19? Find a brief overview of each candidate here," said one student's Facebook post. The impact on the students' practice and their perceptions of job readiness is summarised in these comments:

> I pretty much had no knowledge of digital editing or digital recording devices when I started this project. My competency went from 0 to 6 or 7, so now I am basically familiar with those types of technologies and I have a starting point to learn about new software. If you look at journalism job descriptions, for a lot of them the applicants have to be comfortable using software, social media and online tools. You have to be able to use the new technology or you just get left behind.

> To have the experience of using the digital technology, a purpose for using the software, putting it all together for an outcome, and to receive feedback from professionals in the field – you can see what they are doing, take that in and apply it next time you are in a similar situation. Working on the election project gave us real experience to conduct interviews, use audio recording technology and work as a team toward a deadline ... You learn more from experience than you can in a classroom.

> The project was a crash-course in real-world neutrality in doing journalism. There was conscious knowledge of the listener who wants facts with no bias or spin while I was recording interviews and putting together the final product. Because the audio needed to be of a professional standard, through the project I learnt more awareness of [the impact of] my surroundings on audio quality.

WIL offers more than opportunities for student journalists to engage in learning situations in the real world. Stewart et al. (2010) wrote that focusing on the nature and effectiveness of WIL goes well beyond simple work experience or work placements, because "it necessitates the identification and application of specific teaching and learning goals and outcomes" (Forde & Meadows, 2010, n.p.). The students' work products (their stories) provided a healthy flow of fact-based news for the local community (Newton, 2013). One student also observed that the project demonstrated to potential employers the quality of the audio obtained, decision-making regarding the audio grabs selected, the news value of chosen angles and the ability to interview a diverse group of people. "I would probably never do an interview now without recording it," he said. "You can go back over the interview when you write the story, to verify the accuracy of information for legal and ethical reasons."

The students' stories were published and broadcast as a direct result of industry partnerships in this intensive teaching mode experience. In line with Newton's (2013) concept of a journalism education clinic, the involvement of industry mentors from the beginning, in the production and in the editorial stages of each story, gave the students the real-world experience of collaborating with professionals, and one that is "not necessarily guaranteed in a standard journalism internship" (Stewart et al., 2010, p. 65). They said:

> It was really good to have levels of mentoring … that encouraged us the entire way, giving advice or help when we needed it. It was also great that they trusted us to do the job properly and on-time. This project was yet another jump in understanding team work in the profession of journalism.

> Being able to capture fantastic quotes and add life to a story while ensuring accuracy in quoting sources is a very practical skill to develop in a real world scenario. The entire process, from recording, to editing and uploading, was a great learning experience that did challenge me, though knowing there was a support network to help, coach and guide participants through any difficulties was reassuring.

Conclusion

These election reporting projects have given the student journalists the opportunity to see how the theory they have learned translates into the practical world, by bringing the practical world to their campus. The projects not only provided access to the experience of WIL, they ensured it was meaningful by providing high quality supervision in the one workplace and reducing the potential for inequities in WIL experiences between students (Patrick et al., 2008). The students developed new skills and fluency with digital technology and social media tools to make them more versatile and a greater asset to a newsroom. They improved their pre-existing levels of technical and digital competency through immersion in the daily routines of a converged newsroom, enabling a standard of workplace learning that cannot be assured in professional industry placements (Cullen, 2015). The students also have a permanent archive of their digital literacy. Tanner et al. (2012) have argued that experiential learning must be included as a core component of journalism programs. Broadcasting and publishing online the USQ students' reportage in these WIL projects both developed and showcased their multimedia reporting, newswriting and production skills. Those stories enhanced their university's outreach "by providing professional quality news to the local community that otherwise would not have been covered by declining mainstream outlets" (Freedman & Poulson, 2015, p. 188). With three successful service learning projects completed, each has reinforced my view that journalism educators must try to infuse their courses, or independent projects, with WIL opportunities and outcomes as a way of better preparing their students as entry-level journalists.

References

ALGA (2016). *Facts and figures on local government*. http://alga.asn.au/?ID=59 [viewed 31 Jul 2016]

Billett, S. (2008). *Learning through work: exploring instances of relational interdependencies.* http://www98.griffith.edu.au/dspace/bitstream/handle/10072/22166/52200_1.pdf [viewed 28 May 2015]

Christensen, N. (2012, April 18). Journalism schools churn out too many. *The Australian*, 3.

Coddington, M. (2014). Normalizing the hyperlink: how bloggers, professional journalists, and institutions shape linking values. *Digital Journalism*, *2*(2), 140-155.

Cullen, T. (2015). A capstone unit for tertiary journalism programmes that aims to facilitate the demonstration of graduate capabilities. *Asia Pacific Media Educator*, *25*(2), 297-304.

Cullen, T., Tanner, S., O'Donnell, M. & Green, K. (2014). Industry needs and tertiary journalism education. In *Transformative, innovative and engaging. 23rd Annual Teaching Learning Forum, University of Western Australia.*

Forde, S. & Meadows, M. (2010). The impact of cooperative peer reflection on the integration of work integrated learning into journalism education. In *Curriculum and pedagogic bases for effectively integrating practice based experiences within higher education. National Teaching Dialogue Forum*, *Brisbane.*

Forde, S. & Meadows, M. (2011). Industry placements in journalism education. www.jrejournal.com/ojs_2.3.7/index.php/jre/article/view/12/33 [viewed 16 Sep 2012]

Freedman, E. & Poulson, D. (2015). Real-world learning of public affairs and environmental journalism: two models. *Journalism & Mass Communication Educator*, *70*(2), 187-196.

Furlan, P. (2007). Journalism education and experiential learning. *Australian Journalism Review*, *29*(2), 123-130.

Hodgson, P. & Wong, D. (2011). Developing professional skills in journalism through blogs. *Assessment & Evaluation in Higher Education*, *36*(2), 197-211.

Jones, D. (2005). Problem-based learning and critical analysis of practice in online news media. *Australian Studies in Journalism*, *14*, 97-113.

Jones, D. (2011). e-campaigning in local elections: out with the old, in with the new? *Dare to be different: 2011 Local Government Association of Queensland Annual Conference*. Gold Coast, 2011.

Jones, D. & Feldman, A.D. (2006). Local media and local elections: voters' preferred information sources. *Australian Journalism Review*, *28*(1), 43-56.

McIlveen, P., Brooks, S., Lichtenberg, A., Smith, M., Torjul, P. & Tyler, J. (2008). *Career development learning and work-integrated learning in Australian Higher Education: a discussion paper, June 2008*. www.usq.edu.au [viewed 16 Sep 2012]

McNamara, J., Kift, S., Butler, D., Field, R., Brown, C. & Gamble, N. (2011). Work-integrated learning as a component of the capstone experience in undergraduate law. *Asia-Pacific Journal of Cooperative Education*, *12*(1), 1-18.

Newton, E. (2013). *The "teaching hospital" – a goal for journalism education*. http://www.knightfoundation.org/press-room/speech/teaching-hospital [viewed 8 Nov 2015]

Patrick, C.-J., Peach, D., Pocknee, C., Webb, F., Fletcher, M. & Pretto, G. (2008). *The WIL (work integrated learning) report: a national scoping study*. QUT, Brisbane. www.altc.edu.au/system/files/grants_project_wil_finalreport_jan09.pdf [viewed 22 Jan, 2009]

Ramsay, G. & Moore, M. (2016). *Monopolising local news*. Kings College, London. www.kcl.ac.uk/sspp/policy-institute/CMCP/local-news.pdf [viewed 16 Jul 2016]

Royal, C. (2015). Developing and assessing experiential learning opportunities. *Teaching Journalism and Mass Communication*, *5*(1), 22-32.

Stewart, H., Meadows, M., Bowman, L., van Vuuren, K. & Mulligan, P. (2010). Indigenous Voice: a work-integrated learning case study in journalism education. *Australian Journalism Review*, *32*(2), 59-72.

Tanner, S., Green, K. & Burns, S. (2012). Experiential learning and journalism education: Special Olympics – a case study. *Australian Journalism Review*, *34*(2), 115-127.

Waller, L. & Hess, K. (2014). Local government reporting. In B. Griffen-Foley (Ed), *A companion to the Australian media*. Melbourne: Australian Scholarly Publishing.

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Ethical considerations in the use of student data: International perspectives and educators' perceptions

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As more emphasis is placed on the notion of "Show Me the Learning", institutions and individual staff are looking to the field of learning analytics to provide evidence of the learning that is happening. There is growing concern within the field that this evidence needs to be collected and utilised in ethical ways. However, there is a disconnect between national and international perspectives of the importance of institutional policy and guidelines regarding ethical use of student data, and the perceptions of academics about these guidelines. Although many universities are adopting such policies, results from a survey of academics suggest that such policy and guidelines are low on the ranking of factors that impact their current use and knowledge of learning analytics. Practical strategies are suggested to promote policy and guidelines, with appropriate support mechanisms that enable staff to embrace and adopt learning analytics through efficient, sustainable, and accessible processes.

Keywords: Ethical use of data, learning and teaching culture, learning analytics, PESTER plan, student data

Background

Learning analytics as a field has been building momentum over the last few years, providing an integrated way of gathering evidence of students' learning and taking action on insights gained. As this momentum has built there has been a corresponding increase in concern regarding ethical use of student data at international and national levels (Pardo & Siemens, 2014).

Throughout this paper *ethical use of student data* refers to the use of information collected by an institution about individual students and cohorts of students. This includes consideration of transparency of use, staff and student awareness of - and consent to - use of data, reasons for use, de-identification of data, options to opt-in or opt-out, use for staff performance management, who has access to the data and consequences of not taking appropriate action as a result of analysis of the data (Drachsler & Greller, 2016; West, Huijser, & Heath, 2016; Willis, Slade & Prinsloo, forthcoming). Student data can incorporate different elements at different institutions and encompasses any information that is collected by an institution, such as demographic data, admission and enrolment data, data from the Learning Management System, and information about usage of university services such as library and student services. Whilst academic research is covered by Human Research Ethics Committee processes and approvals, the same is not usually the case for use of student data as part of core business and normal teaching practice - yet the same principles need to apply, to help ensure student trust and the integrity of learning analytics in informing teaching practice (Willis et al., forthcoming).

Ethics and privacy issues have been important considerations for several years at the international level, with most discussion centering on the need for development of institutional policy and guidelines. Some notable examples are:

- Learning Analytics Community Exchange (LACE) Project has developed the DELICATE Checklist to implement trusted learning analytics (Drachsler & Greller, 2016).
- Learning Analytics & Knowledge conference for 2015 and 2016 included workshops and presentations on ethics and privacy
- Journal of Learning Analytics Volume 3, No. 1 2016 included a special section on ethics and privacy, the editorial of which discussed 22 challenges and 6 ethical goals for adoption of learning analytics (Ferguson, Hoel, Scheffel & Drachsler, 2016).
- JISC/CETIS in UK have developed a Code of Practice for Learning Analytics which sets out responsibilities for institutions (JISC 2015) and overview series (Kay, Korn, & Oppenheim, 2012)

- From an investigation in universities across 3 continents, Willis, Slade and Prinsloo (forthcoming) developed a "working typology of ethical approaches" (p.1) which considers 6 approaches of "learning analytics As.." across several categories and descriptors with the aim of providing "insight into the existing gaps in approval processes relating to both research and practice" to "encourage an awareness of the ethical issues relating to widespread adoption of learning analytics"

At the national level there have been two major Office of Learning and Teaching (OLT) funded projects which have included ethical considerations. West et al. (2016) report on the ethical considerations that were discussed by institutions and individual staff in their project and note that conversations regarding ethical principles are generally not yet occurring in institutions and propose an ethical decision making process for learning analytics. Colvin et al. (2015, p. 38) in their final report noted that there was a lack of discussion of these issues throughout their interviews and recommended that "a national conversation be initiated in which ethical considerations will be identified, framed and possible actions identified." An earlier report which the Society of Learning Analytics Research (SoLAR) completed for the OLT noted that "Establishing **guidelines for privacy and ethics** will require a transparent and broad ranging conversation between learners, faculty, institutions, government, and other stakeholders" (Siemens, Dawson & Lynch, 2013, p.29, their emphasis) It is hoped that this paper contributes to these conversations.

At the institutional level, many, (though not all), institutions are developing policy, guidelines and/or Codes of Practice around ethical use of student data. For example, Welsh & McKinney (2015, p CP241) reported on the development of a learning analytics Code of Practice at Charles Sturt University, Australia, noting that this was "an essential step in building trust between the institution and its students and staff through openness and transparency."

What is not clear though, through all of these discussions is how institutions are embedding these policies and guidelines into the learning and teaching culture nor how individual staff are responding to these high level initiatives. Results from a survey of academic staff at one regional Australian university are now discussed to consider one perspective on this aspect.

Academic Staff Survey

A comprehensive survey of academic staff at a small regional university was undertaken in 2016 asking questions about their current knowledge, use, and intentions with regards to learning analytics. The survey is one aspect of a larger ongoing study investigating the adoption of learning analytics at the university, which has been approved by the University of Southern Queensland (USQ) Human Ethics Research Committee (H15REA229) and was developed by the researcher for the purposes of this study. In 2015 USQ had a total student population of 28203, with 70.2% of these studying externally (online) and a further 16.4% in multi-mode, indicating the importance of the online environment. (USQ, 2015). The survey was distributed via email invitation from the Senior Deputy Vice Chancellor to 539 full and part-time academic staff with a teaching role and 94 responses were received with 62 completing all questions. Eight respondents indicated that they had no teaching role and were directed immediately to the end of the survey. Whilst these were small numbers of responses this is in the generally accepted range of at least 10% for online surveys and responses were received from across all disciplines and levels of academic staff. The survey will be repeated in mid-2017 to gauge any changes that have occurred and it is hoped that larger number of responses will be received for that survey.

This paper reports on the responses to three questions in this survey which were concerned with policy and guidelines. Spearman correlations were undertaken using SPSS for the questions reported on in this paper across the demographics of discipline groupings and academic level and these indicated very low correlations. For example, the response of *Lack of institutional guidelines* to the question of *Please indicate which, if any, of the following factors impact your current knowledge of learning analytics* resulted in a Spearman's rho of 0.047 with the question regarding in which discipline group staff teach and -0.047 with staff academic level. This suggests that neither discipline nor role affect responses and hence using responses from staff who did not respond to the demographic question is valid.

The three questions under consideration are shown in Figures 1-3 and compare the importance of policy and guidelines to other factors that impact on knowledge and use of learning analytics and the types of support needed by staff. The responses to these questions indicate that the provision of policy and guidelines is the lowest ranking factor across all three questions which suggests that staff, at this university at least, do not immediately consider policy and guidelines as important considerations when examining student data and are more concerned with lack of time and support. The results could be influenced by the fact that this institution does not currently have any specific policy or guidelines around ethical use of student data. Whilst these results all indicate that lack of institutional guidelines are the least important factor this does not infer that staff do not consider these guidelines important, more that they have less of an effect on their use of learning analytics than the other factors mentioned. These results could be used by institutions to inform development of training and support for staff in regards to adoption of learning analytics and ethical use of student data through embedding information about these principles, and their importance, into workshops and support services.

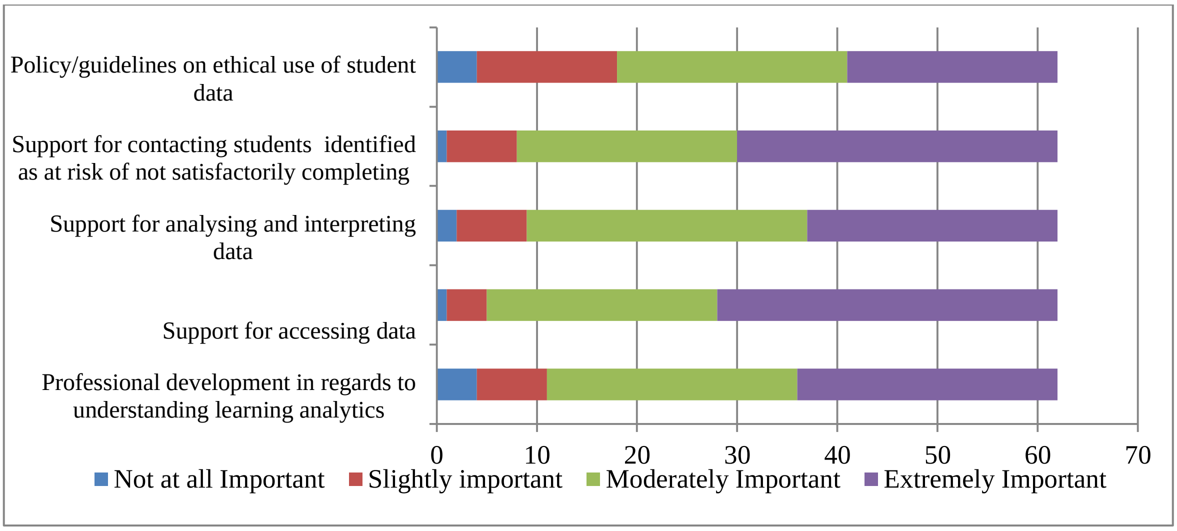

Figure 1: The importance of support in adopting learning analytics (n=62)

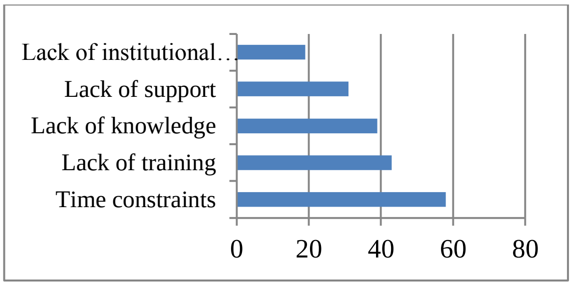

Figure 2: Factors which impact current knowledge of learning analytics. (n=68)

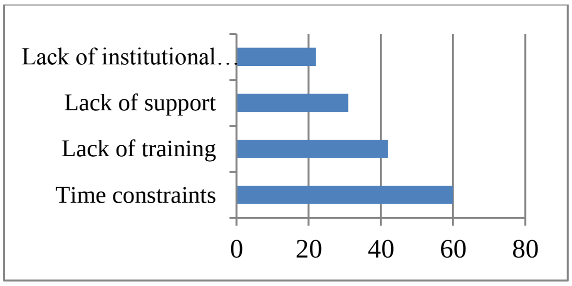

Figure 3: Factors which impact current use of learning analytics. (n=68)

Discussion

Although much has been written on the implementation of learning analytics and frameworks for ethical use of student data at the institutional level, as shown in the examples earlier in this paper, there remains a gap in practical solutions of how institutions engage staff (or students) in adopting ethical practices. It is suggested that this needs to be the next level of conversation, as there has also been little consideration of how individual staff can adopt ethical practices. Those institutions who have successfully adopted such strategies could share their successes (and failures) to assist those institutions who are just embarking on the journey and the institutions who are still to embark on the journey could seek out mentors to assist them in the process. The Special Interest Group (SIG) for learning analytics in ASCILITE, along with state networks and ALASI (Australian Learning Analytics Summer Institute) could play pivotal roles in bringing these groups together and enabling these conversations.

USQ is an institution which is starting out on the journey of learning analytics, and is currently at the Aware to Experimentation Stages of the Maturity of Learning Analytics Deployment model (Siemens et al., 2013). The results from the survey provide opportunities for institutions to consider innovative ways of promoting the importance of understanding policy and guidelines around ethical use of student data, through incorporating discussion of the need for, and purpose of, relevant policy and guidelines in any training sessions and support materials.

An adaptation of the PESTER plan (Jones, 2008), as shown in Table 1 provides a structured pathway with some practical suggestions on how institutions can help bridge this divide. Whilst this plan was originally developed to assist institutions in the implementation of online teaching and learning, the same principles can be adopted to the implementation of learning analytics and ethical use of student data as all of the same processes can be applied. The plan offers examples of strategies and actions that can be implemented at institution, faculty or school level from the early planning stages through different types of support, to recognising and rewarding staff for their achievements.

Table 1: PESTER Plan for implementation of learning analytics and Ethical Use of Student Data (Adapted from Jones, 2008)

Stage of PESTER Plan	Barrier(s)	Strategies	Action
Planning and Promotion	Lack of strategic planning Lack of understanding. Unwillingness to change teaching styles Perception of teachers losing their power and control Poor articulation of vision re learning analytics	Development of strategic plan for implementation of learning analytics, including ethical use of data, aligned with faculty and institution strategic plans Dissemination of rationale to staff students and professional/ accreditation bodies through meetings, memos, emails Identification of benefits to all stakeholders	Open discussions at Faculty/School and Discipline meetings on why policy and guidelines have been introduced Bulk emails to all students explaining learning analytics and ethical use of data Inclusion of session on learning analytics during student and staff orientation
Education	Lack of understanding Skepticism/ Fear of the unknown	Exemplars of current best practice Models of implementation – different utilisation of online learning and technological tools based on insights from learning analytics	Open discussions at Faculty/School and Discipline meetings
Support	Lack of time Lack of support and acknowledgement	Inclusion of time for analysing data and student intervention in workloads Statistical, technological and learning design support	Templates/exemplars for communicating with students Simplified Ethics application processes, including provision of templates
Training	Lack of skill level / perceived ability to adapt to new tools	Workshops in learning analytics, data analysis and ethical use of data Centralised help desk Online help manuals and "How-To" documents	Faculty-specific training sessions Presentations of Best Practice Case Studies Workshops linking practical uses of technology tools to sound online pedagogies
Encouragement	Lack of time Much more emphasis on research	Raise profile of learning analytics and ethical use of data Provision of Teaching and Learning grants and awards	Show and Tell sessions presented by early adopters Support provided to prepare applications for grants and awards
Recognition and Reward	Lack of support and acknowledgement Much more emphasis on research	Recognition of time required to analyse data and implement interventions and changes Provision of Teaching and Learning grants and awards achievements in probation and promotion process	Develop guidelines for faculty workloads model and implement across faculty Achievements noted in faculty-wide email bulletins

Further Research and Conclusion

The survey discussed in this paper will be repeated in mid-2017 to investigate any changes in levels of use and knowledge over time and will be reported on as part of the wider study. It would be interesting to disseminate the survey to staff in other institutions, nationally and internationally, that are at different stages of widespread adoption of learning analytics and have implemented policy and guidelines on ethical use of data. Investigation of the effectiveness of conversations within and between institutions regarding how these policy and guidelines can be implemented and impact on learning and teaching culture would also be a beneficial area for further study.

It is widely accepted that the adoption of such policy and guidelines needs to be an imperative at all levels and institutions, what does need to be ensured is that these are developed and promoted widely with staff, and students, in a transparent and collegial approach so that they are embraced by staff and become ingrained into the learning and teaching culture. In this way a clear and evidence-based picture of students' learning will be able to be achieved.

References

Colvin, C., Rogers, T., Wade, A., Dawson, S., Gašević, D., Buckingham Shum, S. & Fisher, J. (2015). *Student retention and learning analytics: A snapshot of Australian practices and a framework for advancement.* Final report 2015. Retrieved November 11, 2015 from http://he-analytics.com/au/the-report/

Drachsler, H. & Greller, W. (2016). Privacy and Analytics – it's a DELICATE issue. A Checklist to establish trusted learning analytics. *6th learning analytics and Knowledge Conference 2016, April 25-29, 2016*, pp. 89-98 Edinburgh, UK. DOI: http://dx.doi.org/10.1145/2883851.2883893

Ferguson, R,. Hoel, T, Scheffel, M., & Drachsler, H. (2016). Guest Editorial: Ethics and privacy in learning analytics. *Journal of learning analytics*, *3*,(1) pp 5-15. Retrieved from http://dx.doi.org/10.18608/jla.2016.31.2

JISC. (2015). *Code of practice for learning analytics.* Retrieved February15, 2016 from https://www.jisc.ac.uk/guides/code-of-practice-for-learning-analytics

Jones, H. (2008). Pestering staff into online learning: An Integrated plan for implementation. In *Hello! Where are you in the landscape of educational technology?* Proceedings ascilite Melbourne 2008. Retrieved from http://www.ascilite.org/conferences/melbourne08/procs/jones-h.pdf

Kay, D., Korn, N., & Oppenheim, C. (2012). *Legal, risk and ethical aspects of analytics in higher education (White Paper)*. Retrieved from http://publications.cetis.ac.uk/wpcontent/uploads/2012/11/Legal-Risk-and-Ethical-Aspects-of-Analytics-in-Higher-EducationVol1-No6.pdf

Pardo, A. & Siemens, G. (2014). Ethical and privacy principles for learning analytics. *British Journal of Educational Technology 45*(3), pp 438–450. doi:10.1111/bjet.12152

Siemens, G., Dawson, S., & Lynch, G. (2013). Improving the quality and productivity of the higher Education sector: policy and strategy for systems-level deployment of learning analytics. *Society for learning analytics Research*. Retrieved March 22, 2015 from http://www.olt.gov.au/resource-improving-quality-and-productivity-higher-education-sector-2013

University of Southern Queensland (2015). *University of Southern Queensland Annual Report 2015.* Retrieved October 7, 2016 from https://www.usq.edu.au/about-usq/about-us/plans-reports/annual-report

Welsh, S. & Mckinny, S. (2015). Clearing the Fog: A learning analytics Code of Practice. In T. Reiners, B.R. von Konsky, D. Gibson, V. Chang, L. Irving, & K. Clarke (Eds.), Globally connected, digitally enabled. Proceedings ascilite 2015 in Perth (pp. CP:241-CP:245).

West, D., Huijser, H. & Heath, D. (forthcoming). Putting an ethical lens on learning analytics. *Education Technology Research and Development pp1-20* doi:10.1007/s11423-016-9464-3

Willis, Slade & Prinsloo (forthcoming).Ethical oversight of student data in learning analytics: A typology derived from a cross-continental, cross-institutional perspective. *Educational Technology Research and Development (Early Access).*

Please cite as: Jones, H. (2016). Ethical considerations in the use of student data: International perspectives and educators' perceptions. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 300-304).

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Deakin Hallmarks: principles for employability credentials

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Graduates need to be able to articulate and evidence their capabilities in order to secure or create opportunities for meaningful work (Oliver, 2013). Therefore, students should be made aware of the capabilities required in the workplace and encouraged to actively integrate learning experience from their coursework with learning and achievements from other aspects of their lives. However, getting students to engage with graduate capabilities and think ahead about employment is a challenge. Deakin Hallmarks are an extra-curricular work-integrated assessment strategy designed to give students the opportunity to differentiate themselves to employers by recognising outstanding achievement through digital credentials. Here we report on the design principles and processes developed to ensure that they warrant meaningful achievement in the workplace; and encourage students to become aware of the capabilities they will require specific to their intended career.

Keywords: graduate capabilities, employability, work-integrated assessment, digital credentials, university-industry partnerships

Introduction

It is now widely accepted that universities have an obligation to develop graduate capabilities beyond discipline specific knowledge and skills (Green, Hammer, & Star, 2009; Su, 2014). Universities commonly articulate additional 'generic' or 'transferable' graduate learning outcomes that students are expected to develop over the duration of their degree. This more holistic approach is largely derived from a need to address graduate employability; a topic that has been the focus of discussion and numerous reports by governments, professional groups and academics over several decades (Reviews: Curtis & McKenzie, 2001; Tomlinson, 2012). Universities are not able to predict or guarantee job opportunities in students' intended field of interest; but they can assure that students are given opportunities to develop capabilities that will help them to find or create meaningful work (Oliver, 2015; Yorke & Knight, 2006). Course-wide approaches to embedding learning outcomes are important to support, scaffold and align the development and assessment of graduate capabilities across courses of study. However, of equal importance is how we engage students in the conscious development of their capabilities.

The changing nature of the workforce is making the jobs of tomorrow increasingly difficult to predict; so it is imperative that graduates be equipped not only with transferable skills, but also with an understanding of how they can repackage, adapt and present their skills across contexts (Bowden, Hart, King, Trigwell, & Watts, 2000; Oliver, 2013, 2015). Employability is developed over time so graduates should be encouraged to integrate a wide range of learning experiences within and beyond the formal curriculum (Precision Consulting, 2007; Sullivan & Baruch, 2009).

Yorke, (2006) defines employability as *"a graduate's achievements and his/her potential to obtain a 'graduate job'"*, distinguishing between employability (potential) and employment because employment is dependent on external factors, including labour market conditions. In recent years, competition between graduates has increased as a result of increased graduate unemployment (Callaghan, 2011; Graduate Careers Australia, 2013, 2014), and degrees are increasingly being seen as a prerequisite rather than as a differentiator (Brown, Hesketh, & Williams, 2003; Burning Glass Technologies, 2014; Tomlinson, 2008). Contemporary graduates need more than just good marks; they need to articulate and evidence their achievement and capabilities, and to understand their audience - what would an employer find convincing?

Here we report on an extra-curricular work-integrated assessment strategy designed to give students the capacity to differentiate themselves to employers by recognising outstanding achievement through digital credentials. In doing so, this initiative encourages students to become aware of the capabilities required to support self-directed employment in an industry sector. This initiative has identified a suite of principles that could guide future development of credentials developed specifically to address graduate employability.

Deakin Hallmarks

Deakin Hallmarks are non-credit-bearing university awards that warrant achievement in specific graduate capabilities with more detail than is possible through grades. Each Deakin Hallmark addresses one of Deakin's institutional graduate learning outcomes and is associated with a specific degree which creates a context for achievement and focuses attention specifically on related employment opportunities. Deakin Hallmarks ask students to self-assess the capabilities that are a priority for their discipline.

Hallmarks are available to all students enrolled in the associated course and are awarded where students submit evidence demonstrating outstanding achievement. Courses must distinguish between the achievement embodied in the course learning outcomes and expected of every graduate, and the further level of achievement that characterises a Deakin Hallmark. Two foundational characteristics are most important to making Deakin Hallmarks a unique and meaningful way of warranting learning.

First, Hallmarks are developed and are conferred in partnership with industry and professional bodies. Each Deakin Hallmark is associated with criteria and standards that are developed in consultation with industry partners or professionals to ensure that they represent achievement that is meaningful in the workplace. To apply, students must submit evidence that addresses the criteria and meets the standard – similar to applying for a job. Their evidence is assessed by a panel of experts that includes both faculty and industry representatives.

The second foundational characteristic is the platform for award. Recipients of the award receive their digital credential using digital badging technologies. This methodology creates a share-able digital record that provides both the circumstances of the award and the evidence that justified it (Bowen & Thomas, 2014). The digital credential has equivalent authentication as other university credentials, such as degrees, with the added advantage of making the evidence of learning transparent. The digital credential can be shared publicly through social media and professional platforms such as LinkedIn (https://www.linkedin.com/); making the associated data (i.e. criteria, standards and evidence) directly available to external audiences. Information about the assessment panel and industry partners who endorse the award is also included in the digital credential to give the achievement greater credibility amongst employers in that industry or profession.

Six key principles for Deakin Hallmarks were developed to guide the design of individual awards and to establish a robust framework for quality assurance and enhancement. These foundational principles (detailed below) reflect alignment of the interests of students, employers and the university to promote graduate employability.

Principles

Deakin Hallmarks were developed iteratively by a small group of volunteer course directors drawn from across all Faculties and supported by University leaders in learning and teaching, governance and management. Development of the principles for Deakin Hallmarks guided implementation through University policy and procedures, and the 'nuts and bolts' of delivery to students, and management of assessment and award.

The consensus principles have been tested through implementation of Hallmark credentials in 2015-2016 associated with five disparate degrees in environmental science, psychology, accounting, business administration and arts management. The course directors for this diverse group of disciplines have explored different forms of evidence such as portfolio presentation, investigation of authentic case studies and authoring articles for industry publications. Hallmarks have been delivered to undergraduates, postgraduates and students enrolled online. Students were also involved in the initial development and implementation of Hallmarks to ensure that the awards and application process was made meaningful to them (Healey, Flint, & Harrington, 2014). The final consensus suite of principles illustrates factors to be considered in the construction of new employability credentials.

Principle 1: Hallmarks recognise outstanding achievement of specific Deakin graduate learning outcomes particularly valued in the workplace

Each Deakin Hallmark must assess and warrant outstanding achievement of a single graduate learning outcome. Deakin University specifies eight graduate learning outcomes that students demonstrate through successful completion of their degree:

1) Discipline specific knowledge and capabilities: appropriate to the level of study related to a discipline or profession;
2) Communication: using oral, written and interpersonal communication to inform, motivate and effect change;
3) Digital literacy: using technologies to find, use and disseminate information;
4) Critical thinking: evaluating information using critical and analytical thinking and judgement;
5) Problem solving: creating solutions to authentic (real world and ill-defined) problems;
6) Self-management: working and learning independently, and taking responsibility for personal actions;
7) Teamwork: working and learning with others from different disciplines and backgrounds;
8) Global citizenship: engaging ethically and productively in the professional context and with diverse communities and cultures in a global context.

Deakin Hallmarks are not awarded for discipline-specific knowledge and capabilities, for two reasons: 1) student achievement of discipline specific knowledge and capabilities are warranted through the conferral of a degree, and 2) all Deakin Hallmarks are contextualised to courses and require students to apply discipline specific knowledge. Course leaders are encouraged to create one or two Deakin Hallmarks for the graduate learning outcomes most prized by professionals in their field and must work with industry or professional partners to select the appropriate learning outcome and assessment criteria.

Selection of a target graduate learning outcome is illustrated by the Deakin Hallmark for the Bachelor of Environmental Science (Environmental Management and Sustainability). Consultation with the course advisory committee, including industry representatives, highlighted the crucial role of teamwork in the multi-disciplinary nature of environmental science. This choice was also supported by the disciplinary threshold learning outcomes for environmental science identified nationally (Phelan et al., 2015). Hence, the Deakin Hallmark for Teamwork in Environmental Science recognises outstanding achievement in teamwork beyond the standard required by the degree.

Principle 2: Hallmarks acknowledge achievement distinct from grades awarded for assessment tasks within the course

Achievement of a Deakin Hallmark has no bearing on assessment marks and grades in units of study. Each Hallmark sets criteria and standards that are qualitatively different from, but thematically related to, learning within the associated degree. This principle ensures that a Deakin Hallmark offers students the opportunity to distinguish themselves on a different basis than academic marks and grades which are not necessarily a good indicator of suitability for a specific industry position or entrepreneurial future (Tomlinson, 2008; Velasco, 2012). Hallmarks are available to all students within a course, are voluntary and associated workload is in addition to normal study. The objective is to makes these awards that any student, regardless of their grade average, can aspire to achieve.

Principle 3: Hallmarks are associated with a specific course or major offered by Deakin and reflect the learning of students during their enrolment in that course or major

Although Deakin Hallmarks are an extra-curricular opportunity, distinct from grades, they are associated with courses because graduate capabilities are most effectively contextualised and taught within a disciplinary context (Bath, Smith, Stein, & Swann, 2004; Oliver, 2011; Precision Consulting, 2007; Radloff et al., 2009). Deakin Hallmarks also require students to integrate achievement from outside the formal curriculum with learning from within their degree. Consistency in the icons and terminology used for learning outcomes in the degree and the Hallmark intentionally link both credentials and encourage students to review their learning holistically.

Principle 4: Hallmarks are developed at the discretion of the course director in partnership with relevant industry or professional groups

To be valuable and credible, the assessment criteria and standards associated with digital credentials must be meaningful to future employment or self-employment in associated industries; so employers and professional bodies are involved in both design and assessment. Engagement with external stakeholders requires additional time and resources but is a necessary part of the developmental process. Appropriate industry partners are identified by course directors and consulted about all aspects of the Hallmark design; from selection of the most valued graduate learning outcome, to development of the criteria and standards of achievement and the assessment task. Industry partners are also involved in the assessment of the award and are identified in the data embedded in the digital credential.

This principle embodies a commitment to ensure the relevance of Deakin Hallmarks. Partnerships between industry and universities are increasingly being sought to modernise the curriculum, improve the work-based skills and competencies of graduates, increase the flow of knowledge across sectors, and foster economic competitiveness (Edmondson, Valigra, Kenward, Hudson, & Belfield, 2012; Thune, 2011). Industry-university collaborations are often most productive where they are strategic and long-term (Edmondson et al., 2012). Industry partners for Deakin Hallmarks are usually also associated with the university in other capacities, for example via course advisory committees, work-integrated learning and accreditation. Deakin Hallmarks form part of the multi-faceted and deep relationships sought between the university and industry.

Principle 5: Hallmarks are awarded on the basis of holistic judgements about student achievement with reference to approved criteria, standards and evidence

Students need to develop an ability to make effective judgements about their own work to become effective learners during their degree and beyond graduation (Boud & Falchikov, 2007; Boud, Lawson, & Thompson, 2015). Course directors describe the criteria, standards of achievement, application process and time frame for assessment to students. It is then the responsibility of students to create and curate evidence that meets the Hallmark requirements with minimal guidance from the course teaching team. This assessment approach is intended to encourage a mind-set in which students take responsibility for collecting and articulating evidence of their own capabilities.

Principle 6: Hallmarks are awarded using digital badges which carry the insignia of the University, describe the basis for granting the Hallmark and can be shared publicly

The credibility of the Deakin Hallmark outside the University is crucial to its value. Credibility is derived from industry participation and from the reputation of the awarding institution, so both characteristics are embedded within the credential. The authority of the credential and consequential assurance of quality requires university governance arrangements that ensure institutional standards for award so the criteria and standards for each Hallmark are endorsed by relevant Faculty Board/s and approved by the Deputy Vice-Chancellor Education.

Deakin Hallmarks are awarded using digital credentials that bear the insignia of Deakin University, the icon and name of the graduate learning outcome (contextualised to the discipline or profession) and record details of the award including up to 125 words describing the award, the criteria for award, and the identities of the assessment panel who warrant the award. Award to an individual student also includes the name of the awardee and digital evidence used to support the award.

Students' achievement of a Deakin Hallmark is also recorded on their statement of academic achievement at graduation. Although the profile of digital credentials have increased in recent years, they are still an emerging phenomenon in higher education (Oliver, 2016). The use of digital credentials to warrant student achievement offers a unique combination of digital accessibility and authentication, however, it was important to also link the digital credential to the universities official student records to ensure long-term security and credibility. Students involved in the development of the Deakin Hallmark concept saw this as an important indicator of the validity and prestige associated with the award.

Implications

The creation of Deakin Hallmarks has produced a suite of practical, learner-centred principles that are relevant to future credentials designed to address graduate employability. These principles recognize the value of four affordances of the award that can be generalised to broader application.

1. **Combining** in-course and extra-curricular learning by:
a) aligning learning outcomes for degree programs and associated employability credentials,
b) clear identification of the distinct criteria and standards for the added credential,
c) criteria expressed as holistic judgments.

2. **Relevance** to future employment by:
   a) focusing on learning outcomes that are prized by associated industries,
   b) collaborating directly with industry to ensure relevance.

3. **Acknowledging** the potential of all students by:
a) rewarding outstanding achievement that is not recognized by academic marks and grades,
b) making the award available to all students regardless of grades.

4. **Ensuring** the credibility of the award by:
a) rigorous institutional oversight
b) publication of the criteria and standards of the award
c) publication of evidence of achievement for individual students.

Collectively these principles create a novel way of recognizing student achievement. The conventional evidence of graduate achievement in a university degree is an academic transcript. These documents hold limited information and are often use language that is inaccessible to any audience outside the issuing institution. Relative achievement is represented by marks and grades, but these parameters have little relation to the world outside academia. In general, students are left to draw out their own connections between achievement during a degree and application to their future career. However, the award of a degree carries the credibility of the awarding institution and is often seen as a baseline indicator for employment.

Universities are beginning to value alternative indicators of achievement of graduate outcomes. In Australia, the introduction of the Australian Higher Education Graduate Statement (AHEGS) has created a nationally recognized format for universities to record achievements other than marks and grades. The AHEGS is an official statement that lists, for example, extra-curricular awards. It can be more informative than a transcript but it does not present the evidence that justified the award, nor does it involve the students in the presentation of their evidence.

E-portfolios have emerged as a digital means of accumulating and curating evidence for learners and may serve many purposes in learning and assessment (Watty & McKay, 2016). In particular, portfolios can be used to expose students to integrated and holistic learning experiences that enhance their employability through developing their capacity for reflection and self-assessment (Watty et al., 2016). However, they appear to be less useful in presenting evidence to employers, who may believe review of a portfolio is time-consuming or does not align with existing recruitment processes (Leece, 2005). Digital credentials have emerged as a way to combine the advantages of digital evidence in a summarized form with the authority of an institutional brand.

From a student perspective, employability is constructed through a range of learning activities as students move closer to the intended graduate learning outcomes. However, future employment requires more than academic achievement; employability includes awareness of employment and careers (Bridgstock, 2009). Deakin Hallmarks are an example of a new type of credential that prompts students to link achievement with careers.

References

Bath, D., Smith, C., Stein, S., & Swann, R. (2004). Beyond mapping and embedding graduate attributes: bringing together quality assurance and action learning to create a validated and living curriculum. *Higher Education Research & Development, 23*(3), 313-328.

Boud, D., & Falchikov, N. (2007). Developing assessment for informing judgement. In D. Boud & N. Falchikov (Eds.), *Rethinking assessment for higher education: Learning for the longer term* (pp. 181-197). London: Routledge.

Boud, D., Lawson, R., & Thompson, D. G. (2015). The calibration of student judgement through self-assessment: Disruptive effects of assessment patterns. *Higher Education Research & Development, 34*(1), 45-59.

Bowden, J., Hart, G., King, B., Trigwell, K., & Watts, O. (2000). Generic capabilities of ATN university graduates. Canberra: Australian Government Department of Education, Training and Youth Affairs.

Bowen, K., & Thomas, A. (2014). Badges: A Common Currency for Learning. *Change: The Magazine of Higher Learning, 46*(1), 21-25.

Bridgstock, R. (2009). The graduate attributes we've overlooked: enhancing graduate employability through career management skills. *Higher Education Research & Development*, *28*(1), 31-44.

Brown, P., Hesketh, A., & Williams, S. (2003). Employability in a knowledge-driven economy. *Journal of Education and Work, 16*(2), 107 - 126.

Burning Glass Technologies. (2014). Moving the Goalposts: How Demand for a Bachelor's Degree is Reshaping the Workforce. Boston, MA: Burning Glass Technologies.

Callaghan, R. (2011). *Selling the dream: Are we offering employability or making a vocational offer?* Paper presented at the Developing student skills for the next decade: Proceedings of the 20th Annual Teaching Learning Forum, Perth. http://otl.curtin.edu.au/tlf/tlf2011/refereed/callaghan.html

Curtis, D., & McKenzie, P. (2001). *Employability Skills for Australian Industry: Literature Review and Framework Development*. Retrieved from Melbourne: http://www.voced.edu.au/content/ngv%3A33428

Edmondson, G., Valigra, L., Kenward, M., Hudson, R. L., & Belfield, H. (2012). *Making industry-university partnerships work: Lessons from successful collaborators*. Retrieved from http://www.sciencebusiness.net/Assets/94fe6d15-5432-4cf9-a656-633248e63541.pdf

Graduate Careers Australia. (2013). *GradStats: Employment and salary outcomes of recent higher education graduates*. Retrieved from http://www.graduatecareers.com.au/wp-content/uploads/2013/12/GCAGradStats2013.pdf

Graduate Careers Australia. (2014). *GradStats: Employment and salary outcomes of recent higher education graduates*. Retrieved from http://www.graduatecareers.com.au/wp-content/uploads/2014/12/GCA_GradStats_2014.pdf

Green, W., Hammer, S., & Star, C. (2009). Facing up to the challenge: why is it so hard to develop graduate attributes? *Higher Education Research & Development, 28*(1), 17-29.

Healey, M., Flint, A., & Harrington, K. (2014). *Engagement through partnership: students as partners in learning and teaching in higher education*. Retrieved from York, UK: https://www.heacademy.ac.uk/sites/default/files/resources/engagement_through_partnership.pdf

Leece, R. (2005). The Role of E-Portfolios in Graduate Recruitment. *Australian Journal of Career Development, 14*(2), 72-79.

Oliver, B. (2011). Assuring Graduate Outcomes Good Practice Report. Sydney: Australian Learning and Teaching Council.

Oliver, B. (2013). Graduate attributes as a focus for institution-wide curriculum renewal: innovations and challenges. *Higher Education Research & Development, 32*(3), 450-463.

Oliver, B. (2015). Redefining graduate employability and work-integrated learning: Proposals for effective higher education in disrupted economies. *Journal of Teaching and Learning for Graduate Employability*, *6*(1), 56-65.

Oliver, B. (2016). *Better 21C Credentials: evaluating the promise, perils and disruptive potential of digital credentials*. Melbourne, Australia: Deakin University.

Phelan, L., McBain, B., Ferguson, A., Brown, P., Brown, V., Hay, I., . . . Taplin, R. (2015). *Learning and Teaching Academic Standards Statement for Environment and Sustainability*. Retrieved from Sydney: http://www.olt.gov.au/

Precision Consulting. (2007). Graduate employability skills. Melbourne, Victoria: Business, Industry and Higher Education Collaboration Council.

Radloff, A., de la Harpe, B., Scoufis, M., Dalton, H., Thomas, J., Lawson, A., . . . Girardi, A. (2009). The B Factor Project: Understanding academic staff beliefs about graduate attributes. Melbourne: ALTC.

Su, Y. (2014). Self-directed, genuine graduate attributes: the person-based approach. *Higher Education Research & Development*, *33*(6), 1208-1220.

Sullivan, S. E., & Baruch, Y. (2009). Advances in Career Theory and Research: A Critical Review and Agenda for Future Exploration. *Journal of Management, 35*(6), 1542-1571.

Thune, T. (2011). Success Factors in Higher Education–Industry Collaboration: A case study of collaboration in the engineering field. *Tertiary Education and Management*, *17*(1), 31-50.
Tomlinson, M. (2008). The degree is not enough: students' perceptions of the role of higher education credentials for graduate work and employability',. *British Journal of Sociology of Education*, *29*(1), 49 - 61.
Tomlinson, M. (2012). Graduate Employability: A Review of Conceptual and Empirical Themes. *Higher Education Policy*, *25*(4), 407-431. Retrieved from http://dx.doi.org/10.1057/hep.2011.26
Velasco, M. S. (2012). More than just good grades: candidates' perceptions about the skills and attributes employers seek in new graduates. *Journal of Business Economics and Management, 13*(3), 499-517.
Watty, K., Kavanagh, M., McGuigan, N., Leitch, S., Holt, S., Ngo, L., & McKay, J. (2016). Realising the potential: Assessing professional learning through the integration of ePortfolios in Australian business education. Sydney, Australia: Office for Learning & Teaching.
Watty, K., & McKay, J. (2016). Pedagogy and ePortfolios: purpose aligned to design (or the why and how). *International Journal of Pedagogies and Learning*, 1-14.
Yorke, M. (2006). Employability in higher education: what it is - what it is not *Learning and Employability Series*: Higher Education Academy.
Yorke, M., & Knight, P. T. (2006). Embedding employability into the curriculum: Higher Education Academy.

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The Rise of the Flip: Successfully engaging students in pre-class activities through the use of technology and a flipped classroom design template.

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Educational literature has acknowledged that teaching students who are prepared for class encourages student engagement and active learning. This is a core reason why the flipped classroom has risen to the forefront of effective learning strategies. However, key to the success of this strategy lies in the ability to motivate students to complete the necessary pre-class activities, posing a real issue in higher education settings. Teachers still ask *'How can I be sure if my students have completed their pre-class activities? How do I motivate students to want to engage in pre-class preparation?* This paper will demonstrate how mindfully designed pre-class learning approaches can successfully motivate students to complete pre-class activities that prepare them for active in-class learning. A pilot design template created by a community of colleagues, highlights how the use of simple technologies aligned to sound pedagogies, effectively engage students through accountability across a range of undergraduate courses.

Keywords: Design template, flipped classroom, pre-class activities, learning technologies

Introduction

Flipped Learning is a term that is associated with a contemporary learning and teaching strategy and often defined as a reversal of lecture and homework elements enabling class time to become more interactive. The popularity of the flipped classroom is reflected through the rise in educational commentary through the literature and various online collaborative sites such as Jon Bergmann's (2016) *Flipped Learning Network*. Early versions of flipped learning can be traced back in the literature as early as 1990's when Mazur (1997) changed the face of physics education with Peer Instruction and Novak et al. (1999) brought Just in Time Teaching to the forefront of learning. Flipped learning is not a new phenomenon in education but what is new about this approach is the way in which educators can use simple technologies and instructional design frameworks to successfully flip their classes.

The translation of the flipped learning concept into effective classroom practice still presents students and educators with innate challenges. Academics across 26 Australian and North American universities where the University of Adelaide's Office of Learning and Teaching (OLT) Flipped Classroom Project Team have conducted a range of capacity building workshops, identified the issue of student acceptance of active learning as one of the challenges of the flipped classroom. Effective flipping relies on students being prepared to assume a much more active role in the group based classroom activities. For this to work effectively, students need to enter the classroom with the same level of understanding of the topic's foundational concepts (McCormack, 2001). Pre-class learning can help to address this, but engaging all students in pre-class learning is still at the forefront of teachers' concerns. Simply pre-recording lectures and placing them online, asking students to watch videos or read chapters of text, does not guarantee student pre-class engagement. The success of flipped learning is dependent on students completing the pre-class activities which are strategically linked to all phases of learning. In this model the educator becomes the 'coach on the side' in-class and the students become the drivers of their learning (Gilboy et al., 2015) whilst they engage with higher order learning activities under the guide of their teachers.

The need for an underpinning instructional design framework is crucial to successful flipped classrooms, along with an understanding of how to use technologies effectively to support the achievement of learning outcomes to close the learning cycles in a flipped classroom (Porcaro et al., 2016). Professional educators who are reflective and engage in scholarly networks are essential to effective flipped learning (Hamden et al., 2013). The collaborative and collegial development of flipped learning resources provides educators with the opportunity to share ideas, success and challenges, and consequently create quality assured learning resources for effective flipped classroom outcomes. Furthermore, discipline experts may not have the necessary skills of knowing how to embed active learning segments that are aligned with authentic assessment practices. This calls for discipline experts to be willing to work in collegial teams, such as an interdisciplinary community of practice (Wenger-Trayner, 2015) to provide them with the support and critical feedback necessary to design flipped classes.
This concise paper will discuss the use of a collegially developed flipped classroom design template created by an interdisciplinary community of practice with a special focus on pre-class student engagement. Examples of well-designed pre-class activities from three different undergraduate contexts along with student engagement rates will form the basis of this paper and demonstrate the principles of the design template. It will also demonstrate how these teachers use simple technologies to motivate and engage students in their flipped learning approaches.

Developing the flipped classroom design template.

A design template (Table 1) was developed by colleagues belonging to a cross-disciplinary community of practice that consisted of academics and educational designers with varied experiences in flipping learning design and implementation. The majority of colleagues also belong to the University of Adelaide's OLT Flipped Classroom Project. Outcomes of these collegial discussions informed the design of a user-friendly template to encourage best practices in flipped classroom learning design. Using Bloom's Modified Taxonomy (Anderson & Krathwohl, 2001) as the underlying instructional design framework, the pre-class learning activities introduce foundational key concepts of a specific topic. Through embedded interactivity, students engage with learning activities to help them to remember and understand the pre-class content prior to attending the linked in-class session. Central to the success of pre-class learning activities is the focus on foundational or threshold concepts (Meyer & Land, 2003). These are concepts of a topic that a student must demonstrate understanding of in order to be able to move to the more complex aspects of the topic in subsequent classes. Foundational concepts should form the basis of the pre-class activities and need to be presented in an engaging and interactive manner. A workload shift is central to the success of pre-class engagement to ensure that pre-class learning is not adding to students' workload, but rather shifts a portion of the content from in-class to pre-class.

A set of principles were developed through collegial review of current flipped classroom practices. These principles form the basis of the flipped classroom design template and are accompanied with examples in each phase of flipped learning. Student accountability to complete the pre-assigned learning activities is captured through the either the submission of responses to pre-class online 'checkpoints' or through the expectation that students will bring their completed tasks to the linked face-to-face class to form the basis of further learning. Teachers must also demonstrate accountability through the review of pre-class student responses, providing feedback to those responses and finally clarifying any misunderstandings that resulted from the pre-class tasks in the linked in-class session/s. In this design template there are clear linkages between pre-class, in-class and post class, which underpin the need for both teacher accountability to respond to student learning issues and student accountability to complete the learning tasks throughout each cycle.

Flipping across diverse undergraduate courses

When classes consist of students with diverse levels of understanding, the teacher is faced with the challenge of supporting the students who are learning a subject for the first time whilst at the same time challenging those students who are at a more advanced level of understanding of the same subject. As there are no existing pre-requisites for students entering specialised programmes such as oral health, some first year students undertaking human biology are challenged with complex terminology and abstract concepts. On the other hand, other students with a more advanced understanding of biology need to be extended and further challenged.

As early as 2010, the human biology teaching team in the oral health program introduced flipped classrooms to address these diverse levels of student understanding by enabling students to actively engage in class activities to develop a common understanding of the foundational concepts. Similarly, general sciences courses are also faced with the challenge of diverse student cohorts as they enrol students from a variety of degree programs. These students are not only studying for different vocations but may also vary in age, work and life experiences and English language proficiency. To appeal to such a diverse range of students and reinforce the relevance of the content, a flipped classroom approach was adopted in 2013 in the Animal and Veterinary Sciences, Agricultural, Viticulture and Oneology course. The aim of this flip was to introduce the topic of genetics in a real life context so that students develop the same foundational understanding of the key concepts before they engage in real life scenarios and case studies specific to each degree programme in follow up classes. As in the oral health example, it was important to ensure that all students had the required foundational knowledge to enable an interactive and engaging face-to-face in-class experience.

As well as the challenge of having diverse student cohorts, class sizes in many science disciplines have increased significantly over the past 3-4 years. This is particularly so at first year level, due to the removal of the enrolment caps and the increasing global nature of higher education. This increase in enrolments has not been matched by increasing numbers of academic staff (Brown et al., 2010). The resulting decline in staff to student ratios has led to a reduction in the types of assessment. For example, first year students are no longer required to write scientific/lab reports as the time required to mark these more lengthy reports is too high. Consequently, second year students are expected to write comprehensive laboratory reports but have not yet developed the skills to do this. This problem prompted the development of a flipped tutorial in a second year Animal and Plant Biochemistry course to introduce students to the foundational scientific writing skills required to produce a laboratory report.

The large second year cohorts of Animal and Veterinary Sciences students also posed issues of student engagement and understanding of content heavy topics such as the structure and function of haemoglobin. Student attendance to class and engagement was traditionally low and summative exam questions on based on core concepts for this topic were generally poorly answered. To overcome this issue, the topic was flipped to engage students prior to attending the linked classes using the principles of Team-Based Learning (TBL) (Sibley & Ostafichuk, 2014). The aim of this approach was to allow students to learn the structure of haemoglobin individually as a pre-class activity and then to apply their understanding to real world applications in an in-class group work activity, helping them to make sense of their learning, and thus increasing student engagement.

Design of the pre-class activity across contexts to promote student and teacher accountability

In our flipped classroom template, the aim of the pre-class activities is to introduce students to the expected learning outcomes for the subject and provide them with the opportunity to develop an understanding of the foundational concepts. Pre-class activities need to be short, interactive and focused on these key concepts. Here is where technology aligns with flipped learning pedagogy to support and enhance the implementation of effective flipped classes. The technologies that teachers use to flip with need to be user friendly for both the teacher and the student, and not require large amounts of time to be spent on resource development at the expense of the pedagogical integrity of the flipped class. Once the pre-class activities are completed, students move to higher order thinking levels during in-class and post-class learning and assessment activities. (Refer to Table 1 for examples of in-class and post-class learning approaches.)

Pre-class activity in Health Sciences

Understanding the histological appearance of oral tissues was one of the most important outcomes for oral health students studying Human Biology I OH. Students need to achieve this outcome in order to apply this knowledge to clinical practice. Applying this knowledge to oral health practice required a sound understanding of general cell biology. A 20-minute interactive and narrated PowerPoint was produced on general cell structure. This online module contained embedded checkpoint questions every 5 minutes to flip this introductory topic. Checkpoints consisted of 4-5 simple recall Multiple Choice Questions (MCQs) that were powered by Survey Monkey and linked to the Learning Management System (LMS). Three relevant 1-2 minute YouTube videos on cell structure were also embedded in the pre-class learning module.

Students were allocated a week to complete this pre-class module and the time saved from having to cover this foundational knowledge in class was then dedicated to more applied cellular physiology questions in the linked classroom time. The due date of completion was 24 hours before the scheduled in-class session and the pre-class responses were collated and analysed by the teachers to clarify any salient points in class, prior to moving on to more complex and collaborative learning activities.

The design of the module allowed students learning this material for the first time to undertake the pre-class activities as often as needed, and those who had mastered the content previously could use the checkpoints as a revision tool. As such, all students were prepared for the face to face session. The in-class activities required students to collaboratively identify cells from a series of histological slides. In post class sessions students needed to identify how cells of the oral tissues specialised to perform their particular function. Embedding this form of interactivity in the pre-class activities with clear post class linkage resulted in a consistent completion rate of an average of 95% despite the fact that completing these learning activities did not contribute to the assessment marks for this course. Initial data emerging from student focus groups indicate that providing them with a due date to complete the pre-class activities, coupled with the regular interactive checkpoints motivated students to complete the assigned tasks.

Pre-class activity in General Sciences

In the general sciences program, the aim of introducing a flipped class to second year genetics students was to show how scientists use biotechnology in their field of study and assist students to understand the complicated terminology of molecular biology. For this purpose, controversial topics such as genetically modified organisms were presented to all students regardless of their chosen vocation.

One week prior to the face-to-face session, students were required to complete an interactive online exercise via the course LMS. The exercise was developed using the Articulate Storyline software and included information, voice-overs, videos and MCQ checkpoints for students to test their knowledge. The main focus for this pre-class activity was for students to gain an understanding of how genetically modified golden rice was developed, the techniques used to create a genetically modified line, such as golden rice, and the corresponding societal benefits. The aim was to help students form their own opinion about genetically modified organisms by reviewing opinions for and against modified foods. The completion of the pre-class exercise was monitored in the LMS Grade Centre. Even though no marks were associated to the pre-class activity, approximately 80% of students viewed and attempted the pre-class activity consistently over 3 years. The linked in-class activities required students to work in groups and refer back to their pre-class responses, making them accountable not only to themselves but to their group members to enable effective and equitable contribution to the in-class group tasks.

Pre-class activity in Animal and Plant Sciences

In Animal and Plant Biochemistry, a second-year laboratory report writing exercise was flipped early in the semester to introduce and familiarise students to the core foundational aspects of this scientific exercise. Students were provided with a fictional electronic example of a laboratory report containing many commonly made student errors. Students were also provided with examples of well-written reports and graphs via their LMS. A simple online rubric, based on the one used to assess laboratory reports Animal and Plant Biochemistry was linked to the example report. Students were required to mark the fictional laboratory report against the rubric before coming to tutorial where they would share their pre-class marking experiences. Students were expected to spend 30 minutes completing this pre-class exercise and were accountable for coming to class with the completed marked report.

When the students arrived for the in-class session, they were provided with a mini-lecture on report writing and were asked to review the pre-class laboratory report again in pairs. Using a much more detailed rubric student pairs had to mark the report again and provide comments to justify their marking. The pre-tutorial activity contributed to the overall tutorial marks for this subject, creating a layer of accountability that supported the completion of the pre-tutorial activity. Over 90% of the class completed the online pre-class activity and submitted the annotated hard copy after the in-class session over the last 2 years. The conceptual link of the pre- and in-class activities to the post-class activity was clear: during the following practical classes students undertook experiments, collected data and were required to write their own laboratory report.

Pre-class activity in Animal and Veterinary Sciences

The Articulate Storyline software suite was once again used to create an interactive pre-reading package covering the basics of haemoglobin structure and oxygen transport for first year Animal and Veterinary Science students as preparatory work for the in-class TBL session. The haemoglobin eLearning package included a narrated presentation of basic facts, figures and definitions as well as a relevant YouTube videos. This package was then uploaded onto the LMS as a SCORM package.

The number of students that completed the eLearning package was tracked through the LMS Gradebook centre. Around 90% of the students engaged with the pre-class learning module. The students were held accountable by using the GRAT (Group Readiness Assurance Test) in TBL, meaning that if they came to class unprepared they would have let their team members down. The analytics available in the LMS provided teachers with the opportunity to track how long each student had the SCORM package opened and how many times they viewed it. In class the students role played haemoglobin loading and unloading, followed by a physical activity that involved them exercising on stationary bicycles and then discussing and diagramming how exercise shifts the haemoglobin saturation curve. To align learning with assessment, one of the application exercises formed the basis of a long answer question in the written summative exam. The combination of the pre-class preparation, the in-class accountability resulting from the team based test, the physical nature of the in-class application exercises and the post-class assessment in the exam resulted in a learning experience that catered to a diverse range of learning styles as was evidenced in student feedback from formal course evaluation surveys and through informal discussions with students.

Discussion and Concluding Comments

In each of the cross-disciplinary examples described in this paper, the flipped classroom approaches were carefully aligned to the design template presented in this paper. The collegially developed flipped classroom template demonstrates how effective flipped classes can be designed with careful planning that considers alignment to learning outcomes and assessment. The use of familiar and simple technologies supported the pedagogical integrity of the flipped classes described and did not drive the learning process. Effective flipped classrooms require careful consideration of the underlying pedagogical framework/s and begin with well-structured and engaging pre-class activities. Based on the experiences of interdisciplinary colleagues from the University of Adelaide's Flipped Classroom Community of Practice, mechanisms such as tracking student completion of pre-class activities and responding to the students' submitted answers embeds both student and teacher accountability which seems to motivate students to complete pre-class activities. The examples covered in this paper, demonstrate how succinct pre-class activities which are mindful of student workload and cover foundational concepts in a self-paced manner lead to successful pre-class engagement. The challenges of flipped classrooms still remain for both students and teachers however strategies that may address some of these challenges can be adopted through the use of a design framework and simple technologies that serve to motivate students and increase student engagement in all phases of learning.

Table 1: A Community of Practice Flipped Classroom Design Template.

All learning segments aligned to clear learning outcomes and assessment				
	Pre-class *Understand and Remember Key Concepts*	**In-Class** *Analysing Key Concepts*	**In-class** *Applying Key Concepts*	**Post –Class** *Assessing higher order synthesis of Key Concepts*
Purpose	Define key concepts Identify relevance of topic Shift the workload from in class to preclass or post class. Embed interactivity/checkpoints for student feedback Analyse student responses to checkpoints prior to classtime	Report back on pre-class responses Address any salient areas identified in pre-class activity Provide teacher and peer feedback to the pre-class responses Work through Instructor guided examples on 'real world' applications Highlight relevance	Workshop authentic tasks in a real world or simulated context. Actively learn in a safe space Receive peer to peer and student to teacher feedback feedback Prepare students for assessment Explicitly identify relevance to authentic applications	Apply key concepts to new situations within broader contexts Receive feedback on performance from peers and teacher Provide opportunity for students to reflect on further learning needs and devise improvement strategies
Examples and aligning technology to pedagogy	Short Reading Narrated PowerPoint Short lecture recording 7-10 min Audio/Video Articulate/Adobe Presenter (Interactive Learning Module) Discussion Board/Chat room Concept Map drawing	Case study/real life worked exemplars Team Based Learning (Assurance Testing) In class voting e.g., Plickers Simulation activities with instructor providing debrief	Real-world examples including: Case studies Student presentations Tutorials In class debate Simulation with student leading the debrief	Tutorial Assignment Field work Clinical Placements Report Writing Project work and research Written and/or oral exams

References

Anderson, L. W. and Krathwohl, D. R.. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Allyn & Bacon. Boston, MA (Pearson Education Group)

Bergmann, Jon. (2016). Flipped Learning Network. http://www.jonbergmann.com/about-m/ (viewed 4 Sept 2016)

Brown, T., Goodman, J and Yasukawa, K. (2010) Academic casualization in Australia: Class Divisions in the University. *The Journal of Industrial relations*, 52(2): 169-182

Gilboy, M. B., Heinerichs, S., & Pazzaglia, G. (2015). Enhancing student engagement using the flipped classroom. *Journal of Nutrition Education and Behavior*, 47(1), 109–114.

Hamden, N., et al. (2013) A Review of Flipped Learning. www.flippedlearning.org

Kolari, S. & Savander-Ranne, C. (2007). Pre-lecture Assignments-a Method for Improving Learning in Engineering Education. *International conference on engineering education – ICEE.* 3 - 7 September 2007, Coimbra, Portugal.

Mazur, E. (1997). *Peer Instruction: A User's Manual*. New Jersey: Prentice Hall.

McCormack, W. (2011). *Team Based Learning*. http://www.teambasedlearning.org (viewed 1 August 2016)

Meyer, J.H.F. and Land, R. (2003). *Threshold Concepts and Troublesome Knowledge – Linkages to Ways of Thinking and Practising in Improving Student Learning – Ten Years On.* Rust, C (ed), OCSLD, Oxford

Novak, GN, Patterson, ET, Gavrin, A, and Christian, W (1999), *Just-in-Time Teaching: Blending active Learning and Web Technology*, Saddle River, NJ: Prentice Hall. ISBN 0-13-085034-9

Porcaro, P., Jackson D.E., McLaughlin P.M. & O'Malley, C.J. (2016). Curriculum Design of a Flipped Classroom to Enhance Haematology Learning. *Journal of Science Education and Technology* 25:345-357.

Sibley, J. & Ostafichuk, P. (2014). *Getting Started with Team-Based Learning* Sterling, VA: Stylus.

Wegner-Trayner, E., & B. (2015). Introduction to Communities of Practice. Accessed from http://wenger-trayner.com/wp-content/uploads/2015/04/07-Brief-introduction-to-communities-of-practice.pdf, (Viewed 5th August 2016).

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All roads lead to Rome: Tracking students' affect as they overcome misconceptions

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Helping students to overcome misconceptions is a complex problem in digital learning environments in which students need to monitor their own progress and self-regulate their own learning. This is particularly so in flexible, discovery-based environments that have been criticised for the lack of support and structure provided to students. Emerging evidence suggests that discovery-based environments might be ineffective due to students becoming confused, frustrated or bored. In the study reported here, we examined the affective experience of students as they worked to overcome a common misconception in a discovery-based environment. While the results suggest that students experience a range of emotions, they all successfully overcame their initial misconception. Implications for the investigation of student affect in discovery-based environments and the design of these environments are also discussed.

Keywords: misconceptions, confusion, discovery-based learning, digital learning environments

Introduction

Misconceptions are common in many disciplinary areas. Contrary to traditional assumptions that students enter educational situations as blank slates, students in fact often have extensive intuitive notions of concepts or ideas. These 'folk' notions are also often not an accurate representation of the concept as it is understood scientifically. Misconceptions are particularly evident in areas such as physics (e.g. Brown, 1992) and psychology (e.g. Kuhle, Barber, & Bristol, 2009), where students' experiences in the world and interactions with other people do not necessarily match a more sophisticated understanding of the physical or psychological world as uncovered by science. In this paper, we describe a study that examined how students overcame misconceptions in a digital, discovery-based learning environment. The purpose of this study was to uncover the different experiences students have as they overcome scientific misconceptions when given flexibility to explore a relatively unstructured digital learning task.

Discovery-based learning environments have been the focus of much discussion over several decades (see Bruner, 1961). On the one hand, there is evidence to suggest that learning environments with minimal guidance that encourage student exploration can be effective in helping students develop strategies for enhanced conceptual understanding (De Jong & Van Joolingen, 1998). On the other hand, an argument made by some in the educational research community is that lightly scaffolded learning does not work and that students need explicit guidance to effectively work through learning tasks (Alfieri, Brooks, Aldrich & Tenenbaum, 2011). According to this view, giving students flexibility to determine their own path through a learning task ostensibly creates extraneous cognitive load that hampers learning (Kirschner, Sweller & Clark, 2006). So while there is evidence to suggest that discovery-based learning environments can pose problems for learning generally (see also Hattie, 2009), there is some evidence to suggest that they can be effective for enhancing conceptual understanding (Dalgarno, Kennedy & Bennett, 2014).

Despite the uncertainty around the prospect of using discovery-based environments, there is evidence to suggest these environments can be effective under particular circumstances. Dalgarno et al. (2014) found that a discovery-based environment assisted students to learn about blood alcohol concentration or global warming in comparison to tutorial versions of the same lessons. The caveat in this instance was that students needed to be systematic in their approach to navigating the lesson. Following on from this we (Lodge & Kennedy, 2015) have found that confidence, confusion and perceived difficulty also contributed to the strategies that students employ when working through discovery-based lessons in digital environments.

Previous research has also indicated that, aside from their approach or strategy, students' affective experiences during their learning can serve as important predictors of their progress in overcoming misconceptions. Previous research (e.g. D'Mello & Graesser, 2014; D'Mello, Lehman, Pekrun & Graesser, 2014) has suggested that students in both discovery-based and other learning environments experience cognitive disequilibrium as a result of being exposed to information contradicting their intuitive conceptions. This disequilibrium often results in the epistemic emotion (i.e. an affective response) of confusion. Despite confusion intuitively being seen as an indicator of ineffectiveness in discovery-based learning environments, there is evidence to suggest that confusion can be an essential part of an effective student learning process. While there are certainly times when confusion can impede learning, there are circumstances in which it can be particularly useful for students to achieve meaningful conceptual change (D'Mello, Lehman, et al., 2014).

Lehman, D'Mello and Graesser (2012) found that in "breakdown" scenarios (i.e. problem-based exercises where the task is to determine why a system or machine is not functioning) presented in digital environments, conflicting information and false feedback can all reliably generate confusion. If not adequately resolved, this confusion can lead to the further emotional responses of frustration and boredom. It is likely, in the circumstances where a student is persistently confused to the point of boredom or frustration, that the original misconception will remain or even be reinforced, rather than corrected. This has been referred to as a 'backfire effect' (Trevors, Muis, Pekrun, Sinatra & Winne, 2016). This confusion, boredom and frustration may explain why "pure" discovery-based environments are seen as ineffective (e.g. Mayer, 2004); if students are not able to successfully navigate the environment, they are likely to experience persistent confusion leading to frustration, boredom and eventually this may cause them to give up. However, when confusion is effectively resolved, it has the potential to lead to deeper learning, particularly of complex concepts (D'Mello & Graesser, 2014). What this suggests is that the confusion that is commonly seen as a negative aspect of discovery-based environments can in fact be both productive and necessary for conceptual change, as long as it can be resolved in a timely manner.

The overall purpose of the current study was to examine the affective experiences of participants using a digital learning task that was designed to help students overcome a scientific misconception. Previous research in this area, including our own (e.g. Lodge & Kennedy, 2015), has suggested that prior knowledge is a critical factor in determining how students approach a discovery-based digital learning environment. In order to control for this variability, we have focussed in this study on a scientific concept that is largely misconceived by novices in the area. As detailed in the method section below, the concept students were asked to explore was the relationship between the size of a star and its lifespan. Intuitively larger stars should have longer lifespans but, due mostly to the effects of gravity, the opposite is true (see Schwarzschild, 1958). Using a misconception as a starting point has allowed us to explore a scenario in which we were able to control for prior knowledge to allow greater emphasis on examining students' affective trajectory though the task. In effect we wanted all students to have a misconception and limited knowledge so that they predominantly start from a similar point (i.e. believe that larger stars live longer). The purpose of the study was thus to delve into the ways in which students move from this point towards resolution of the misconception (i.e. come to understand that smaller stars have longer lifespans).

Intrinsic to the design of relatively open, discovery-based learning environments, is the ability of students to take a range of learning pathways in order to come to their own understanding of the material. As indicated above, a concern with these environments is that these pathways, and students' learning processes that are aligned with these pathways, do not always lead to productive learning. While there are a range of ways that students can approach open-ended, discovery based tasks – that is, in fact the point – in this study we were interested in whether there were patterns associated with particular affective experiences, and whether these could be related to the successful resolution of a fundamental misconception. Thus a central aim of this research was to determine how the affective experience of students changed as they negotiated a discovery-based learning task, and to see how this was related to their (hopeful) resolution of a misconception. The approach used in this study adds to the research to date by examining the changes in affective experience throughout the course of conceptual change. We then compare and contrast this to the global, overall impression that participants have of the session, which is the most common means of assessing the experiences students have of completing a learning task. Having a better understanding of the affective trajectories of students will allow educators and designers to not only modify the design of learning environments to accommodate students' learning needs, but it could also form the basis of interventions to support students when their intuitive notions are challenged, thereby leading them to meaningful conceptual change.

Methods

Participants

Participants were recruited via an online advertisement through the university careers page. Participants were offered compensation of $20 (in retail vouchers) for their time. A total of 24 participants completed the study, all of whom were undergraduate students from The University of Melbourne studying in a range of areas. Participants were predominantly commerce or arts students. None of the students who completed the study reported having previously studied cosmology or physics and therefore had little to no prior scientific knowledge of the content of the learning task. The mean age of participants was 22.6 years. Eight participants were male and 16 were female. Ethics approval for this study was granted by the institutional Human Research Ethics Committee.

Materials

A mixed methods approach was used in this study. The measures of overall experience used in the study reported here are consistent with those we have used in previous studies and have been useful in gauging the global impressions participants had of the learning tasks they completed (see Lodge & Kennedy, 2015). Qualitative and quantitative questionnaires were supplemented by the use of video stimulated recall. Multiple measures were used to provide a deeper analysis of student progression through a discovery-based environment and offer suggestions as to when students were experiencing particular subjective states, such as confusion, during the task compared to their post-session reflections.

This study was conducted in a purpose-built computer laboratory on a 2012 model Apple iMac 27-inch computer running OSX ‘Mavericks’ operating system. The stellar lifecycle task (described below) was housed in a web-based interface provided by the *Smart Sparrow* platform run on Apple Safari web browser. Screen recording software (built in to Mac OSX operating system) was used to capture the sessions. All other materials (as described below) were provided on paper and were entered into Microsoft Excel and IBM SPSS software packages for analysis.

Stellar Lifecycle Learning Task
The task used as the lesson of this research was part of a larger task called *Habitable Worlds* (*HabWorlds*) created by Anbar and Horodyskyj in the *Smart Sparrow* platform and used at Arizona State University. HabWorlds is a course designed to help students learn about “the formation of stars, planets, Earth, life, intelligence, technological civilizations” (Anbar & Horodyskyj, n.d.). For the purpose of the current study, the section on stellar lifecycles was chosen as it provided a case of a commonly misconceived notion dealt with in a discovery-based learning environment. The Stellar Lifecycle task is not a ‘pure’ discovery-based environment but has some structure and scaffolding incorporated into it, as described below. Regardless, it serves the purpose of allowing us to explore how students experience environments where they have some flexibility in how they will progress through the task.

For this learning task, participants were asked to work through a series of screens that conform to a predict-observe-explain learning design (White & Gunstone, 1992). That is, participants first make a prediction (prediction screen) about what they believe is the relationship between star size and lifespan. Before moving on, they are also required to fill in a free text field explaining why they chose to make the prediction they did. From there, participants move onto a screen where they create virtual stars in a simulation space and observe what happens to the stars over time (observation screen 1). This space is displayed in figure 1.

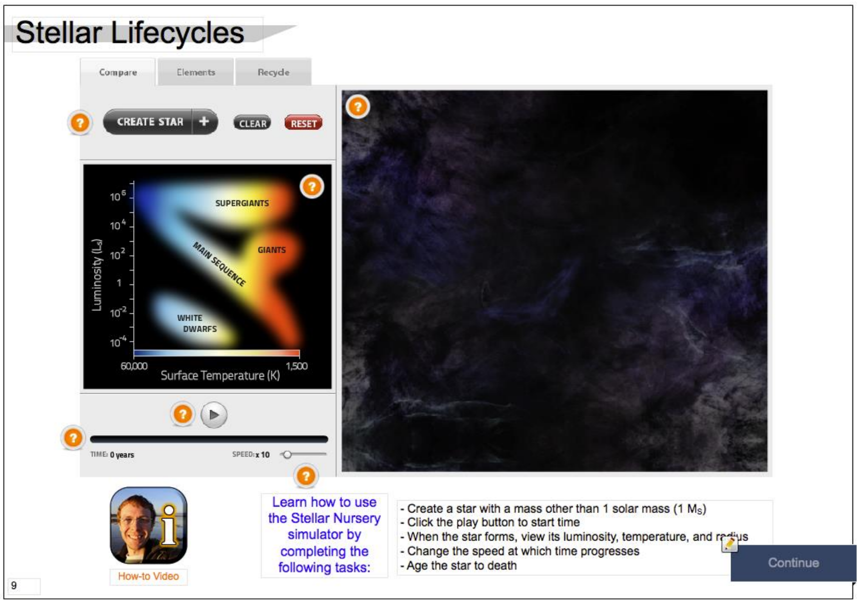

Figure 1. Observation screen for Stellar Lifecycle task

As can be seen in figure 1, there are numerous help options on the screen. There are also basic instructions on how to use the star simulator in the lower right hand portion of the screen. There is also an option for watching a 'how to' video in the lower left corner. A feature of the *Smart Sparrow* platform is that adaptive feedback can be given to students as they work through the tasks. The purpose of this screen is to allow students to create stars and see if their prediction holds. Students can run the simulator as many times as they wish before moving on. There is also the option of speeding up the simulator by manipulating the slide tool on the left side of the screen. Feedback and hints are given to participants if they are not using the stellar simulator effectively.

Upon completing the initial observation screen, participants then move to a more detailed simulation screen (observation screen 2), which has a very similar look and feel to the first observation screen. On this second observation screen, however, students are required to provide more detail in the simulator to create and age the stars. The main difference in the second observation screen is that participants are required to enter the mass and lifespan of the star. Again adaptive feedback was given to participants as they were completing the task, and as they were able to run through the simulator as many times as they wanted. Before moving on to the next screen, students were reminded of their initial prediction and asked if they still agreed with this or wanted to revise it.

Following the second observation screen, participants are simply asked to report what the correct relationship is between star size and lifespan by using a dropdown menu at the bottom of a screen (correct misconception screen). When they had completed this, participants were able to move on to the first of two explanation screens (explain screen 1 and 2). The first of these asked participants to estimate the shortest and longest lifespans of different classes of stars (according to standard classifications) in relation to mass. This estimation asks students to understand an extra layer of complexity to the content covered in the first few screens. While many stars fit within a main sequence where the relationship between surface temperature and luminosity is relatively consistent, some classes of star exist outside this main sequence. In the first explanation screen, participants are asked to incorporate this new information into what they have just learned. Examples of these classes of stars and their relationship to the main sequence are displayed on the left side of figure 1. White dwarf, giant and supergiant stars are all outside the main sequence so this detail is incorporated at this point in the task. The graph on the left side of figure 1 was also given to participants as a reference point on this first explanation screen. Again participants were provided with hints and feedback as they worked through the screen and were provided the option of attempting to enter the estimates as many times as they needed to.

A final screen was presented to participants to fully explain the lifespan of stars in relation to their mass. This screen included a video explanation, a reminder of their initial and corrected predictions and the correct estimates of the lifespans of different classes of stars. An overview of the learning design sequence of the task is presented in figure 2.

Figure 2. Overall learning design sequence for Stellar Lifecycle task

Video Stimulated Recall

The session was captured by screen recording software for a representative subset of 16 of the 24 participants. For practical and technical reasons, it was not possible to collect this data from all participants. These 16 participants were asked to complete a video stimulated recall session after they had completed their learning session. In this recall session, a research assistant played the screen capture of the learning session back to participants in its entirety. The video was stopped once every screen to allow participants to describe what they were doing, what they were experiencing, and what they were thinking at that point. The research assistant was trained in the use of prompting questions and took a handwritten transcription of the report of each of the participants about their experiences on each screen.

Survey

Participants completed survey instruments before and after completing the stellar lifecycle task to determine their overall impressions of their learning before and after the session. These instruments were based on similar instruments used in our previous studies (Lodge & Kennedy, 2015). Before completing the learning task, participants were asked to rate their confidence in their ability to learn about star lifecycles, how challenging they thought it would be to learn about star lifecycles and how much mental effort they felt they would need to invest in learning about star lifecycles effectively. These factors have been shown to be important considerations in the conceptual change process (Muller, Sharma & Reimann, 2008). Each of these ratings was made on a 0 – 10 scale with 0 representing “not at all” and 10 representing “very much so”. A second survey was used at the completion of the task. Participants again rated perceived confidence, challenge and mental effort on scales of 0 – 10 but were also asked to rate the degree to which they agreed that the task was interesting, enjoyable, confusing, frustrating and boring on Likert scales of 1 – 7 (with 1 representing “strongly disagree”, 4 representing “neutral” and 7, “strongly agree”). This survey also asked participants to provide demographic information.

Procedure

Participants were provided with information about the study and gave informed consent to participate as per the institutional ethics approval. Once completed, participants were given basic instructions about the sequence of the session. They were then given a survey to complete. After this, they were then permitted to complete the Stellar Lifecycle task at their own pace. At the conclusion of their learning session, participants were given the post-session survey to complete and then a subset of participants were asked to complete the video stimulated recall exercise. Once participants had completed all phases of the study, they were debriefed and given their compensation for completing the study.

Analytic coding of the responses to the prompts in the video stimulated recall session was conducted after the completion of the data collection. Thematic coding of the reported experiences of participants was conducted by one member of the research team and was then confirmed by a second member of the project team to ensure reliability of the coding process. The experience of participants on each screen was coded in such a way as to distil their experiences into a dominant theme (as per Merriam, 2009). Where participants reported experiencing several subjective states, the more prominent of these was chosen as the overarching theme being expressed at that point in the task. The resulting data therefore captures the prevailing experience of participants as they progressed through the task rather than a comprehensive survey of all of their subjective states at all points.

Results and discussion

Misconceptions

As expected, all participants except two incorrectly predicted the relationship between star size and lifespan on the prediction screen, indicating widespread misconceptions. Five participants reported explicitly that they took a random guess. The two participants who correctly predicted the relationship later reported they had guessed and that they did not know what the answer was. This supports the assumption that the relationship between star size and lifespan is a common misconception and, more to the point, the participants in this study showed this misconception. This observation also supports the notion that all participants in this study have started from a similar level of prior knowledge with the majority having an incorrect view of the concept in question.

Video stimulated recall

As reported, video stimulated recall was conducted with 16 of the 24 participants who completed the study. Summaries of the thematic analysis across participants for each screen are outlined below.

Prediction screen
As described above, the majority of participants made an incorrect assessment of the relationship between star size and lifespan. The main theme that emerged from the prediction screen was that the detail given on the screen confused participants, particularly the graph on luminosity that was included in the left side of figure 1. Nine of the participants reported that the graph confused them. The luminosity graph is only indirectly related to the star size-star lifespan relationship and the inclusion of the graph could be considered seductive details; details that are interesting but superfluous to the main intention of the lesson (as per Harp & Mayer, 1998). Whatever the cause, the observations from this screen highlight an important distinction between confusion that is caused by elements of the environment and confusion that is caused by the conceptual nature of the content. Future studies will need to be mindful of separating affective responses to elements of the environment and task from affective responses that are directly related to the conceptions at hand. This observation aligns with those we made previously in relation to tasks on pharmacodynamics and blood alcohol concentration (Lodge & Kennedy, 2015).

Observation screen 1
There was a mixed response to the information presented on this screen and several different themes emerged from participants' responses. While there was an overall theme of confusion and unhelpfulness in relation to elements of the screen, there also was an element of confidence and engagement in the reports, with seven participants reporting that they felt like they were making solid progress at this point. Two participants reported that they felt overloaded and confused as a result. Four others mentioned that they were explicitly confused at this stage. For example, one claimed "there is a lot going on in this page, I got confused". Two participants reported making the same errors multiple times by re-entering incorrect values into the simulator. There was more variance in the reports of participants as they worked through this screen than on the first. This again may be a reflection of different triggers (i.e. confusion triggered by the environment, the task or the concepts) and consequently of different affective trajectories.

Observation screen 2
The dominant theme to emerge from this screen was one of resolution. Six of the participants reported that they had developed a strategy of using specific intervals in the information they inputted into the star simulator. One stated: "I chose masses 2, 10 and 25 because it seemed the right range for low, medium and high". Despite this, there was still one participant who was confused about the luminosity by surface temperature graph. While there was still some sense that there was confusion among the group, there was a clear indication that the initial misconception was resolved as a result of the observations conducted in the observation screens.

Correct misconception screen
Participants spent very little time on this screen (14.8sec compared to the overall average screen time for all other screens of 153.9sec) and all managed to correctly select that smaller stars tend to have longer lifespans. The dominant theme to emerge from this screen was again one of resolution. Five participants explicitly stated that they were "very confident" in their knowledge by this stage. All participants managed to correct their misconception so the emergence of resolution as a theme is not surprising.

Explain screen 1
There was again some variability in the themes that emerged from participants' responses at this stage. While the dominant themes to emerge were again confusion, resolution and engagement, some sense of frustration was also expressed. One participant claimed that they "expected to be correct" while another claimed that they "didn't understand star classes and what they meant", further stating that they "found it really annoying". Nearly half of the group (seven) relied on the adaptive feedback provided on this screen to complete the task as they reported having difficulty filling out the approximate lifespans for each of the star classes so it is perhaps not surprising that frustration emerged as a theme here.

An extra layer of complexity was added at this point of the task (see explanation in "materials" above) as participants were asked to consider star classes that exist outside the main sequence. Ten of the 16 participants explicitly stated that they were confused by the numbers they needed to input into the screen (i.e. millions, billions and trillions of years). So while there had been one cycle of participants being confused and resolving the confusion and the misconception, this screen tended to plunge participants into a second round of confusion. The persistent experience of being confused may have led some to become frustrated, as predicted.

Explain screen 2
The main theme to emerge from the final screen in the task was again one of resolution. Eleven of the 16 participants reported that they were confident they understood the content of the task at this stage. Five further mentioned that they found the content presented in this final screen 'very interesting' and stated that they wanted to learn more. What this suggests is that participants were largely able to cycle through two rounds of confusion and resolution. Despite this, there was also some indication that some participants were frustrated and bored. Seven participants reported not paying attention to the video that provided further explanation of what the nature of the lifespan of stars is and this may have been a symptom of their boredom or frustration. Conversely, five participants felt that the video was important and watched it intently.

Individual pathways through the task
The thematic analysis conducted and described above was aggregated across all participants to provide a visual representation of the transitions between affective states participants experienced during the session. These are displayed in Figure 3.

As can be seen in the figure, participants reported various different affective experiences as they worked through the task. For example, one participant started off working through the task by being engaged but quickly became confused. She reported considering the information provided about luminosity when making a decision about which of the available options to choose. Moving along to the first observation screen, this same participant demonstrated that she was very much in a state of confusion. She reported:

> *"I got confused because data deletes when the star dies. 200 was not working, so I changed to fifteen. Didn't know what to do. Keep on trying. Noticing that smaller masses, life is longer. Try 300, still haven't realised. Tried "elements" and "recycle" because maybe I'm missing other options… not sure what I was doing. Didn't quite understand left graph and relationship to right."*

This participant then moved onto the second observation screen where she reported that she was developing an understanding of the correct relationship between star mass and lifecycle. She said “I was thinking I was pretty sure”, suggesting that she had managed to work through her confusion and had attempted to address whether or not her initial misconception was correct. When then reaching the correction of the misconception screen, this participant had little hesitation in changing the dropdown menu to reflect the correct star size to lifespan relationship. She then demonstrated an engaged approach to the explanation screen:

> *“Looking at numbers in the graph on the right. I change the numbers to match. I prefer 1 by 1 - my style. I use mouse to track - counting billions or trillion. I expected to be correct.”*

This description of the approach taken by the participant at this stage resembles the systematic approach taken by a proportion of students, as reported in Dalgarno et al. (2014). By this we mean that, similar to the observations in that study, this participant altered one variable at a time to determine “1 by 1” what the relationship between the variables is. This participant then completed the task by working through all the information in the second explanation screen. She reported that she found this part of the task interesting and wanted to learn more.

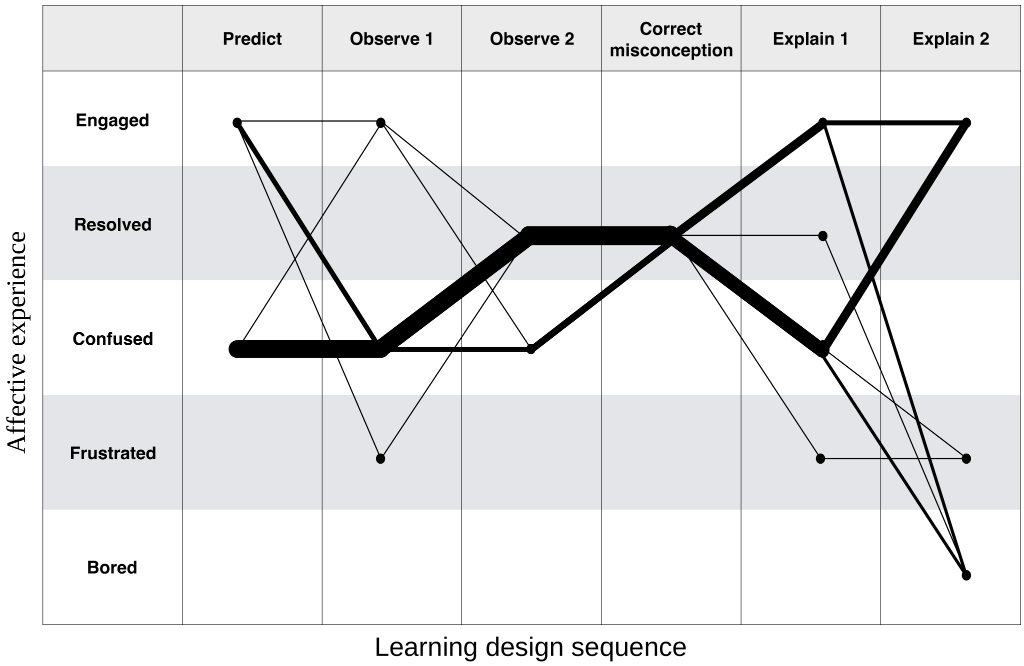

Figure 3. Affective transition diagram showing changes in participant experience through the stellar lifecycle task (heavier lines representing more participants following the path)

As can be seen in Figure 3, several other participants followed a similar pattern through the task (confused-resolved-engaged). However, a number of participants demonstrated a different pattern of responses. For example, two participants began in a state of confusion, resolved the confusion in the second observation screen and were initially engaged in the explanation of stellar lifecycles in explanation screen 1 but became bored by explanation screen 2. For example, one of the two stated that they “wanted to know more” suggesting they were engaged but then shifted to saying “I wasn’t so interested; wasn’t explained efficiently; lost interest”. Other participants were initially uncertain and confused, managed to resolve their confusion in the screen where they were asked to correct their misconception but became frustrated and disengaged by the time they reached the explanation screens. One participant claimed, “I got annoyed… it was too long… it went from very interactive to very ‘sit and watch’”.

These results suggest that this discovery-based learning environment, through its design, provided sufficient support and scaffolding to ensure that all participants effectively overcame their initial misconceptions or lack of knowledge about star lifespans and were able to achieve conceptual change. It seemed that, from the video stimulated recall and the recordings of students’ interactions within the environment, that the adaptive feedback played a role in keeping participants on track. In most cases, the feedback helped to correct information that was entered incorrectly into the screens. For example, the feedback given to participants on the first explanation screen helped them to set ranges for the classes of stars that were within the required range. The feedback given to participants took a form such as: "Your range of lifetimes for M class stars is incorrect. Run a star at 0.06M and one at 0.40M to determine the full range of ages for M class stars.” So while participants were relatively free to work through the task in their own way, the environment was not completely unstructured. Feedback was also given to students when they strayed too far from the "correct" path through the task. For example, participants were told if they had not completed important elements in the process such as leaving fields blank that should be filled in. These two mechanisms of feedback – adaptive pop up screens and hints about the sequencing of activities – are possibly the most important aspects of the design of this stellar lifecycle task from an affective perspective. That is, these built-in feedback mechanisms not only kept students focussed on the content and adaptive pathways within the learning task, they may also have warded off confusion and, importantly, persistent confusion that may lead to boredom and frustration.

When taken together the thematic analysis of students' affective responses from the VSR suggest that while students showed different learning actions and pathways though the task, and also different affective trajectories while traversing the material, there was some consistency in the "confusion to resolution" pathway. All roads lead to Rome.

Self report survey responses

While patterns were evident in the affective transitions participants made during the task, we also examined their overall impressions of the task. This provided an important contrast between participants shifting experiences during the task and their overall impressions.

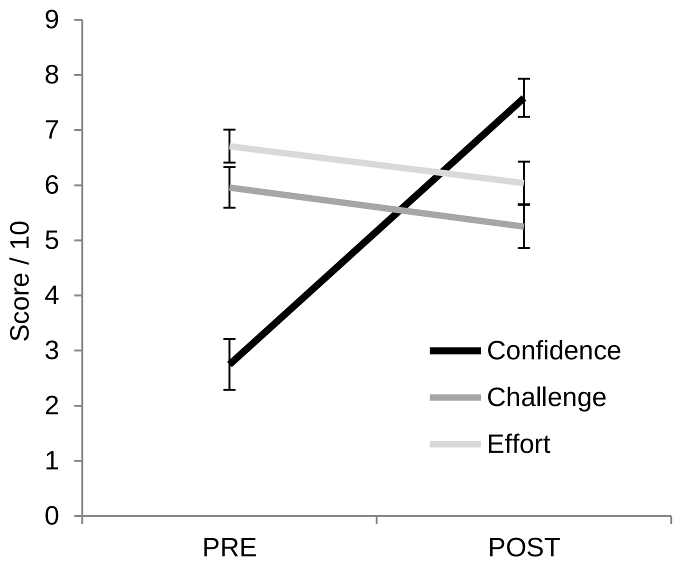

Figure 4. Mean (SE) pre and post-session ratings of confidence, challenge and effort

As can be seen in figure 4, participants reported relatively low levels of confidence in their ability to understand the material before the session (M = 2.75, SD = 2.3) compared to their assessment of how challenging the material would be (M = 6.0, SD = 1.8) and how much effort they would need to expend (M = 6.7, SD = 1.5). This relationship was reversed in the post task assessment. While there was a drop – but no significant difference – in participants' reported mental effort (F (1, 23) = 4.135, p = .054, partial eta squared = .15) and challenge (F (1, 23) = 2.33, p = .14, partial eta squared = .09) before and after the session, this was contrasted with participants reported confidence which significantly increased as a result of completing the session, (F (1, 23) = 75.27, p < .01, partial eta squared = .77).

Figure 5 shows participants ratings of their affective responses to the learning task after the session which indicate that they were more likely to report the session was interesting (M = 4.3, SD = 1.6) and enjoyable (M = 5.2, SD = 1.2) than confusing (M = 3.0, SD = 1.7), boring (M = 2.5, SD = 1.5) or frustrating (M = 2.4, SD = 1.5). While when asked to respond after the session participants predominantly indicated they enjoyed and found the task interesting, their experiences when prompted during the video stimulated recall suggested they spent a substantial amount of time being confused. Thus, there is evidence of a discord between measurements of affect completed through participants' global assessments and those completed through video stimulated recall.

Social desirability may in some way account for this; student participants may be more inclined, in a university context, to indicate to researchers they were more positive about the experiment and less confused or bored by it, in order to avoid any embarrassment or tension. However, leaving aside the potential of response bias due to social desirability, the findings also suggest that the specific affective transitions experienced by participants through the stellar lifecycles task (Figure 3) were not entirely reflected in the global assessment that participants made of their overall learning experiences (Figure 5). It is possible that retrospective, global ratings of affect inevitably ask students to commit to a "composite" self-assessment of their affect – students give a general estimate of their feelings about the entire learning session or task. And it is also possible that an individual's global assessment of affect could be different from assessments of their affective responses to specific components of the task. In effect, their assessment of the affective sum is different from their assessment of the affective parts.

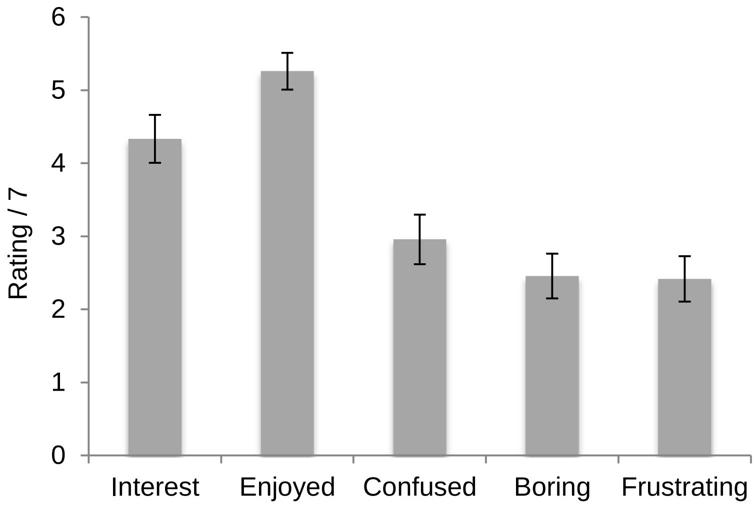

Figure 5. Mean (SE) affective ratings post-session

This potential raises important methodological questions about the investigation and measurement of students' affective responses to learning tasks. One interpretation of the findings from this study is that researchers may not be able to assess learning confusion by asking students at the conclusion of the task. That is, any assessment of affect needs to be closely tied with specific components and attributes of the task, as affect dynamically changes across open ended tasks and retrospective global measures are not able to capture this.

Researchers such as Rotgans and Schmidt (2014) and Ainley and Hidi (2002) provide useful rubrics that may act as the basis for further research in this area. These researchers, while investigating self-regulation and interest rather than confusion, considered how task-based changes in students' learning states impact on their learning strategies, processes and outcomes. Therefore, future research could fruitfully investigate the temporal, task-based nature of confusion and how the dynamics of confusion about the environment, about the task requirements and about the concepts interact to influence the student experience. This research would be useful in determining when students spend long periods of time being confused, which may lead to frustration and boredom (see Arguel, Lockyer, Lipp, Lodge & Kennedy, in press). Moreover, understanding, measuring and "seeing" specifically when students are confused during learning tasks, will be foundational to the provision of feedback to students both about their understanding of the content of the task and their approach to it, hopefully leading to the resolution of confusion and productive learning.

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References

Ainley, M. D., & Hidi, S. (2002). Dynamic measures for studying interest and learning. In I. P. R. P. M. L. Maehr (Ed.), *Advances in motivation and achievement: New directions in measures and methods*. (Vol. 12, pp. 43-76). Amsterdam: JAI.

Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2011). Does discovery-based instruction enhance

learning? *Journal of Educational Psychology*, *103*(1), 1–18. doi: 10.1037/a0021017
Anbar, A. & Horodyskyj, L. (n.d.). *Habitable Worlds (HabWorlds)*. Retrieved from www.habworlds.org
Arguel, A., Lockyer, L., Lipp, O., Lodge, J. M., & Kennedy, G. (in press). Inside out: ways of detecting learners' confusion for successful e-learning. *Journal of Educational Computing Research*
Brown, D. E. (1992). Using examples and analogies to remediate misconceptions in physics: Factors influencing conceptual change. *Journal of Research in Science Teaching*, *29*(1), 17-34.
Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*, *31* (1): 21–32.
De Jong, T., & Van Joolingen, W. R. (1998). Scientific discovery learning with computer simulations of conceptual domains. *Review of Educational Research, 68*, 179–201.
Dalgarno, B., Kennedy, G., & Bennett, S. (2014). The impact of students' exploration strategies on discovery learning using computer-based simulations. *Educational Media International*, *51*(4), 310–329. doi: 10.1080/09523987.2014.977009
D'Mello, S. K. & Graesser, A. C. (2014). Confusion. In R. Pekrun & L. Linnenbrink-Garcia (Eds.), *International handbook of emotions in education*. New York: Routledge.
D'Mello, S., Lehman, B., Pekrun, R., & Graesser, A. (2014). Confusion can be beneficial for learning. *Learning and Instruction*, *29*, 153–170. doi: 10.1016/j.learninstruc.2012.05.003
Harp, S. F., & Mayer, R. E. (1998). How seductive details do their damage: A theory of cognitive interest in science learning. *Journal of Educational Psychology*, *90*(3), 414.
Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London, UK: Routledge.
Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, *41*(2), 75–86.
Kuhle, B. X., Barber, J. M., & Bristol, A. S. (2009). Predicting students' performance in introductory psychology from their psychology misconceptions. *Journal of Instructional Psychology, 36*, 119–124.
Lehman, B., D'Mello, S., & Graesser, A. (2012). Confusion and complex learning during interactions with computer learning environments. *The Internet and Higher Education*, *15*(3), 184–194. doi: 10.1016/j.iheduc.2012.01.002
Lodge, J. M. & Kennedy, G. (2015). Prior knowledge, confidence and understanding in interactive tutorials and simulations. In T. Reiners, B.R. von Konsky, D. Gibson, V. Chang, L. Irving, & K. Clarke (Eds.), *Globally connected, digitally enabled*. Proceedings ascilite 2015 in Perth (pp. FP:178-FP:188).
Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? *American Psychologist*, *59*(1), 14.
Merriam, S.B. (2009). *Qualitative research: A guide to design and implementation* (3rd ed.). San Francisco: Jossey-Bass.
Muller, D. A., Sharma, M. D., & Reimann, P. (2008). Raising cognitive load with linear multimedia to promote conceptual change. *Science Education*, *92*(2), 278-296.
Pressley, M., & Ghatala, E. S. (1990). Self-regulated learning: Monitoring learning from text. *Educational Psychologist*, 25(1), 19-33.
Rotgans, J. I., & Schmidt, H. G. (2014). Situational interest and learning: Thirst for knowledge. *Learning and Instruction*, *32*(C), 37–50. DOI: 10.1016/j.learninstruc.2014.01.002
Schwarzschild, M. (1958). *Structure and evolution of the stars*. New York, US: Princeton University Press
Trevors, G. J., Muis, K. R., Pekrun, R., Sinatra, G. M., & Winne, P. H. (2016). Identity and epistemic emotions during knowledge revision: A potential account for the backfire effect. *Discourse Processes, 53* (5-6), 339-370, DOI: 10.1080/0163853X.2015.1136507 .
White, R. T., & Gunstone, R. F. (1992). *Probing understanding*. London: Falmer Press.
Zimmerman, B. J., & Paulsen, A. S. (1995). Self- monitoring during collegiate studying: An invaluable tool for academic self- regulation. *New Directions for Teaching and Learning*, *63*, 13-27.

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Engineering professional identity practices: Investigating the use of web search in collaborative decision making

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Collaborative learning and problem solving are important aspects of engineering professional practice that need to be addressed in preparing competent engineering graduates and forming their professional identities. Taking the *learning as becoming a professional* perspective, we illustrate the diversity of engineering practices in a collaborative decision-making episode, where students' participation in the activity is mediated by their use of web search. We present how our development of the *implied identity* approach could help to understand how technology mediates collaborative sense making in relation to professional practices and identities. We illustrate this by providing examples of ways in which students use web information to justify their decision making.

Keywords: Collaborative learning, Engineering education, Implied identity, Professional identity, Sense making, Web search

Introduction and background

Higher education is expected to prepare globally competent professionals in different areas, such as engineering, teaching, and medicine. In other words, learning in higher education should be oriented towards becoming a professional and the development of one's professional identity. In this paper we explore professional engineering identity practices during collaborative work.

Identity is a central aspect of learning from a situative perspective (Wenger, 1998). From this perspective, identity formation and learning practices are inseparable and jointly accomplished between individuals through their interaction with context, tools, and cultural norms. Therefore, understanding learning practices requires looking at joint accomplishments through engagement and participation in particular activities (Greeno, 1998; Lave & Wenger, 1991; Rogoff & Lave, 1984; Wenger, 1998; Gresalfi, 2009; Langer-Osuna, 2011; Hand & Gresalfi, 2015; Cobb et al., 2009; Gresalfi & Cobb, 2011).

Web search mediated collaboration and sense making

Information seeking and sense making are two important aspects of collaborative learning and problem solving. There is an increasing attention to collaborative information seeking (Twidale, Nichols, & Paice, 1997; Hansen & Jarvelin, 2005; Reddy & Spence, 2008) and sense making in different fields of studies (Jacobson, 1991; Dervin, 2003; Sarmiento & Stahl, 2006; Paul & Morris, 2011). On the importance of sense making, research has shown information-seeking practices in organizations are more influenced by participants' understanding of the information, than the information itself (Hansen, & Jarvelin 2005). Sense making plays a crucial role in collaborative learning and decision making. However, understanding how technology mediates the process is still a challenging problem and an important issue to be addressed (Whittaker, 2008).

In addition, little is known about technology mediated collaboration and sense making in relation to identity practices. Understanding collaborative practices of identity is particularly important when looking at learning in the context of higher education and more specifically in areas such as engineering education where teamwork projects are at the core of students' assignments and activities. Students' collaboration is often mediated by using different resources such as web information. Although web search engines are mainly designed to serve individuals for information seeking purposes, there is evidence of collaborative access and decision making in web search (Evans & Chi, 2008). In this paper, we explore joint accomplishments of identity in a collaborative problem solving environment mediated by web search. Following this, we briefly review approaches in identity research that may inform such inquiry.

Sense making in identity practices

Sense making in identity research can be approached by looking at a person's (or group's) response to the affordances of the environment. Studies addressing this concern often distinguish between one's identity and expectations of *being*. Previous research have coined terms to differentiate *normative* and *personal* identity (Cobb, Gresalfi, & Hodge 2009), *actual* and *designated* (expected) identity (Sfard & Prusak, 2005), and *intended* and *implied* identity (Khosronejad, Reimann, & Markauskaite 2015). Cobb and colleagues (2009) have identified normative identity in the context of mathematics education, as "a doer of mathematics that is established in the classroom" and looked at personal identities that "individual students develop as they participate in class room activities" (p. 43). They further demonstrated that learners articulate different forms of expectation- of what it meant to participate in mathematics- in their class. Furthermore, learners have a preference for specific norms, due to the ways they perceived themselves.

According to the recent study of identity practices (Khosronejad et al. 2015) such differences in perceived normative identities can be explained through the concept of *implied identity*- as the mediator between the social environment and people. The concept refers to interpretations of normative identities. In the current study, we apply the implied identity framework, as we are interested in understanding how aspects of identity are perceived and put into practice through a group's interaction and use of resources including web information. Therefore, we build on previous research to unpack technology mediated collaborative practices and sense making in relation to aspects of professional identity.

Theoretical approach

Implied identity is a theoretical approach (Khosronejad, Reimann, & Markauskaite 2015) to study professional identity practices. The framework looks at the individual's or a group's sense making of available resources through the concept of implied identity. It refers to the interpretation of either an individual, or a collective group of people from resources, about what it means to be a professional. The context of experience is identified as a resource with suggestions of *becoming*. As an example, a team work activity at the university is a resource with a potential suggestion that collaboration is an aspect of one's identity in the field of its inquiry. In addition, assigning students tasks that require writing implies that having writing skills is an essential part or at least a dimension of being a professional. However, the student's implied or perceived identity depends on the individual's interaction with the resource and what s/he brings to the experience. Not all students may perceive and accept, in a direct sense, that team work activities are indications of the collaborative nature of their future work. The perception may be in contrast to their ideal image of being a professional who works individually.

The implied identity perspective argues that differences between *perceived identity* and *ideal identity* or perceptions of self (*what one thinks about her own abilities and ways of being*), lead to reflections and internal dialogues towards decision making (Figure 1). Therefore, sense making processes involve the negotiation between different perceived identities and is mediated through reflection.

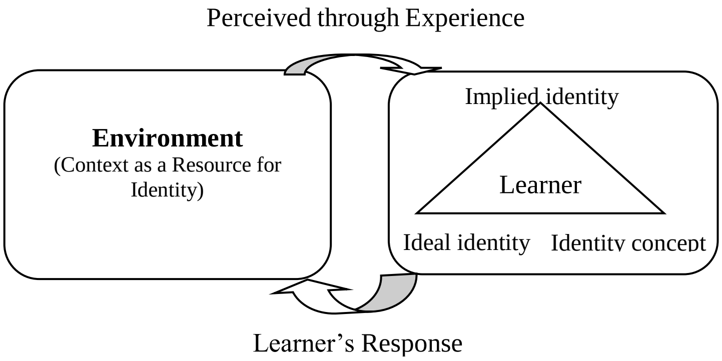

Figure 1. Implied identity: A framework to study professional identity practices (Khosronejad et al. 2015)

The framework provides tools needed for the description of collaborative sense making and participants' response to intended aspects of designed learning activities. In the current study, we look at the emergence of engineering identities during a collaborative decision making environment and explore the interaction between individuals as well as individuals' interactions with different resources including task description and web information. We further investigate how dispositions brought to the situation by individuals may influence such interactions.

Method

We take a qualitative approach to take an in-depth look into one participant group's collaboration and address the following research questions:

1. How do engineering identities emerge as a joint accomplishment in response to identities intended by educational design?
2. How are web resources used for collaborative sense making in relation to professional practices and identities?

Participants and setting

Participants of the study were Chemical Engineering students from one of the leading universities in Australia located in a metropolitan area. Participants were purposefully invited among enrolled students in a course about sustainability and the recruitment process was facilitated by the unit coordinator for ethical considerations and maximizing students' participation. A selected group for this paper consisted four international exchange students including Alex, Sam, Sally, and Mandy, who voluntarily participated in the study (we use pseudonyms here to protect the participants' anonymity). The collaborative session was two hours long, conducted at a special studio designed for studies of group collaboration, and was video and audio recorded. Participants had access to shared platforms for communication including writable walls and a compute.

Task

A task was assigned to facilitate all dimensions of engineering work based on Figuierdo's (2008) four dimensional model and engineering graduate attributes. To this end, a *wicked* problem on sustainability was selected for participants to provide solutions for air pollution in mega cities. Wicked problems have no definitive and clear right or wrong answer and no immediate test of their resolution or possibilities for trial and error. There are consequences to every solution given to the problem (Rittel & Webber, 1973). Working on wicked problems about sustainability promotes the inclusion of different perspectives in the discussion, and facilitates decisions that consider environmental, social and economical concerns.

The task was designed in consultation with an academic expert in sustainable design and engineering. Participants were asked to provide solutions for air pollution in mega cities, prioritize their solutions based on their proposed criteria, and prepare a report.

Data collection and data analysis

Students' collaboration was video and audio recorded. Each group of students was asked to use one computer, whose screen activity was also recorded.

In the first round of analyzing the video data, the aim was to investigate practices of professional identity. Audio transcriptions were analyzed qualitatively applying both inductive and deductive approaches to find practices of engineering identities. We applied Figueiredo's (2008) four dimensional model of engineering to guide our deductive analysis and find episodes of collaboration that draw on engineering as a) basic sciences, b) design, c) practical realization and d) social sciences. Respectively these dimensions were supported by examples such as the use of statistical information, drawing on intuition and personal experience in decision making, suggestions for creating artefacts, and paying attention to the needs of end users and society.

The analysis was conducted using NVivo software. More specific sub categories were added according to the description of each dimension. A new category was added for the engineering as environmentalist to highlight concerns about environment and sustainability (Khosronejad, Reimann, & Markauskaite, 2015).

In the second phase of the analysis, we applied the implied identity framework to investigate the emergence of identity practices as the group progressed through the activity and made decisions. We used interaction analysis (Jordan & Henderson, 1995) to study participants' interaction, with one another as well as with the task and web resources (Figure 2). We investigated the perceived identities that mediated participants' responses to identity resources.

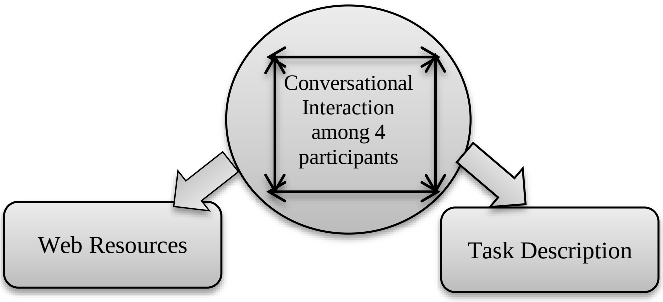

Figure 2: Participants' interaction during collaboration

In the analysis of group interaction, we followed what each participant suggested in relation to the four dimensions of engineering identity. These suggestions were made through talk and were either the result of their interpretations of the task and web resources or were manifestations of their beliefs about legitimate practices. We further looked into how different suggestions were picked up or refused by a group as a joint accomplishment.

Result

Findings suggest that group's main practices of engineering identity include engineering as design and engineering as practical realization through different phases of decision making (Table 1). In the first two phases of decision making, the group relied on intuition, and drew on participants' personal experience and knowledge to make decisions. Therefore, their practice was interpreted as engineering as design.

The third phase of decision making is to provide solutions for the problem of air pollution. The group was mainly focused on the creation of artefacts such as filters and therefore their practice was indicative of engineering as practical realization.

Table 1: Identity practices in different phases of decision making

Decision Phase	Dimension of Engineering Practiced
Phase 1: Choosing a city	Engineering as design: Having personal experience and knowledge of the selected city
Phase 2: Finding sources of air pollution	Engineering as design: Relying on intuition and personal experience
Phase 3: Finding possible solutions to the problem	Engineering as practical realization: Creating artefacts

To answer the research questions, we now take an in depth look into the first episode of collaboration where the group decided to select a specific megacity in approaching the task. Our focus is only on the sequence of talk and turn taking. We illustrate how the group began collaboration and moved towards decision making by practicing engineering as design. We further examine how web resources were used to guide or justify group's decisions.

Contextual thinking and "engineering as design"

L1. Sally: Should we pick a city maybe, like it could be easier to, if you focus on a specific place?
L2. Sam: Yeah, because they mention culture somewhere here. Oh yeah, also address ethical considerations as well as technologies as part of your discussion. So I think we should pick a country.
L3. Sally: I need to have a context.
L4. Sam: New Delhi.
L5. Sally: Could be. I know nothing about it but… in India.
L6. Mandy: That could be tough

At the beginning of the collaboration, Sally suggests it is easier for the team to select a specific city before continuing to work on the problem (Line 1). Sam supports her suggestion by referring to the task description (Line 2) and explaining later that a consideration of “cultural aspects” is required and so it will be helpful to think contextually. The task as a resource is used to justify the decision of contextual thinking.

Then the group starts brain storming about possible cities. Sam proposes New Delhi first. This is followed by Sally’s statement that she doesn’t “know about it” (Line 5) which implies her preference of selecting a city that she has personal knowledge and experience about. Sally’s turn in talk has a suggestion of implied identity to practice “engineering as design” because it draws on the use of personal experience in decision making. This is inferred via a comparison with alternative ways of engineering practice such as when engineers rely on statistical information for decision making and practice engineering as “science”.

The group continues with brain storming, naming Beijing and Santiago as other options while Sally starts using the computer to search for “most air polluted city”. Sam guides the group’s decision to use the first link among suggested Google responses, a link to a CNN article. In approaching the article, the group mostly attends to the visual map of cities (Figure 3).

L7. Alex:	Do we really have to choose one city?
L8. Sally:	I think you have to talk about the environment
L9. Sam:	Have to talk about culture
L10. Alex:	It would be good if we chose one ((place)) that we know.
L11. Sam:	Well all of them are in Asia ((refers to online information- Figure 3)). ((group looks through the page))
L12. Sam:	Oh it’s a map. Really are the most polluted cities over here, in that region?
L13. Alex:	Because I don’t know so much about these cities, you know, to talk about them. ((group discusses about the cities))
L14. Mandy:	scroll up please. Cities with greatest annual mean blah blah ((referring to the content of the article)) which is one of the most dangerous pollutant for human health. See if you can get a website for this air pollution database, the data source for the picture ((referring to the map)).

Note: Double parentheses contain transcriber’s descriptions rather than, or in addition to, transcripts of talk in interaction.

As they look through the webpage, Alex challenges the idea of choosing one city in approaching the task (Line 7). Sam and Sally defend the idea of contextual thinking one more time by referring to the task requirement of talking about “environment and culture” (Line 8 and 9). Consequently, Alex agrees with them (Line 10).

Sam suggests the current (CNN) article is drawing on examples from Asia only, implying that it may not be a good resource (Line 12). Following the group’s further reflection on the illustrated map, Mandy suggests they track down the “Ambient Air Pollution Data Base WHO 2014” resource cited in the article (Line 14).

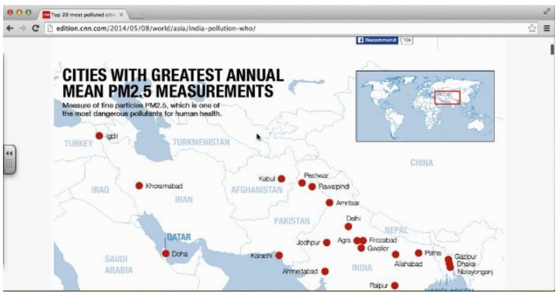

Figure 3: Web search to assist brain storming

((Sally initiates the search by opening the new window))

L15. Alex:	Don’t you think you can talk about like Rio or Sao Paulo?
L16. Sally:	We can
L17. Alex:	Because we know, like better… about the culture.
L18. Sally:	We can even talk about Sydney.

However, before the search for the new resource is complete, Alex’s suggestion to select Rio or Sao Paulo interrupts the process (Line 15). Alex has now accepted the implied identity of “engineering as design” as his suggestion is following the idea of having personal knowledge and experience about the selected city. He is building on previous turns in conversation in the favor of this dimension of engineering identity. Sally re-builds on the idea (Line 16) and suggests “Sydney” (Line 18).

Being specific: Setting stage for "engineering as science"

L19. Sam: But is Sydney that pollutant?
L20. Sam: And actually it's saying mega cities. Is that a specific concept or any city that's big? What is the concept of a mega city, can you check that, please?
((group searches for "megacity" and opens the page as shown in Figure 4, they agree to select a city with more than 10 million people in its population, and they continue brainstorming))

Sam asks if Sydney is polluted (Line 19) and if the team should have a look into the concept of megacity (Line 20). Therefore, Sally searches for "megacity" in Google and clicks on the Wikipedia link (Figure 4) explaining the concept. As the group is looking over the list of mega- cities, they encourage one another to come up with a decision and move to the next phase to continue discussing sources of air pollution with references to the task description.

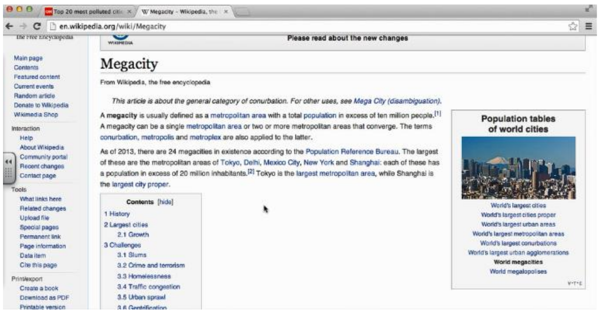

Figure 4: Search to find exact definition

Reminder for a facilitator: Towards engineering as "social practice"

L21. Alex: So first have to choose the facilitator
L22. Sally: I don't think we have to choose the facilitator. I think we'll be fine.
L23. Alex: The problem is she asks for her work, you know. I think she wants someone.
Who wants to be… who wants to be the facilitator? But this person will always get to discuss as well.
L24. Sally: So Alex, because you're worried about it so
((group choses Alex as a facilitator, he agrees, and the topic is changed to the selection of the city))

Alex reminds the group about choosing a facilitator (Line 21). Sally rejects the idea (Line 22). The group discusses whether the facilitator can also engage in decision making. Alex emphasizes that selecting a facilitator is an important part of their collaboration with references to the task description and researcher's request (Line 23). Sally suggests that "the one who is concerned should" take the position (Line 24). Therefore, Alex accepts to be a facilitator and starts taking notes of group's discussion using the writeable wall. Despite the intended aspects of "engineering as a social practice" in the design of the task and the perceived implied identity to position one member as a facilitator, all members except Alex are reluctant to accept the suggestion. This means that "engineering as a social practice" is rejected by the majority.

Engineering as science to justify engineering as design decision

L25. Mandy: Ok do we want to talk about Sau Paulo then?
L26. Alex: Is Sau Paulo that pollutant?
((searching for "Sau Paulo air pollution", and reading through the first article, Figure 5))
L27. Group: So, Sao Paulo is the chosen city.

The group gets back to the previous topic of choosing a city, with Mandy suggesting Sao Paulo as an option (Line 25). Alex asks if Sao Paulo is "that polluted", a question that builds on the previous turn in talk to be "specific" in terms of the definition of "megacity" (Line 26). Sally searches for "Sao Paulo pollution" in Google to answer the question. She clicks on the first link "Air pollution in Sao Paulo kills more people than car accidents…" (Figure 5). As Sally reads through the title, everyone agrees to select Sao Paulo (Line 27), and Alex stands up to take notes using the main wall. Alex's taking up the position of a facilitator is reinforced by team members calling out "Go facilitator!"

Figure 5: Search to confirm decision made based on personal knowledge

As the details of the collaboration show, the group's use of web resources in phase 1 is influenced by their initial decision to rely on personal experience in tackling the problem. Sally's initial suggestion of selecting a context that they have personal experience about (Line 1) offers the implied identity of engineering as design, which is further accepted and practiced in next turns in talk. The group builds up on the idea irrespective of the information they read on the web. A summary of the group's transition between different dimensions of engineering identity practices and their use of web resources is shown in Figure 6. In this phase of collaboration, web resources are used to justify and assist group's practices of "engineering as design".

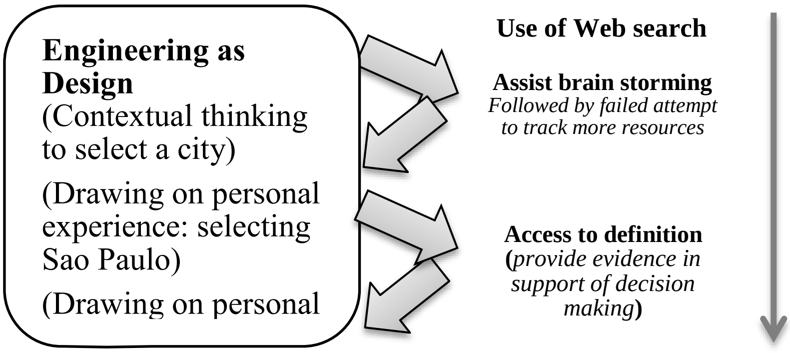

Figure 6: Phase 1 decision making practices in relation to dimensions of identity

Discussion and conclusion

This paper looked at the emergence of engineering identities in relation to local affordances of the collaborative environment including the use of online information retrieved through web search. The result builds on previous research to show that local practices of identity are inseparable from activities (Hand & Gresalfi, 2015), with an emphasis on how one participant's ways of being acts as a resource for others during collaboration and influences joint accomplishments of identity in relation to both the task and the online information. Therefore, the individual's way of being becomes part of the context shaping other individuals' interaction with resources, in a dynamic and non- neutral sense to guide the group's interpretations and practices of identity. Similar insights are pointed out by research looking at interpersonal aspects of communication in relation to the use of resources (Greeno & MMAP, 1998; Gresalfi, 2009).

The *implied identity* framework conceptualizes online information as a potential resource for identity practices with suggested ways of being. However, our result shows that, in one episode of collaboration, web information is used only to justify decision making practices. This is an example of accommodative use of web search, meaning the search of information is meant to accommodate the decisions made rather than guide the group to different decisions and new ways of professional practice.

We conclude that collaborative sense making in web search and the use of web information was mediated by implied identities initially perceived through interpersonal interaction. Future research may further explore how online information is played out in the group's decision making in relation to the practices of identity.

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References

Cobb, P., Gresalfi, M. & Hodge, L. L. (2009). An interpretive scheme for analyzing the identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education*, 40(1), 40-68.

Dervin, B. (2003). *From the mind's eye of the user: The sense-making qualitative-quantitative methodology*. In B. Dervin, L. Foreman-Wernet, & E. Lauterbach (Eds.), Sense-making methodology reader: Selected writings of Brenda Dervin. Cresskill, NJ: Hampton Press Inc., 269-292.

Evans, B. M. & Chi, E. H. (2008). Towards a model of understanding social search. *Proceedings of the CSCW '08 Conference on Computer Supported Cooperative Work*. New York, NY: ACM Press.

Figueiredo, A. D. (2008). Toward and Epistemology of Engineering. In Goldberg, D. & McCarthy, N. (Eds.), Proceedings Workshop on Philosophy & Engineering (WPE 2008), Royal Engineering Academy, London, November 2008, pp. 94-95. .

Greeno, J. G. (1998). The situativity of knowing, learning, and research. *American Psychologist*, 53, 5-26.

Gresalfi, M. (2009). Taking up opportunities to learn: Constructing dispositions in mathematics classrooms. *Journal of the Learning Sciences*, 18, 327-369.

Gresalfi, M. S. & Cobb, P. (2011). Negotiating identities for mathematics teaching in the context of professional development. *Journal for Research in Mathematics Education*, 42, 270-304.

Hand, V. & Gresalfi, M. (2015). The Joint Accomplishment of Identity, *Educational Psychologist*, 50(3), 190-203, DOI: 10.1080/00461520.2015.1075401

Hansen, P. & Jarvelin, K. (2005). Collaborative information retrieval in an information intensive domain. *Information Processing and Management*, 41, 1101-1119.

Jacobson, T. L. (1991). Sense making in a database environment. *Information Processing and Management*, 27, 647-657.

Jordan, B. & Henderson, A. (1995). Interaction analysis: Foundations and practice. *Journal of the Learning Sciences*, 4(1), 39-103.

Khosronejad, M., Reimann, P. & Markauskaite, L. (2015). Implied identity: A conceptual framework for exploring engineering professional identity practices in higher education. *Frontiers in Education Conference Proceeding*, Piscataway: (IEEE) Institute of Electrical and Electronics Engineers.

Langer-Osuna, J. M. (2011). How Brianna became bossy and Kofi came out smart: Understanding the trajectories of identity and engagement for two group leaders in a project-based mathematics classroom. *Canadian Journal of Science, Mathematics and Technology Education*, 11, 207-225. doi:10.1080/14926156.2011.595881

Lave, J. & Wenger, E. (1991). *Situated learning and legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.

Paul, S. A. & Morris, M. R. (2009). CoSense: Enhancing sensemaking for collaborative Web search. *Proceedings of the CHI '09 Conference on Human Factors in Computing Systems*. New York, NY: ACM Press.

Paul, S. A. & Morris, M. R. (2011). Sensemaking in Collaborative Web Search, *Human–Computer Interaction*, 26(1-2), 72-122.

Reddy, M. & Spence, P. R. (2008). Collaborative information seeking: A field-study of a multi-disciplinary patient care team. *Information Processing and Management*, *44*(1), 242-255.

Rittel, H. & M., Webber, (1973). Dilemmas in a general theory of planning. *Policy Sci.*, 4, 155-169.

Rogoff, B. & Lave, J. (Eds.). (1984). *Everyday cognition: Its development in social context*. Cambridge, MA: Harvard University Press.

Sarmiento, J. W. & Stahl, G. (2006). Sustaining and bridging sense making across multiple interaction spaces. *Proceedings of the Annual Meeting of the American Society for Science and Technology* (ASIS&T '06). New York: Wiley.

Sfard, A. & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. *Educational Researcher*, 34(4), 14-22.

Twidale, M., Nichols, D. M. & Paice, C. D. (1997). Browsing is a collaborative activity. *Information Processing and Management*, 33, 761-783.

Wenger, E. (1998). *Communities of practice: Leaning, meaning, and identity*. Cambridge, UK: Cambridge University Press.

Whittaker, S. (2008). *Making sense of sensemaking*. In T. Erickson & D.W. McDonald (Eds.), HCI remixed: Reflections on works that have influenced the HCI community (pp. 173-178). Boston: MIT Press.

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Incorporating student-facing learning analytics into pedagogical practice

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Despite a narrative that sees Learning Analytics (LA) as a field that enhances student learning, few student-facing solutions have been developed. A lack of tools enables a sophisticated student focus, and it is difficult for educators to imagine how data can be used in authentic practice. This is unfortunate, as LA has the potential to be a powerful tool for encouraging metacognition and reflection. We propose a series of learning design patterns that will help people to incorporate LA into their teaching protocols: *do-analyse-change-reflect*, *active learning squared,* and *group contribution*. We discuss these learning design patterns with reference to a case study provided by the Connected Learning Analytics (CLA) toolkit, demonstrating that student-facing learning analytics is not just a future possibility, but an area that is ripe for further development.

Keywords: learning analytics, dashboards, pedagogy, learning design patterns, CLA toolkit

Learning Analytics for students

Learning Analytics (LA) is a rapidly growing field aimed at understanding and optimising learning and the environments in which it occurs (Long and Siemens, 2011). However, despite a declared interest in analytics *for* the learner, we continue to see solutions that are focussed upon institutions and academics, and in particular the identification of "at risk" students. The historical dominance of student success models in the field (Dawson, Gašević, Siemens and Joksimovic, 2014) means that many institutions appear to equate LA with the identification of student engagement patterns, a trend that has led to claims that it does not help learning at all (e.g. Bain and Drengenberg, 2016). This is a poor argument to mount; LA has a far richer set of methods, frameworks and tools available, from the automated content analysis of online discourse (Kovanović, Joksimović, Waters, Gašević, Kitto, Hatala, and Siemens, 2016), to social learning analytics (Buckingham Shum and Ferguson, 2012), and multimodal methods (Blikstein, 2013). Anyone tempted to equate LA with the prediction of at risk students is encouraged to examine more recent *Learning Analytics and Knowledge (LAK)* conference proceedings for an indication of the extensive range and breadth developing in the field as it matures. In this paper we consider one specific sub-method; student facing LA. In doing so, we demonstrate that student facing analytics is a field ripe for further development that will help to circumvent many of the issues which arise within more institutionally focussed approaches.

LA has placed surprisingly little emphasis upon the learner. This is unfortunate, for a number of reasons:

- Ethically, we consider it problematic to collect data about a person without giving them an opportunity to access that data, examine it, and perhaps to make use of it in their own ways.
- From a sensemaking and interpretational perspective, it is far easier for the person who generated a datapoint to understand what it means. For example, the student who drops out of a MOOC could have done so for a number of reasons: they may have enrolled for mere curiosity; they might have learned the one specific thing that they were interested in; perhaps the teaching mode was terrible and they decided to leave; or perhaps they just got busy at work. It is usually only that individual who will know why they left and be able to interpret the digital traces (Latour, Jensen, Venturini, Grauwin, and Boullier, 2012) with reference to their life situation. Importantly, these traces can often be understood in a far more nuanced manner than "big data" which hides the specifics of subgroups and behaviours in averages that generate an idealised norm. However, sensemaking requires far more care than merely providing students with a dashboard that has "wow" factor (Duval, 2011).

- The opportunities afforded by LA for encouraging metacognition and reflection will only eventuate if learners are given pedagogically relevant access to reports and data about their learning. In the coming forecasted age of workforce disruption (CEDA, 2015) it will become increasingly important that we train our students to think about data, reflect upon its meaning and then act. What better data source to maintain their interest than their own behaviour? The lessons of the quantified self movement could be put to good use, and significantly extended in the case of learning (Duval, 2011; Lee, 2013).

However, there are reasons to be careful. In particular, there are important ethical considerations in relation to providing analytics to learners. For example, what might be the expected response of a student who is the first person in their family to attend university, when they are informed that they have been classified as “at risk” by a LA system? We consider it highly likely that such a student would believe the classification of the LA system instead of fighting back and changing their behaviour. Thus, the failure of the student would be in no small part *generated* by the system. LA is not merely reporting upon reality, in some cases it has the very real potential to create it, and it is essential that we develop a form of *algorithmic accountability* in our use of learning data (Buckingham Shum, 2016). However, as raised by Slade and Prinsloo (2013), *not* acting upon information about the predicted failure of a student can also be seen as highly unethical; in an increasingly fee driven system they are likely to be wasting large sums of money on a course of study where they are not likely to succeed.

We consider it essential that learning analytics practitioners, learning designers and educators start to explore new ways in which learner centred LA can be authentically incorporated into pedagogical practice. But why has so little emphasis been placed upon the learner in the ongoing systemic institutional adoption of LA?

What is going wrong?

LA appears to be hovering on the boundary of moving from a research discipline into a practice that is increasingly considered essential at an institutional level (Siemens, 2013). However, the institutional adoption of LA in higher education can only be considered sporadic at best (Siemens, Dawson and Lynch, 2013; Colvin, Rogers, et al. 2015; Sclater, Peasgood and Mullan, 2016). Even more worrying, a number of popular claims have been emerging recently that learning analytics does not help student learning (e.g. Bain and Drengenberg, 2016; Ruggiero, 2016). Many of these discussions assume that LA is merely about collecting click stream data and using it to predict student success. They further assume that students will not be involved in interpreting the data traces that they leave. This is only one understanding of LA, and the discussion above points to the fact that the field is far more diverse. Indeed, there are a number of competing narratives starting to emerge about what LA is, and who it is for. This has been highlighted in a recent LACE report (Griffiths, Brasher, Clow, Ferguson and Yuan, 2016), which uses a policy Delphi study to examine the responses of 103 LA experts to 8 very different visions of the future – and some were ranked as far more desirable than others. The field is contested.

We consider it likely that one of the reasons for the generally slow uptake of LA lies in the lack of work considering how LA might be used at a small scale. How can LA solutions be flexibly adapted by practitioners in learning designs (LDs) fit for the classroom? Tools that instructors and students could quickly roll out by themselves would empower them to adopt LA as desired to analyse and understand their own behaviour, instead of waiting for a full institutionally supported LA system which is less likely to support their specific needs.

However, it is often difficult for educators to imagine how students might use educational data, much less design student oriented solutions. Verbert, Duval, Klerkx, Govaerts and Santos (2013) have suggested a learning analytics process model that considers four stages: *awareness, reflection, sensemaking,* and *impact*, but in the survey they conducted of existing dashboards a minority had a student facing focus, and none addressed the problem of impact. It is challenging to find ways in which students can be encouraged to look at and use their data in the context of a specific course. While it is relatively easy to motivate the use of student facing dashboards in a class that uses reflective practice, few sophisticated models have been developed. There is a tendency for studies to show students a dashboard and to perhaps conduct interviews or surveys to explore usage (see e.g. Arnold and Pistelli (2012); Corrin and de Barba (2014); Muldner, Wixon, Rai, Burleson, Woolf, and Arroyo (2015); Khan and Pardo (2016)). We are not aware of any pedagogical models where students were required to act in response to the information that they see in an analytics dashboard.

This problem is compounded by an interdisciplinary gap between computer scientists and educators. Many of the people that would be most interested in exploring novel ways in which LA might be incorporated into learning designs do not have the programming skills necessary for developing their own technologies. This leaves them hostage to vendor provided solutions. Even more problematic, a lack of awareness about the wide variety of ways in which data can be analysed and represented means that they often underestimate the abilities of data science and what it might be able to achieve. The collection, analysis and use of student data occurs at multiple intersections and a range of stakeholders, ideologies, assumptions and beliefs are involved. It is essential that all concerned parties are welcomed at the table, and given tools that will facilitate their participation in the field.

Here, we start to sketch out a series of learning design patterns that we hope will encourage those creating new pedagogical approaches and methodologies to participate and extend the field of learning analytics with their own contributions. More learner facing LA patterns are required; this paper is merely an early step towards a LA that is *for* the learner rather than *about* them.

Strategies for Building Learner Centred LA into Learning Design

Despite the problems identified above, student facing LA solutions are possible, and gaining in sophistication. Firstly, there is reason to believe that students can understand simple dashboards describing their learning processes and participation (Corrin and de Barba, 2014). A second study (Kahn and Pardo, 2016) exploring the use of student facing dashboards that summarise weekly engagement with course materials corroborates this finding. Of particular interest, the second study shows evidence that students move through a quick burn in period while they are learning to interpret a dashboard, after which they tend to relax in their access of the dashboard, only checking back on a weekly basis to ensure that their behaviour patterns are keeping "on track" when compared to the rest of the cohort. Regardless of how different practitioners might interpret the claims of these papers, they demonstrate that students can learn to interpret and understand some analytics dashboards, and we might expect that these capabilities will improve with practice.

Despite this promise, the bulk of existing work appears to consist of a one step process. That is, students do something in a class, and some analytics are used to inform them about their participation in this activity. They are not required to do anything with this newfound knowledge. Lockyer, Heathcote and Dawson (2013) have introduced a notion of *checkpoint analytics*, to describe this scenario. In this case, LA gives advice on whether a student has met the prerequisites for learning by assessing whether they have accessed the relevant resources. In contrast, a form of *process analytics* provides insight into learner information and knowledge processing within a set of tasks. In this case, there are a number of points throughout a complex whole of course process where social network analysis can be used to inform staff and students about patterns of behaviour and engagement.

How can we extend this early work? Moving forward will require a series of technology enhanced learning (TEL) design patterns (Dalziel, 2014; Goodyear and Retalis, 2010) that make use of LA at their core. In what follows, we sketch out three LA learning design patterns, and an early case study where two of them have been tested in a pilot using the Connected Learning Analytics (CLA) toolkit (Kitto, Cross, Waters and Lupton, 2015).

Do-analyse-change-reflect

One obvious strategy for using student facing LA in a class context involves the following sequence:

1. **Do:** Students are instructed to participate in some sort of activity. Perhaps they should prepare for a flipped class by watching videos; maybe they need to write a blog post and then comment on three of their classmate's blogs. The possibilities for this step are potentially infinite as long as it is possible to collect data arising from this initial learning activity. LMS data, social media APIs, mobile apps, and online games all provide examples of tools that might be used to collect such data.
2. **Analyse:** Students are encouraged to consider LA dashboards that result from the *do* phase. Reports and tools from the standard LA toolboxes could be used, or new ones developed, depending on the teaching context and learning objectives of a specific activity.
3. **Change:** A well designed LA pattern would then encourage a student to consider *changing* their behaviour as a result of the analytics that they see in the *analyse* phase. They could then iterate through a continuing sequence of *do-analyse-change* cycles, or perhaps the LD only requires a single iteration.
4. **Reflect:** Finally, students should participate in a reflective process where they explain what the LA reports revealed about their behaviour, how they made sense of their behaviour, and whether they decided to change as a result (and how). We consider this final stage to be essential to the effective implementation of this LA pattern. An all too common scenario in LA implementations that have a student focus typically involves students being shown a dashboard, being interested in it, but then failing to consider what it means *to them* (Verbert, Duval, et al., 2013). It is important that the *change* phase be driven by a *reflect* phase to encourage students to towards higher order critical thinking. One strategy would be to assess the *change* phase formatively and the *reflect* phase summatively, as this would encourage students to explore and try new things out, without fear that this would affect their final grade. However, we can imagine that other options might arise in specific circumstances.

Each of the patterns that follow make use of this core sequence. The fundamental nature of this pattern stems from the core question that it asks students to consider, which could be summarised as: Are my self-perceptions reflected in my profile? How might we encourage students to ask this question? Perhaps students could consider an activity dashboard that shows them how much time they are spending in class activities compared to the rest of their cohort, as implemented in a study by Khan and Pardo (2016). Interestingly, the lack of the final *reflect* phase in that study means that students are unlikely to be motivated to *change* their behaviour as the learning design remained in the *do-analyse* phases. A full implementation of the above pattern would require an extension of that learning design where students are required to complete a critical analysis of their behaviour throughout the semester. This leads us to introduce the case study that we will draw upon for informal examples throughout the remainder of this paper.

Case Study: Using the Connected Learning Analytics (CLA) toolkit

The Connected Learning Analytics (CLA) toolkit (Kitto, Cross, Waters, Lupton, 2015), has been designed to enable those educators who are teaching “in the wild” using standard social media, to utilise the benefits of Learning Analytics. It makes use of the Experience API (xAPI) to unify the description of data gathered from various media, and a Connected Learning Recipe (or xAPI Profile) to unify the syntax and semantics of data gathered from these disparate media (Bakharia, Kitto, Pardo, Gašević & Dawson, 2016). At present, data harvest has been implemented for Twitter, Facebook, WordPress and YouTube comments, Trello and Github. Contextualised activity, social network, and content analysis reports are available for instructors, with a student facing dashboard giving individual students access to amalgamated reports about their participation in learning activities that make use of the CLA toolkit.

As a tool that is still in development, the CLA toolkit has only been trialled in a few specific class contexts, and always in an opt in mode (as per the conditions under which ethical approval for this research project was obtained). However, two iterations of class trials have inspired the three patterns discussed in this paper, along with a number of results about the usability of the current interface. In what follows, we interlace the description of our LD patterns with reference to this particular tool and we consider data from trials with two example cohorts. In each case the same instructor (Kate Davis) coordinated the unit using her own WordPress installations, rather than the Blackboard LMS environment that is the standard offer at the University. A few key differences between the two units are worth noting:

- **IFN614: Information Programs**
  Design: This is a core unit in the Master of Information Science program (although it is available as an elective to students across the university). It is offered in a flexible delivery mode, with both on campus and online cohorts, and students are invited to move fluidly across enrolment modes from week to week. The unit was hosted on a WordPress installation that used a membership plugin called Ultimate Member to provide social functionality, along with bbPress to implement discussion forums. The site is available at http://2015.informationprograms.info. Students each had their own personal forum on the site where they posted their weekly activities, and could use the forums to ask questions about assessment and unit content.
  Assessment: A blogging assignment worth 50% of their final grade required students to post critical reflection activities weekly on their personal blogs. Posts covered a range of topics related to unit content, and comprised 40% of the final grade. The blogging assignment also required students to actively contribute to the learning community by commenting on their peers’ forum posts, engaging in discussion using the social functionality on the site including the forums, or using social media like Twitter with the unit hashtag. Engagement in the learning community comprised 10% of the final grade.
  CLA toolkit: 33 students enrolled in this offering of the unit, and 12 signed up for the trial discussed here.
- **IAB260: Social Technologies**
  Design: This is an undergraduate unit for students in the Bachelor of Information Technology. It is a core unit in the Social Technologies minor. In Semester 1 2016, the unit ran on a WordPress Multisite installation that used BuddyPress to facilitate social networking. Each student had their own blog on the unit site, which is available at http://2016.socialtechnologi.es
  Assessment: A blogging assignment required students to post critical reflection activities weekly on their personal blogs and was worth 50% of their final grade. Posts covered a range of topics related to unit content. They were also required to complete a number of activities that asked them to ‘play’ with social technologies and post about it on their blog, or to share articles, videos or tools with their peers via their blogs. Blog posts comprised 40% of the final grade. Active contribution to the learning community was worth 10% of the final grade. This included commenting on peer’s blog posts, engaging in discussion using the social functionality on the site, or using social media like Twitter with the unit hashtag.
  CLA toolkit: 68 students enrolled in IAB260, and 24 students participated in the trial discussed below.

Methods

The Toolkit was implemented in IFN614 Information Programs in Semester 2, 2015, but was not integrated into the assessment design. Students were invited to sign up in Week 8 via a post on the unit site (http://2015.informationprograms.info/learning-materials/week-8-planning-managing-and-evaluating-programs-products-and-services/). Recruitment focused on piquing students' curiosity and played on their interest in data and classification. Students were not clear on what they should do with the toolkit but were still interested in signing up and having a look at their data in the dashboard. However, the LA offered by the CLA toolkit lacked a clear assessment driven purpose and it is not clear whether usage impacted on students' learning.

Following this initial trial, the *do-analyse-change-reflect* pattern was designed and implemented in S1 2016 with the IAB260 cohort. The trial proceeded as follows:

1. **Do:** The blogging assignment was introduced in the first week of semester. Students set up their blogs on the unit site and began completing critical reflection blog posts.
2. **Analyse:** The toolkit was introduced in Week 5 via a blog post on the unit site (http://2016.socialtechnologi.es/administration/the-connected-learning-analytics-toolkit/), however, take up was initially very low. In Week 9, the unit content focused on quantified and connected lives in the context of exploring the quantified self movement. Students participated in a workshop that presented the LA offered in the CLA toolkit as an example of the quantified and connected self. Just prior to this workshop, students were provided with the reflective prompts for their final blog post, which asked them to consider their contribution to the online community during the semester. Attendance at the workshop was very low (eight of 68 students). A series of further blog posts and videos encouraged them to sign up, resulting in a final uptake of 24 students right at the end of the unit (when the reflective prompt was due).
3. **Change:** Students were encouraged to think about how they were contributing to the community based on looking at their data in the CLA toolkit dashboard, however low uptake right until the end of the semester meant that this step was not realised. There was no observable change in student behaviour.
4. **Reflect**: The Reflect stage was built into the unit assessment, with students being asked to reflect on their contribution to the learning community during the semester. Students were encouraged to use the CLA toolkit to write this reflection. Some students did use the CLA toolkit to prompt their reflections, however, their use of the data was primarily descriptive. They tended to quantify their contribution to the community in terms of number of posts and comments.

The IAB260 cohort exhibited a low level of engagement across the unit, as well as low use of the CLA toolkit. Indeed, the cohort did not in general produce high quality reflections, a pattern that carried through to this final stage. Two iterations of the unit have found that enrolled students are not active content creators, either in the unit or in their personal lives. Encouraging engagement in the online learning community is a considerable challenge and requires more scaffolding. A more robust implementation of the *do-analyse-change-reflect* process might assist with this. The WordPress MultiSite installation is effective in providing a blog network that ensures all students' posts are accessible in a single space, however, it is evident that this environment - even with the use of BuddyPress - does not promote informal conversation and sharing, which is critical for establishing a sense of community. With a more integrated implementation of the *do-analyse-change-reflect* pattern we could imagine more sophisticated behaviour occurring, but at this point there is insufficient data to show that this scaffolding will help students to make use of the LA tools in anything but a shallow manner.

One example of the difficulty surrounding student interpretation of data involves a CLA toolkit dashboard that gives a simple classification of the cognitive presence displayed by that student within their community of inquiry (Garrison, Anderson & Archer, 2000). Recent progress has demonstrated that machine learning can indeed be used to automate the discovery of cognitive presence (Kovanović, Joksimović, et al., 2016) and we have implemented a simple dashboard that applies this approach in the CLA toolkit. However, we are yet to see any students blog about this report, which suggests that they do not understand what it means. We could imagine a *do-analyse-change-reflect* cycle where a student considered their cognitive presence classification at one point in the class, thought about whether they wanted to change it, attempted to modify their behaviour, and then reflected upon how successful (or not) their strategy was at the end of the semester (see Figure 1). However, it has been difficult to encourage students towards anything but a superficial understanding of this educational construct in the two trials run to date. In both cases students were invited to examine their dashboard, but little scaffolding was given to really help them understand what it meant, and more importantly, to reinforce that understanding in a later task. A new trial is currently in progress with the 2016 IFN614 cohort that used a lecture at week 2 to introduce the concept of a Community of Inquiry (Garrison, Anderson & Archer, 2000) and give students the tools they need to understand the cognitive presence report (*do-analyse*) and to then keep using this information throughout the semester (*change*), before incorporating what they have learned into their later assessment (*reflect).* This process will be further facilitated by incorporating the active learning squared pattern that we will now discuss.

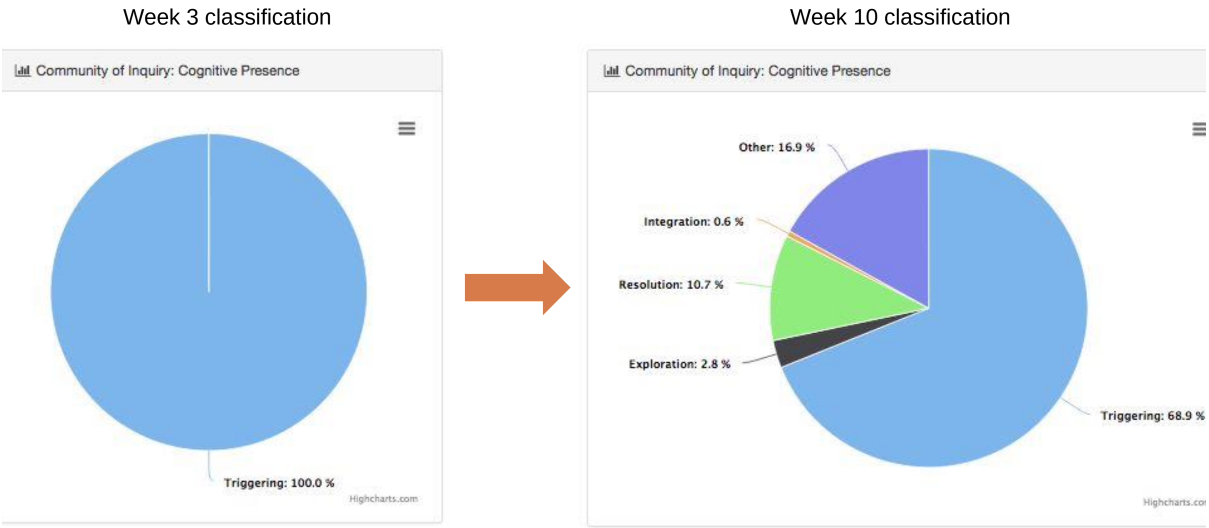

Figure 1: Viewing an early classification of their cognitive presence in an *analyse* phase might lead to a student deciding to *change* their behaviour.

Active Learning Squared

The cognitive presence report discussed with reference to the *do-analyse-change-reflect* pattern can be used in a more pedagogically sophisticated manner with a very simple extension that is grounded in modern machine learning techniques. In this case, a classifier assists students during their *analyse* phase, by telling them how specific posts have been classified, and asking them to correct it if they think the classification is wrong. This provides the scaffolding that appears to be essential in encouraging students towards deeper metacognition.

The *active learning squared* pattern arose from the problem that classifiers are never perfectly accurate, especially so in an educational setting where there are limited amounts of data accessibility. This makes it difficult to justify using them in education where poor classifications can lead to adverse student outcomes. For example, in an adaptive learning system, a student might be forced to repeat a series of exercises that they have already mastered, or they might be classified as “at risk” and receive ongoing recommendations about extra support services that they should access, but do not actually need. The *active learning squared* pattern mitigates this problem by placing the student in this classification loop. Giving students an opportunity to consider the way in which their behaviour has been classified and to correct the classifications if they think they are incorrect means that both the student and the algorithm are learning in the process: the student is encouraged to learn about their own learning processes, and the algorithm is acquiring a data set that is specific to the particular class context over which it is running.

The Active Learning Squared pattern runs as follows:

1. **Do-analyse-change-reflect:** Students participate in learning activity and their data is harvested in some way (as was discussed in the previous pattern).
2. **(Classify):** Machine learning is used to classify the behaviour patterns of students in a class that emerged during the first phase. This step does not include student action but is essential to the *active learning squared* pattern, which requires that the student correct the machine learning output.
3. **Examine:** Students are shown a dashboard that shows how their aggregated behaviour in the *do* phase has been classified. They are informed that the classifications could be incorrect, and that they should carefully consider what the dashboard tells them in the light of how they think they are behaving.
4. **Relabel:** An extension of the dashboard enables students to unpack the black box of machine learning and to understand how they have been classified. They are encouraged to use this dashboard to view the way in which their individual behaviours were classified and to relabel them if they think that the classification is incorrect. The current dashboard allows students to add a free text justification of their relabelling and to highlight features that they think contribute to it.

This pattern both encourages students towards metacognition, and sidesteps an ongoing problem with accuracy and lack of portability of machine learning methods for the purposes of education. For example, the current best performing classifier of cognitive presence (Kovanović, Joksimović et al., 2016) was trained and tested upon one specific data set (computer science classes using Moodle, in a Canadian University.) It has not yet been tested upon a different data set, as no alternative labelled and sharable datasets are currently available. However, we think it reasonable to suppose that the accuracy of this classifier will decrease when it is used on data collected in another context (e.g. a data set that was gathered in Australia from student interactions in the WordPress installation used for IAB260 and IFN614). Rather than ever better classifiers, we have followed an alternative avenue by considering whether it is possible to improve the educational data sets that train them. One way to achieve this would involve the rapid collection of new data that is contextualised to a specific class context using the *active learning squared* pattern.

To test this idea, we ran a short trial with the IFN614 cohort described above. The CLA toolkit currently has a simple Naive Bayes cognitive presence classifier that was trained upon the Canadian data set. As such, it is not the state of the art (Kovanović, Joksimovic, et al., 2016) and is not expected to be terribly accurate. It has been used in trials merely to explore the potential of using this dashboard with students. In the 2015 IFN614 trial, a simple interface was created which invited students who were using the toolkit to *examine* the classifications that it had given their posts, and to *relabel* them if they thought them incorrect. Students who had signed up to the CLA toolkit were notified about the new active learning functionality with only one week to engage with this feature in a small pilot study. In total, 6 students trialled this functionality (a 50% participation rate for those students using the CLA toolkit, out of a possible 34 enrolled in the class). Table 1 provides a confusion matrix that allows us to explore the relative accuracy of the students in the trial and the NB classifier against the classifications of the expert coder. Numbers indicate the posts that were coded by the Students/NB classifier as one of the 5 categories when compared with the classifications of the expert. The accuracy between the student classifications and the expert coder was low 43.05% (kappa=0.256) but this number was much lower for the classifier, which achieved an accuracy of 25% for this trial (kappa=-0.013). We can see that the students performed markedly better than the classifier, which suggests that the *active learning squared* pattern shows promise for use in the classroom. More work is required to further develop this pattern, but we will now move onto a discussion of our final pattern, which has not yet been tested in a trial study, but holds promise for resolving the issues associated with group work in the university sector.

Table1: A confusion matrix for the 2015 IFN614 *active learning squared* trial.

		Students/NB classifier					Recall
		Triggering	Exploration	Integration	Resolution	Other	
Coder - Assumed Ground Truth	Triggering	18/18	1/1	0/0	0/0	0/0	0.947/0.947
	Exploration	1/8	7/0	1/1	0	0	0.538/0
	Integration	4/8	3/0	2/0	0/0	0/1	0.222/0
	Resolution	4/8	3/0	2/0	0/0	0/1	0/0
	Other	12/18	4/4	0/0	2/0	4/0	0.182/0
Precision		0.461/0.30	0.38/0	0.4/0	0/0	0.5/0	

Group contribution

Group work is an ongoing source of frustration for both students and academics at many universities. A team can fail to work well together in a wide range of ways: communication may lapse; or a lack of trust may mean that only one sub group completes all of the assessable work; perhaps the team is a group of “leaders” all trying to head in their own direction. Sometimes an individual student might not be aware of their teammate’s dissatisfaction until it is too late in the semester to adjust their performance. In large classes the teaching team often finds out when it is too late to help the group resolve its issues. How might a LD pattern be created where LA is used to inform students about their participation in teams? We propose the following sequence of steps:

1. **Nominate Forums:** Team members start by discussing what tools they are going to use to manage a project, and how these will be used. They then link those tools to a data harvest tool (perhaps the CLA toolkit, but other data sources could be used instead, e.g. Google Analytics).
2. **Do-analyse-change-reflect:** Students then enter a cycle where they continue with their group work project. However, care should be taken to ensure that students are critically analysing their contribution to the team, and adjusting their behaviour accordingly. They could write a weekly journal entry discussing what is going on, what the data tells them and how they propose to change their behaviour. They might have a conversation with their team at the start of each meeting about what the data reveals and provide a progress report to their teacher. The reflect phase during this part of the pattern should be formative rather than summative in order to encourage experimentation among students as they try out new strategies for managing group dynamics.
3. **Report:** Finally, individual students would report upon their contribution to the team in a summative assessment item. They should be required to make use of data from their LA dashboard to argue the case about what they have contributed to the project deliverables and what they have learned about group work in the process of producing them (referencing material from the *reflect* phase of stage 2).

At present the CLA toolkit has a partial implementation of the functionality required to implement a study of this type. One particular difficulty arises with the APIs that are currently publicly available: for example, Google+ data is difficult to access with the API unless a group has been constructed via the Google Apps extension. This tends to rule out the educators that the CLA toolkit is explicitly trying to assist (i.e. those that "teach in the wild" without institutional support). Solutions are available if teaching teams move to other social networks (e.g. the Facebook API does not currently suffer from a similar restriction) but these instructors often feel that doing so would impoverish the learning experience with no immediate benefit to the students. Without an opening of the APIs for use in these types of educational scenarios the CLA toolkit will not be able to assist with the collection of analytics data to enable teaching and learning. *Data access* is increasingly becoming key to a large number of decisions and it is important that educational institutions directly confront the issues associated with access to data that they (or their students) generate (Kitto, 2015).

How might we imagine the *group contribution* pattern being applied given the current functionality of the toolkit? Using the CLA toolkit would allow students to sign up to data collection for the relevant environments where they are carrying out their learning activities. They might declare that they would communicate about the project in Facebook, manage deliverable dates and tasks in Trello, and submit code using a project page on GitHub. If all team members signed up to data collection for these three environments, then the data for the relevant FB group, Trello board and GitHub project would be collected (and no more - which respects privacy). A new dashboard would have to be incorporated into the CLA toolkit to help students to track their group work participation. This is a current project, and the planned wireframe has the layout shown in Figure 2. In this dashboard all group members (M1,…, M4) would be given access to a group dashboard, where they would see both a relative activity count (in the form of a bar chart representing contribution to group processes for each media that they had agreed upon using in their project), and measures that they could use to explore the *quality* of those contributions. For the scenario discussed here we would anticipate using metrics such as:

- A cognitive presence classification to help students to understand how much of their behaviour in Facebook was contributing to the group and its assigned inquiry based task.
- A count of tasks responsible for (R) vs tasks resolved (F) in Trello
- A measure of lines of code (LOC) modified in the Github site (to extend information provided by the bar chart which would just summarise how many commits have been made by that team member).

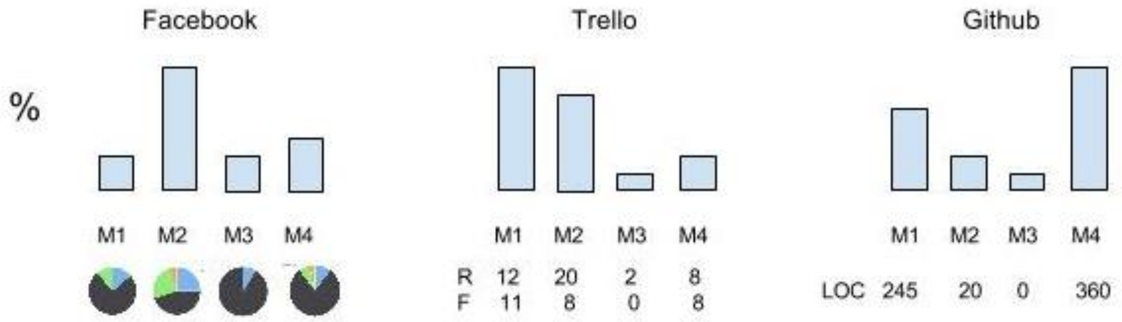

Figure 2: A proposed wireframe for the CLA toolkit groupwork dashboard.

Considering just this simple collection of information it is possible to form hypotheses that might be discussed by the group, or chased up by a teaching team. For example, referring to Figure 2, we can see that group member M3 is perhaps not contributing to either the group processes (i.e. project management in Facebook and Trello) or the final product (i.e. code contributions on Github). Should their participation be marked down? It may be that they are contributing in another way not captured by the data (perhaps they are performing a vital role in face to face group discussions). Perhaps they are just having a very busy week with another assessment in a different unit. It is important that they be given a chance to reflect and respond to this data pattern, rather than be automatically assessed according to what is likely to be only a partial data trace. Similarly, students may be rotating roles, which would result in changes to their behaviours. Dashboards should allow for a drilling down to specific date periods to facilitate the exploration of patterns such as these. Additionally, Khan and Pardo (2016) have demonstrated that a weekly reset of activity data in student facing dashboards is a powerful mechanism for motivating students who may be falling behind (as they can always perform better next week) as well as ensuring that those who perform well one week are less motivated to "slack off" and coast along after discovering that their contribution is far greater than the rest of their cohort. The utility of different data representations and resets will be explored in a future trial.

Dashboards such as these will give students the opportunity to develop both their data literacy, and their ability to think about and analyse their contributions to team based work. This will not only provide them with essential future workforce skills but will encourage them to change poor group based behaviour patterns before it is too late and they have let their team down or obtained an unsatisfactory grade.

Conclusions and Future Directions

Active student participation within the learning analytics cycle is of key importance, and is required to create more sophisticated solutions that utilise LA. This paper has presented three learning design patterns, which should facilitate the use of student facing LA solutions in class based scenarios. Each aims to encourage students towards deeper modes of metacognition and analysis, where they explore the data about their current behaviour and think about how they could change to achieve a data trace that fits more closely with identified goals. Two of the patterns presented here have already been applied in a class context using the CLA toolkit, and early results of these trials have been discussed. Future work will continue to refine and develop this work.

We anticipate that far more than these three patterns are possible, and propose that the LA community create a pattern repository both learning designers and educators might use as a source of inspiration when creating new course content. Future work will seek to establish a common format for describing these patterns, as well as a trusted and searchable repository where they can be both collected and found.

Returning to the broader social setting, this paper has proposed some direct solutions for helping people to imagine how LA might be used in a more nuanced manner than the emerging narrative of "at risk and retention" presupposes. Following these less well-trodden paths will help our students to learn how to learn in a deeper and more thoughtful manner, an essential skill in the coming age of workforce disruption.

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References

Arnold, K. E., & Pistilli, M. D. (2012, April). Course signals at Purdue: using learning analytics to increase student success. In *Proceedings of the 2nd international conference on learning analytics and knowledge* (pp. 267-270). ACM.

Bain, A., & Drengenberg, N. (2016). Data collected about student behaviour doesn't help improve teaching or learning. *The Conversation*. Available at: https://theconversation.com/data-collected-about-student-behaviour-doesnt-help-improve-teaching-or-learning-57793

Bakharia, A., Kitto, K., Pardo, A., Gašević, D., & Dawson, S. (2016). Recipe for success: lessons learnt from using xAPI within the connected learning analytics toolkit. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 378-382). ACM.

Blikstein, P. (2013). Multimodal learning analytics. In *Proceedings of the third international conference on learning analytics and knowledge* (pp. 102-106). ACM.

Buckingham Shum, S., & Ferguson, R. (2012). Social Learning Analytics. *Educational technology & society*, *15*(3), 3-26.

Buckingham Shum, S. (2016). *Algorithmic Accountability for Learning Analytics.* Seminar, London Knowledge Lab, Institute of Education, University College London (video). http://simon.buckinghamshum.net/2016/03/algorithmic-accountability-for-learning-analytics

CEDA. (2015). Australia's future workforce? Technical report, Committee for Economic Development of Australia (CEDA). http://www.ceda.com.au/research-and-policy/policy-priorities/workforce.

Colvin, C., Rogers, T., Wade, A., Dawson, S., Gašević, D., Buckingham Shum, S., & Fisher, J. (2015). Student retention and learning analytics: A snapshot of Australian practices and a framework for advancement. *Sydney: Australian Office for Learning and Teaching*. Available at: http://www.olt.gov.au/project-student-retention-and-learning-analytics-snapshot-current-australian-practices-and-framework

Corrin, L., & de Barba, P. (2014). Exploring students' interpretation of feedback delivered through learning analytics dashboards. In *Proceedings of the ascilite 2014 conference*. http://ascilite2014.otago.ac.nz/files/concisepapers/223-Corrin.pdf

Dalziel, J. (2014). Success factors for implementing Learning Design. Office for Learning and Teaching final report. Available at: http://www.olt.gov.au/resource-success-factors-implementing-learning-design

Dawson, S., Gašević, D., Siemens, G., & Joksimovic, S. (2014). Current state and future trends: A citation network analysis of the learning analytics field. In *Proceedings of the Fourth International Conference on Learning Analytics And Knowledge* (pp. 231-240). ACM.

Duval, E. (2011). Attention please!: learning analytics for visualization and recommendation. In *Proceedings of the 1st International Conference on Learning Analytics and Knowledge* (pp. 9-17). ACM.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher educationmodel. *The Internet and Higher Education*, 2(2-3), 87-105.

Goodyear, P. & Retalis, S. (eds) (2010) *Technology-enhanced learning: design patterns and pattern languages*, Sense Publishers.
Griffiths, D., Brasher, A., Clow, D., Ferguson, R., Yuan, L. (2016). *Visions of the future*, LACE project deliverable D.2, Available at: http://www.laceproject.eu/deliverables/d3-2-visions-of-the-future-2/
Joksimović, S., Gašević, D., Kovanović, V., Riecke, B. E., & Hatala, M. (2015). Social presence in online discussions as a process predictor of academic performance. *Journal of Computer Assisted Learning*, *31*(6), 638-654.
Khan, I., & Pardo, A. (2016). Data2U: scalable real time student feedback in active learning environments. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 249-253). ACM.
Kitto, K. (2015). Towards a Manifesto for Data Ownership. LACE guest blog. Available at: http://www.laceproject.eu/blog/towards-a-manifesto-for-data-ownership/
Kitto, K. (2016). Can students learn from imperfect analytics? Talk presented at the UNSW Video and slides available at: https://teaching.unsw.edu.au/can-students-learn-imperfect-analytics
Kitto, K., Cross, S., Waters, Z., & Lupton, M. (2015). Learning analytics beyond the LMS: the connected learning analytics toolkit. In *Proceedings of the Fifth International Conference on Learning Analytics And Knowledge* (pp. 11-15). ACM.
Kovanović, V., Joksimović, S., Waters, Z., Gašević, D., Kitto, K., Hatala, M., & Siemens, G. (2016). Towards automated content analysis of discussion transcripts: a cognitive presence case. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 15-24). ACM.
Latour, B., Jensen, P., Venturini, T., Grauwin, S., & Boullier, D. (2012). 'The whole is always smaller than its parts'–a digital test of Gabriel Tardes' monads. *The British journal of sociology*, *63*(4), 590-615.
Lee, V. R. (2013). The Quantified Self (QS) movement and some emerging opportunities for the educational technology field. *Educational Technology*, 39.
Lockyer, L., Heathcote, E., & Dawson, S. (2013). Informing pedagogical action: Aligning learning analytics with learning design. *American Behavioral Scientist*, 57(10) 1439–1459.
Muldner, K., Wixon, M., Rai, D., Burleson, W., Woolf, B., & Arroyo, I. (2015). Exploring the impact of a learning dashboard on student affect. In*International Conference on Artificial Intelligence in Education* (pp. 307-317). Springer International Publishing.
Pardo, A., Han, F., & Ellis, R. A. (2016). Exploring the relation between self-regulation, online activities, and academic performance: a case study. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 422-429). ACM.
Ruggiero, D. (2016). What metrics don't tell us about the way students learn, *The Conversation*. Available at: https://theconversation.com/what-metrics-dont-tell-us-about-the-way-students-learn-59271
Sclater, N., Peasgood, A., & Mullan, J. (2016). Learning Analytics in Higher Education. Available at: https://www.jisc.ac.uk/reports/learning-analytics-in-higher-education
Siemens, G., Dawson, S., & Lynch, G. (2013). Improving the quality and productivity of the higher education sector. *Policy and Strategy for Systems-Level Deployment of Learning Analytics. Canberra, Australia: Society for Learning Analytics Research for the Australian Office for Learning and Teaching*. http://www.olt.gov.au/resource-improving-quality-and-productivity-higher-education-sector-2013
Siemens, G., & Long, P. (2011). Penetrating the Fog: Analytics in Learning and Education. *EDUCAUSE review*, *46*(5), 30.
Siemens, G. (2013). Learning analytics: The emergence of a discipline. *American Behavioral Scientist*, 0002764213498851.
Slade, S., & Prinsloo, P. (2013). Learning analytics ethical issues and dilemmas. *American Behavioral Scientist*, *57*(10), 1510-1529.
Verbert, K., Duval, E., Klerkx, J., Govaerts, S., & Santos, J. L. (2013). Learning Analytics Dashboard Applications. *American Behavioral Scientist*. 57 (10), 1500-1509

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Collective effervescence: Designing MOOCs for emotion and community

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This paper shares the experiences of a course team in designing and delivering a massive open online course (MOOC). It offers insight into how their approach can help build learning communities and enhance pedagogy for online learning through a return to best practice. It will discuss how a combined approach of using a core site in conjunction with social media platforms can temporarily overcome the functional limitations of xMOOCs, more deeply engage students, and improve moderation. Central to this, the concepts of collective effervescence and radical inclusion are shown to be effective principles of course design which facilitate ongoing support networks - an effective and sustained strategy for combating pluralistic ignorance within research education contexts.

Keywords: MOOCs, moderation, community, emotion, social media, learning design

As Massive Open Online Courses (MOOCs) increasingly become more common they are prompting more public discussion about education (Ebben and Murphy, 2014). This raises the importance of establishing best practice in this new sphere. In 2014, the Australian National University (ANU) became a global partner of edX and began offering MOOCs on this well known platform. This paper discusses the design process, implementation, and educational outcomes for one ANU MOOC entitled *How to Survive Your PhD*. Delivered over 10 weeks in late 2015, weekly modules sequentially focused on a specific emotion common in research study, such as Frustration (Module 4), Fear (Module 6), Boredom (Module 9), and Love (Module 10). More than 15,000 participants were enrolled and weekly were asked to watch a 1-2 minute video, read around 500 words, and complete either a short forum-based or social media activity reflecting on that week's topic. A final, peer-assessed activity was required to complete the course. Overall, this course aimed to encourage higher degree research (HDR) students and supervisors to improve their understanding, management, and support of emotions in the research workplace. This was achieved through scaffolding an experience of "collective effervescence" (Durkheim, 1976) using the guiding principles of radical inclusion and community building to foster mutual support networks. In this paper, we draw on recent theories of MOOC design and facilitation, facilitator reflections, surveys and feedback collected from participants to argue that connectivist aims can be achieved within the limitations of an xMOOC platform through the addition of social media. The surveys were designed to collect feedback, measure participants' satisfaction, and engagement, and allow the teaching team to adapt to the needs of the community. Two surveys were administered during the course: the first in week 1 (n=1400), and a mid-course survey in week 5 (n=297). Ultimately, we found that inclusion and community were best encouraged and enhanced online through implementing activities specifically designed to promote interaction, engaging in active and consistent moderation, and through 'media events' held with the intention of bringing people together.

Literature on pedagogy and teacher experiences in MOOCs is a growing area for research. Though still limited, the majority of articles focus on the effectiveness of MOOCs as a viable educational tool and the lack of a dedicated pedagogy (Bali, 2014; Pilkey, 2014). The complexities of teaching in MOOCs is largely absent from the debate (Ross *et al*, 2014). Bayne and Ross address MOOC pedagogy as an emergent area, highlighting that pedagogy is not necessarily embedded in platform structures but instead "emerges in complex negotiations between platform, the teaching approaches of the academic team developing the course, disciplinary and institutional norms and expectations, and the pattern of learner interactions" (2014, 37). Crucially, they advocate for a move away from the binary distinctions of cMOOC (driven by social learning and pedagogical innovation) and xMOOC (institutionally-focused and reliant on automated assessment and video-lectures). In the case of our MOOC, the team faced the design challenge of overcoming the limited potential for connectivist learning within an xMOOC system because the course dealt with emotional resilience and support, yet was delivered on edX - a traditionally instructivist platform. Despite potential platform limitations, we were inspired by Bayne & Ross (2014) and also influenced by Wasson's (2013) assertion that learners' resilience could be fostered via smaller sub-groups within the massive numbers enrolled. Drawing on this foundation, our course design thus aimed for the MOOC to prompt a spirit of collective effervescence, where individuals could come together to share an experience to collectively reflect on some of the common emotions experienced during the PhD process, workshop new responses and approaches to these feelings, promote unity, and ultimately create a better sense of community (Durkheim, 1976). In our MOOC, we found that social media, in multiple forms, creates a vital nexus around which these types of learning communities can be formed and maintained. This approach was vital in addressing the core purpose for why we built and implemented a MOOC in the first place.

Why build our MOOC?

Retention of PhD students is a big challenge for all universities, with up to one third leaving before they finish their degree (McGagh *et al*, 2016). In Australia this loss is a risk that must be managed by universities, who only recoup domestic students' fees upon their completion (McGagh *et al*, 2016). One area that has received relatively little pedagogical attention is the role of emotions in attrition. Many issues in research education are emotional yet often positioned as 'other' to problems of academic progress. In practice, however, the academic and the emotional are deeply intertwined. We know that PhD program attrition is a cascade effect where a combined range of set-backs and barriers to completion are experienced before candidates leave (Pearson, 1999). If the causes of PhD student attrition are complex, solutions must be multiple and nuanced. Lovitts (1999) studied attrition in HDR cohorts and identified 'pluralistic ignorance' as one of the key causes for candidates 'leaving in silence'. Pluralistic ignorance occurs when multiple students separately experience the same issues, but, these issues are not talked about, or the feelings they provoke are normalised. Failing to realise their experience is a result of the system, not their own fault, PhD students experiencing pluralistic ignorance can tend to blame themselves for their struggle, give up, and, as Lovitts puts it, 'leave in silence'.

A MOOC has the unique capacity to reach the broader community en masse to raise up these emotional issues, discuss them on a global scale and thus break through the silences in research education. Unlike other kinds of online training, we had no way of controlling who would enrol and this made the design process extremely difficult. Morris and Lambe's (2014) rubric identifies four different kinds of MOOC learners: the University Learner, the Professional Learner, the Self Directed Learner, and the Leisure Learner. This rubric alerted for us that our originally intended audience (supervisors) was unlikely to be our largest one. Within the participant community itself, research candidates would be 'university learners', seeking to better understand their experience. A research supervisor could do the MOOC and contribute to their own professional development. There are many people in administration and pastoral care positions who could be positioned as 'self directed learners', interested in expanding their own practice, or family members interested in learning how to better support their loved ones. Finally, the 'leisure learners' might be people who are thinking about a PhD or just interested in PhD student culture generally.

We countered this 'diversity problem' by designing with the principle of radical inclusion. That is, *anyone* should be able to do this course and learn something about the experience of doing a PhD. This included the moderation team, one of whom had no experience in doing a PhD, and felt very uncertain. Focusing on one emotion a week provided us with a way to encourage participants to jointly reflect from different subject positions and incorporate the richness of their collective experience in the learning environment.

The Learning Community

As previously mentioned, our course was delivered via edX. This platform was originally designed for an instructivist approach, unfortunately resulting in "the notion of large scale social learning" being absent from its "entire design" (Bayne & Ross, 2014). As an xMOOC focused platform, it functioned well for content delivery: videos and written text were easily presented to students. It was not, though, easily capable of offering social elements or sustained forum discussions. This presented a design challenge because we purposely placed a focus on discussion and reflection activities in order to scaffold participants to overcome pluralistic ignorance through dialogue and community. Building community among learners is one of the best antidotes to this problematic state because sharing experiences and discussing strategies to common issues faced in the PhD journey assists people to realise their commonality. But with nearly 15,000 participants enrolled and thousands of daily posts in the forums alone, meaningful discussion was impossible to centrally manage due to the sheer volume of posts and the limited forum functionality. This also had implications for the training and approach taken by the moderation team.

The Moderation Community

Just as community was integral to the pedagogic design and philosophy of our MOOC, so too community was a central concept in the creation, training, and practise of the moderation team itself. Although many MOOCs tend to place a central focus on one ‘superstar’ academic – in this case, Associate Professor Inger Mewburn – the reality is a whole team is needed to ensure successful implementation. Drawing upon the insights of Kop *et al* (2011), we wanted to actively scaffold participant engagement, sharing, reflection, and learning through discussions on both forums and social media. To achieve this, a moderation team was essential to ensure that discussions were appropriately monitored, facilitated, and support given where needed. Our moderation team consisted of six volunteers possessing a diverse range in technological skill from absolute beginner to professional employee grade. This team constituted a community of learning in its own right as well as helping to oversee the learning of others, that is, the MOOC participants.

Creating a community of mutual support *within* the moderation term was essential because, in their own experience, the team was facing the unprecedented challenge of so many participants and a platform with major forum limitations. It was humanly impossible to monitor, moderate, and facilitate everything everywhere. The central question was: how to rapidly train and safeguard well-being among moderators while also ensuring a quality learning experience for participants? Moderators were volunteers who already had numerous other commitments such as study, work, and family duties. In practice, it would have been impossible for one person to do everything, so creating a sense of community within the moderation team also proved a way of fostering genuine cooperation and collaboration as well as providing mutual support. Community also proved an antidote to self blame and pluralistic ignorance among moderators – frank communication meant that team mood was easy to assess and members could easily see that challenges were faced by everyone, not just themselves. The core focus for moderators was to be active, be engaged, model behaviour and prioritise self care and community among both the team and MOOC participants. This was especially important because the emotional nature of course topics meant that extra support was sometimes required, including, for example, referral to counselling, and in a couple of instances, suicide prevention services. We need to acknowledge that the 'frank communication' approach, and the compressed timelines, sometimes created conflict. There was a need to have difficult, sometimes emotionally charged, conversations between team members, which we had not necessarily anticipated. There is limited space to enter into a discussion of the implications of this, but it is discussed further in Freund *et al* (2016).

This community focused and learner-centric design resulted in participants being scaffolded to see themselves in combination as part of the broader MOOC community and smaller spin-off communities, which they themselves would create. In turn, these smaller communities would self motivate, ‘self police’, and help alert the core moderation team if additional support was needed. The moderation team kept in close and active contact via social media through weekly interactive live-chats via Periscope, curated overviews of these on Storify for those who could not make it, and also engaged in daily conversations via the course hashtag on Twitter. By drawing upon the strength of mutually supportive communities and networks, moderators were also freed up to focus on vital triage to identify and assist participants at risk. In practice, we found this to be a highly successful approach. Moderation and support responses were rapid, produced results, and had solid outcomes. It is worth emphasising that both the broader and smaller MOOC communities would not have formed without scaffolding and active moderation. In essence, it takes active moderation and genuine care to build a self-caring community that can self-support and self-perpetuate - a strategy that we would argue is extremely uncommon on xMOOC platforms because of the level of work involved.

Community Engagement

In agreement with Kop *et al* (2011) and Wasson (2013), we saw community development as essential to best practice MOOC design. We hoped for sustainable communities that would continue after the course's conclusion so that participants could achieve connection that would support them into the future. To this end, our design encouraged participants to create social media spaces for course discussion, using tools like Twitter, Facebook, blogs, Instagram, and others. Course activities were designed to take place both inside and outside the MOOC on social media. For example, Module 5 tackled the issue of loneliness in PhD study. Participants were encouraged to meet other students, attend seminars at their campus, or make contact with friends to help reduce loneliness. They were also asked to share photos of their socialising on social media. In a mid-course survey, 27% of respondents meet up specifically to talk about, or as a result of, the course. Of those who met face-to-face, 41% of respondents indicated that this was a new group created as a result of the course.

We observed that hosting the MOOC in a central site brought everyone altogether for the purposes of the course, but social media kept the community alive after the course was over, and built personal relationships and support networks. To help prompt engagement on both, badges were awarded to participants each week for outstanding and thoughtful contributions to the discussion forums and social media spaces. During the live Periscope broadcast on loneliness, the moderation team actively encouraged participants for their own ideas on how to best involve them in sustaining a long-lasting community beyond the course. Ideas shared included continuing the Twitter hashtag and forming LinkedIn and Facebook groups. A very successful example of one such group established by a participant is the Facebook community *PhD OWLs* for mature-age PhD students, which immediately gathered hundreds of members and continues to be active at the time of writing. This participant received an award badge for such a significant contribution. Twitter was also a particularly active and passionate space during, and after, the course. In a mid-course survey, 37% of respondents indicated they joined or started using Twitter specifically for our MOOC. Moderators received much positive feedback on the benefits of building community on Twitter as evidenced by the following de-identified response from the mid-course survey:

> I've always used Twitter and have found a great [#survivePhD15] community who are v[ery] supportive and engaging. I've got a lot out of using Twitter in this way and connected with some interesting people around the world doing a wide range of research topics.

It is worth noting that the response about Twitter was not universally positive, as some participants did struggle with the technology and did not continue to use it after the course finished.

As expected, there were unfortunately significant issues in using the edX forums because of the volume of posts, fixed design, and limited functionality of the platform. Despite these issues, however, students persevered in using the forums, with 73% of respondents viewing them at least once a week, and 24% every second day or so. Despite the use, frustrations were evident. One such participant wrote to the course team at the MOOC's conclusion to share their concerns about the site platform:

> Over time I became more and more frustrated by my inability to hold a conversation [...] in the end I simply gave up [...] In my view, edX's discussion format needs significant humanising, with the ability to accurately bookmark and curate our own conversations and watch the posts of others so it can create virtual learning communities [...] My overwhelming sense is that of a missed opportunity with the 'How to Survive Your PhD' MOOC.

Even with the barriers of functionality and large volume of posts due to the MOOC's scale, participants spoke warmly and overtly about their overall experiences of community as part of the course. The most positive feedback, exemplified in the deidentified quotes below from student video submissions, related directly to the problem of pluralistic ignorance and the feeling of collective effervescence (Durkheim, 1976):

> It takes a village to complete a PhD…I seriously mean it. The sense of community in this course has been humongous, and I think it's very helpful to know that you are not alone in the world.
>
> I think the one thing about the MOOC and the associated Facebook groups are just the sheer amount of community and friendly feeling that you get from everybody else who is travelling along the same journey as you are, with all its highs and lows.

A strong positive outcome is that the original community continues to develop and grow, with many of the Facebook communities (including the PhD OWLs) remaining active. The course hashtag on Twitter, #survivePhD15, has been made into the ongoing discussion #survivePhD, and tweets and live chats are held regularly, run entirely by course participants themselves.

Emotion and Community

The academic and emotional are deeply intertwined, and it is the same for moderators as it is for participants. We set out to combat pluralistic ignorance in research education through opening up discussion on emotions in HDR student experiences of research on both a global and local scale. Active and supportive communities along with frank discussion can push back on the toxic silence that plagues higher education. Best practice requires engaged learning communities and this needs to be considered more in MOOC design. We found that inclusion, community, and harnessing the power of collective effervescence are fundamental to ensuring a positive, supportive, and engaging learning experience for participants on such a massive scale. To achieve this within the constructivist limitations of an xMOOC platform, it was crucial to utilise a combination of the core site itself along with the additional capabilities of social media. In doing so, along with activating the support networks of smaller sub-group communities, we saw that the supposed dichotomy between xMOOCs and cMOOCs could be temporarily overcome and moderation practices could be made more targeted and effective. Communities do not just happen on their own - simply creating a forum will not create a community. Active and consistent moderation that models good behaviour and genuine engagement, emphasises self empowerment, connections, and that builds local capabilities within the participant cohort itself is key to scaffolding, growing, and establishing self-sustaining ongoing communities of support and education. In this process, it is essential that participants themselves are radically included and viewed as peers with agency alongside the moderation team. In the long term, if MOOCs themselves are genuinely to engage in best practice, then some fundamental structures, such as the current fixed forum format, will need to be revisited. In the meantime, it is possible to achieve an engaged, flourishing, and successful participant experience through creative use of people-centric design combinations, such as those we have used here, to ensure that MOOCs can make a positive intervention within higher education through their discussion prompting potential long into the future.

References

Bali, M. (2014). MOOC pedagogy: Gleaning Good Practice from Existing MOOCS. *Journal of Online Learning and Teaching.* 10(1). Merlot.

Bayne, S. & Ross, J. (2014). MOOC Pedagogy. *Massive Open Online Courses: The MOOC Revolution*. Ed. Paul Kim. London and New York: Routledge.

Durkheim, E. (1976). *The Elementary Forms of the Religious Life*. London: Allen and Unwin.

Ebben, M. & Murphy, J. (2014). Unpacking MOOC scholarly discourse: a review of nascent MOOC scholarship. *Learning, Media and Technology*. 39(3), 328-345.

Freund, K., Kizimchuk, S., Zapasnik, J., Esteves, K., Mewburn., I. (forthcoming). A Labour of Love: A critical examination of the 'labour icebergs' of Massive Open Online Courses. *The Digital Academic: Critical Perspectives.* Eds. Deborah Lupton, Inger Mewburn, and Pat Thomson. London and New York: Routledge.

Kop, R., Fournier, H., & Mak, JSF. (2011). A Pedagogy of Abundance or a Pedagogy to Support Human Beings? Participant Support on Massive Open Online Courses. *The International Review of Research into Open and Distributed Learning.* 12(7).

Lovitts, B. (2001). *Leaving the ivory tower: The causes and consequences of departure from doctoral study*. Washington: Rowman & Littlefield.

McGagh, J., Marsh, H., Western, M., Barber, M., Franzmann, M., Gallois, C., et al. (2016). *Securing Australia's Future: Review of Australia's Research Training System.* Melbourne: Australian Council of Learned Academies.

Morris, N. & Lambem J. (2014). *Studying a MOOC*. Basingstoke: Palgrave Macmillan.

Pearson, M. (1999). The Changing Environment for Doctoral Education in Australia: implications for quality management, improvement and innovation. *Higher Education Research & Development*, 18(3), 269–287. http://doi.org/10.1080/0729436990180301

Pilkey, B. (2014). *Moocs E-Learning and Beyond: exploring the future of virtual built environment teaching.* London: University College London.

Ross, J., Sinclair, C., Knox, J., Bayne, S., & Macleod, H. (2014) Teacher experiences and academic identity: The missing components of MOOC pedagogy. *Journal of Online Learning and Teaching*. 10(1). Merlot.

Wasson, C. (2013) "It was like a little community": An ethnographic study of online learning and its implications for MOOCs. *Session 3 EPIC Conference*.

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Individual differences in motivations for using social media among university students

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This study aimed to examine individual differences in motivations for using social media among university students**.** Motivations were measured with a validated social media motives scale. Participants were 348 undergraduate students studying in a university in Hong Kong. Results from a series of MANOVAs showed that there were in general no significant differences in the five motivation variables (entertainment, personal utility, information seeking, convenience, and altruism) with respect to a group of demographic variables (gender, faculty, year of study, experience in using computers or the Internet, and IT proficiency). However, given that students mostly agreed that they used social media to seek free information and to know what is happening recently, educators may encourage students to develop their own personal learning environments and integrate informal and formal learning activities with social media.

Keywords: individual differences, motivations, social media, university students

Introduction

The use of social media has been prevalent in our society. In Hong Kong, results from an online survey with 387 residents indicated that 92% of them visited Facebook, 77% read blogs every week, and 52% wrote blogs (Li, 2011). A recent survey conducted by Pew Research Center in the US showed that nearly 65% of American adults used social networking sites in contrast to only 7% back in 2005 (Perrin, 2015). A number of studies have been performed to understand social media usage patterns of college students (Jesse, 2013) and why people use certain social media platforms (Cheung, Chiu, & Lee, 2011). However, researchers have paid much less attention to investigate the motivations that drive people to use social media in general. It is argued that knowing motivations for using social media is crucial nowadays. Motivations can be defined as "reasons that underlie behavior that is characterized by willingness and volition" (Lai, 2011, p. 2). Participation and interactions that lead to more user-generated contents in social media are increasingly common online behaviors among the youth (Jenkins, Purushotma, Weigel, Clinton, & Robinson, 2009) but it is not always clear about what causes such behaviors. For university students, social media enable them to build their own personal learning environments (PLEs) that enhance academic motivation, engagement, and achievement. Social media also provides a good opportunity for informal learning and the integration of informal and formal learning activities (Deng & Tavares, 2015).

The uses and gratifications theory (UGT) has been widely adopted to study motivations in media research since it was introduced in early 1970s (Katz, Blumer, & Gurevitch, 1974). UGT is "concerned with (1) the social and psychological origins of (2) needs, which generate (3) expectations of (4) mass media or other sources, which lead to (5) differential patterns of media exposure (or engagement in other activities, resulting in (6) need gratifications and (7) other consequences, perhaps mostly unintended ones" (Katz et al., 1974, p. 20). The key premise of the theory is that people choose specific media to satisfy their different needs. It is believed that differences in needs affect how and why media are consumed.

Although UGT has been extensively researched in many studies, there are studies that pointed out the limitations of prior work. Qiao and Zhu (2011) asserted that previous research efforts using the theory "pay little attention to internet new media with various features which have rich recreation and interpersonal communication characteristics" (p. 235) and the theory "has not yet systematically studied users' important individual differences' impact on usage motives and usage behavior" (p. 236). Against this background, this study aimed to examine individual differences in motivations for using social media among university students in which motivations are framed within the UGT. It is hoped that this study contributes to the growing literature that attempts to understand the reasons why university students use social media and their demographic differences if any.

Method

Procedure

In order to recruit participants for the present study, all the undergraduate students in a university in Hong Kong received mass emails to invite their participation. Data were collected anonymously through an online survey website. Participants first completed questionnaires measuring their motivations for using social media. Then they proceeded to provide some demographic information such as gender, age, faculty, major, year of study, experience in using computers or the Internet, and IT proficiency.

Participants

Three hundred and forty eight undergraduate students took part in the study on a voluntary basis. The sample consisted of 109 males and 232 females with ages ranging from 17 to 28 (Mean = 20.252; SD = 1.565). They came from the Faculties of Arts (n = 51), Business Administration (n = 73), Education (n = 19), Engineering (n = 29), Law (n = 8), Medicine (n = 53), Science (n = 47), and Social Science (n = 62). In terms of year of study, there were 123 first year, 85 second year, 75 third year, 57 fourth year, and 2 fifth year students respectively. On average, they possessed 12 to 14 years of experience in using computers or the Internet. They perceived their IT proficiency to be good. Missing data accounted for 1.4 to 2.0% in the above demographic variables.

Measures

The Social Media Motives Scale developed by Al-Menayes (2015) was adapted to measure undergraduate students' motivations for using social media. It was designed with reference to the UGT. Respondents were asked to indicate the extent to which an item describes the reason for using social media. The original scale has 18 items in 5 subscales, namely entertainment (ENT), personal utility (PU), information seeking (IS), convenience (CON), and altruism (ALT), which are rated on 5-point Likert scale (5 = Exactly true, 1 = Not at all true). According to the author, alpha reliability of the subscales ranged from .61 for CON to .84 for ENT. One item in the IS subscale was deleted because it is about finding information for research and homework and its content is quite different from the others. As such, a 17-item scale was used instead.

Results

Fabrigar and Wegener (2012) suggested that the factor structure of a validated scale needs to be explored when the scale is used in different cultural context. As such, exploratory factor analysis using the principal component method with promax rotation was conducted on the 17-item scale that measures the motivations for using social media. Table 1 shows the results of the analysis. Five factors with eigenvalues greater than 1 were extracted and they collectively accounted for 70.98% of the variance of the original item variables. Two items from the ENT subscale ("Because it entertains me" and "Because I enjoy using it") were dropped because they had high cross loadings greater than .50 with items of the CON subscale. All the items had high loadings in their own factors and the factors had high alpha reliability ranging from .77 to .90.

Table 1: Results of exploratory factor analysis on 15 items adapted from the Social Media Motives Scale

Item	Factor				
	1 (ENT)	2 (PU)	3 (IS)	4 (CON)	5 (ALT)
1. I use it to kill time	.89				
2. When I have nothing else to do	.88				
3. To occupy my time	.85				
4. To join groups		.93			
5. To join conversations		.89			
6. I enjoy answering questions		.64			
7. To listen to other's opinion		.42			
8. To search for information			.84		
9. To get free information			.84		
10. To know what's going on			.81		
11. It's easier than meeting				.90	
12. Communication can take place anytime				.75	
13. Because it's free				.61	
14. To encourage others					.91
15. To help others					.88
Cronbach's alpha	.83	.79	.85	.77	.90

Descriptive statistics of the five major constructs are presented in Table 2. It was evident that with the exception of ALT, all the other constructs had a mean value over 3 and thus the participants agreed to a large extent that the items in the respective constructs represented their motivations for using social media. The participants mainly used social media for IS, which was followed by CON, ENT, PU, and ALT.

Table 2: Descriptive statistics of the five constructs obtained from exploratory factor analysis

Construct	Minimum	Maximum	Mean	SD
ENT	1.00	5.00	3.43	.88
PU	1.00	5.00	3.06	.80
IS	1.00	5.00	3.98	.74
CON	1.00	5.00	3.78	.79
ALT	1.00	5.00	2.92	.91

A series of MANOVAs were performed with gender, faculty, year of study, experience in using computers or the Internet, and IT proficiency as independent variables, and with the aforementioned five constructs as dependent variables. Results revealed a marginally significant multivariate main effect for gender, Wilks' $\lambda = .97$, $F(5, 335) = 2.24$, $p = .05$, partial eta squared = .032. Because of this significant result, the univariate main effects were examined but no such effects were found after considering Bonferroni correction for multiple tests. For faculty, no significant multivariate main effect was found, Wilks' $\lambda = .87$, $F(35, 1390.61) = 1.38$, $p > .05$, partial eta squared = .028 and so did year of study, Wilks' $\lambda = .93$, $F(20, 1105.39) = 1.19$, $p > .05$, partial eta squared = .017. There was a significant multivariate main effect for experience in using computers or the Internet, Wilks' $\lambda = .87$, $F(30, 1322) = 1.57$, $p < .05$, partial eta squared = .028 but not the subsequent univariate main effects. Finally, a significant multivariate main effect for IT proficiency was found, Wilks' $\lambda = .91$, $F(20, 1105.39) = 1.68$, $p < .05$, partial eta squared = .024 and so did a significant univariate main effect for IS, $F(4, 337) = 3.74$, $p < .01$, partial eta squared = .043. Post-hoc pairwise comparisons using Tukey's HSD test showed no significant differences in IS for different levels of IT proficiency.

Discussion and implications

This study revealed that among the different reasons for using social media, university students mostly agreed that they used social media to seek free information and to know what is happening recently. It further showed that there were no significant demographic differences in their motivations for using social media. This means that demographic factors including gender, faculty, year of study, experience in using computers or the Internet, and IT proficiency have insignificant effects on the motivation measures. Future research should explore other potential factors such as personality traits that have been shown to influence media preferences and motivation differences (Qiao & Zhu, 2011). On the other hand, it is also worthwhile to consider other research model that may help explain motivations to use social media. For instance, Hallikainen (2015) developed a value and need based research model to analyze what drives a user to utilize social media platforms.

To capitalize on the use of social media for learning purposes, educators may encourage university students to establish their PLEs with the aid of social media tools. PLEs refer to "a collection of loosely coupled tools, including Web 2.0 technologies, used for working, learning, reflection and collaboration with others" (Attwell, 2010). Li (2015) highlighted five features of social media that help learners create their PLEs to achieve personal learning goals. These include the openness of social media that allows learners to construct their learning spaces and environment on their own in a bottom-up manner, the generation of user contents using appropriate web resources with respect to individual learning goals, the networking functionality of social media that facilitates learners to enlist support from experts or peers, the sharing feature of social media that makes the dissemination of PLEs more efficient than before, and the collaborations and interactions afforded by social media that foster knowledge generation and management among learners.

There are also advocates who support the notion of integrating informal and formal learning with social media. Greenhow and Lewin (2016) contended that because pedagogical practices focusing on aspects of formal and informal learning have become very common, it is necessary to understand learning in terms of varying attributes of formality and informality. Despite of the fact that the boundary between the two learning approaches is blurred, social media offer a possible avenue to bridge formal and informal learning through participatory digital cultures (Jenkins et al., 2009) in which there is no longer a clear distinction between "self-directed, intentional learning and spontaneous, incidental and experiential learning" (Greenhow & Lewin, 2016, p. 13). The authors further proposed a model of learning attributes in four categories (purpose, process of learning, location/context, and content) that theorized social media as a learning space with varying formal and informal attributes, and illustrated with two cases on how to make sense of learning from the model's perspective.

Conclusion

This study set out to answer the question of why university students use social media and how their use may differ across some demographic variables. Although individual differences in social media motives are not apparent, it is clear that university students are motivated or self-motivated to participate in social media for various reasons. This study represents an initial step in advancing this line of research. While recognizing the complex nature of motivations as a psychological construct, it is imperative to gain a more comprehensive understanding of the antecedents and consequences of students' motivations for using social media in future studies.

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References

Al-Menayes, J. J. (2015). Motivations for using social media: An exploratory factor analysis. *International Journal of Psychological Studies, 7*(1), 43-50.

Attwell, G. (2010). Personal learning environments and Vygotsky. http://www.pontydysgu.org/2010/04/personal-learning-environments-and-vygotsky

Cheung, C. M. K., Chiu, P., & Lee, M. K. O. (2011). Online social networks: Why do students use Facebook? *Computers in Human Behavior, 27*, 1337-1343.

Deng, L., & Tavares, N.J. (2015). Exploring university students' use of technologies beyond the formal learning context: A tale of two online platforms. *Australasian Journal of Educational Technology, 31*(3), 313-327. https://ajet.org.au/index.php/AJET/article/view/1505

Fabrigar, L. R., & Wegener, D. T. (2012). *Exploratory factor analysis*. New York, NY: Oxford University Press.

Greenhow, C., & Lewin, C. (2016). Social media and education: Reconceptualizing the boundaries of formal and informal learning. *Learning, Media and Technology, 41*(1), 6-30.

Hallikainen, P. (2015). Why people use social media platforms: Exploring motivations and consequences of use. In L. Mola, F. Pennarola, & S. Za (Eds.), *From Information to Smart Society: Environment, Politics and Economics* (pp. 9-17). Heidelberg: Springer.

Jenkins, H., Purushotma, R., Weigel, M., Clinton, K., & Robinson, A. J. (2009). Confronting the challenges of participatory culture: Media education for the 21st century. http://mitpress.mit.edu/sites/default/files/titles/free_download/9780262513623_Confronting_the_Challenges.pdf

Jesse, G. (2013). Like, tweet, or pin: College students and their current use of social media. *Issues in Information Systems, 14*(1), 403-414.

Katz, E., Blumer, J. G., & Gurevitch, M. (1974). Utilization of mass communication by the individual. In J. G. Blumer & E. Katz (Eds.), *The uses of mass communications: Current perspectives on gratifications research* (pp. 19-34). Beverly Hills, CA: Sage.

Lai, E. R. (2011). *Motivation: A literature review*. New York, NY: Pearson.
Li, N. (2015). *Personal learning with social media: Reputation, privacy and identity perspectives.* Unpublished doctoral dissertation, Swiss Federal Institute of Technology in Lausanne, Switzerland.
Li, Z. (2011). Hong Kong social media use higher than United States. *CNN Travel*. http://travel.cnn.com/hong-kong/life/hong-kong-social-media-use-higher-united-states-520745/
Perrin, A. (2015). Social media usage: 2005-2015. http://www.pewinternet.org/2015/10/08/social-networking-usage-2005-2015/
Qiao, X., & Zhu, Y. (2011). A review of theory and research based on uses and gratifications in HCI. In S. Lin & X. Huang (Eds.), *Advances in Computer Science, Environment, Ecoinformatics, and Education, Part III* (pp. 232-236). Berlin, Heidelberg: Springer.

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Lecture Pods Unlimited

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The Blended Learning Team from the School of Humanities and Communication Arts will demonstrate how we assist with the creation of 'lecture pods'. The presentation will be delivered in video format, showing the actual processes we go through. We'll detail how we work with academics to assist them to convert their teaching from live lectures to presenting to camera. The presentation will also showcase several tools created by Peter Steele, that have made a great contribution to sustainable processes in the school for producing large volumes of lecture pod videos.

Keywords: video, lecture-pods, sustainable, processes, team, syncprompter, design, benchmark

Video poster link

https://youtu.be/wT5zsqw-qN0

Video Poster Transcript

The following video is presented by the four Blended Learning Team members from the School of Humanities and Communication Arts from Western Sydney University. It is divided into four short sections: an overview or description of our technology enhances Learning or TEL project; the aims and objectives of this project; the tools and workflows developed for this project - most notably the SyncPrompter app; and the outcomes to date of this project

The TEL innovation developed by the HCA Blended Learning team, is an efficient, sustainable workflow and tools for the development of online lecture pods. Lecture pods are short form video materials that replace face-to-face lectures in fully online delivery, and are embedded in the university's learning management system, or LMS, which is called vUWS.

The School's Bachelor of Communications degree was offered on campus, online, and in a hybrid online form in 2015. The flipped classroom required lecture content to be available exclusively online. Rather than simply video live lectures, a practice that had generated low viewing numbers when trialled some years prior, the four person blended learning team developed and supported the production of lecture pods.

A pod is a small chunk of lecture content, usually around 6-12 minutes long, containing a few key messages or insights. Our campus based students welcomed the opportunity for accessing lecture content asynchronously. These are not simply a long lecture divided up, the academic staff have reworked their material for each pod to contain a few key pieces of information, examples and calls to action. The call to action may appear in the pod itself, or on the vUWS site where the pod is situated. The pods only work when the content is adapted to this shorter style in this asynchronous space. The academics had to see the lecture content from a different perspective.

The team's aims and objectives included: increase production capacity and efficiency of online lecture pod materials, making high volume, and high quality both sustainable and cost-effective for a small team; increase reusability of content through improved scripting and lecture content structure; invigorate the look and feel of vUWS sites within the said LMS, with a view to match and increase "student attendance", both of lecture content and time spent using the LMS for face-to-face students as well as the online cohort.

We have offered a range of support to staff to bring them up to speed with their lecture pods and other blended learning developments. The team developed a style guide for a standard lecture pod video. This guide considered playback on multiple devices of varying sizes, factoring in text legibility, contrast with other learning materials, viewer screen use fatigue and even portable device power drain. The team consolidated the guidelines, templates and instructional videos on one web page. Academic staff were referred to this page as part of initial discussions regarding their individual lecture pod production timeline.

Here the academics can find: a video outlining the rules and processes to help them create a properly formatted script and slideshow for their lecture pods; a link to download the four approved PowerPoint templates; a second video – which we'll play soon – of pod tips, some dos and don'ts.
Links to our pod facilities calendars; and finally, email links to request a booking. This email goes to a shared team mailbox.

A number of instructional videos were produced using the same technology and workflows that academics use for their pods. These videos, often including the team's own brand of humour, have also been screened at meetings and conferences, and the staff from other schools within the university as examples of emerging best practice. When the academics are presenting these pods, and indeed when we're presenting, we're doing so with the aid of a teleprompter.

Teleprompters are wonderful things and basic prompter generators for your web browser can be sourced for free. Very basic tablet prompter apps are under $10. But all these do is scroll your text. Back in the day this meant that a presenter would have to look at the prompter with a prompter remote in one hand, and with the second hand – and their peripheral vision – drive their PowerPoint slideshow. Few people could look cool and professional with this multitasking.

We then experimented with a blended learning staff member operating the slideshow remote 'live', but this was also problematic. It was difficult to anticipate the speed of the presenter's delivery, and hard to note mistake points simultaneously. We needed code. Team member Peter Steele developed, from scratch, SyncPrompter. A staff member writes their script and PowerPoint Slide cue points and presenter checkpoints in this document. This is then saved as a text file to the Blended Learning Team's Dropbox account. Using SyncPrompter, one opens this file from Dropbox on an iPad in an autocue mount. Once the recording has commenced, the SyncPrompter script can be started, at which point the app produces a tone for synch in post-production. The presenter can control the speed of the autocue on-the-fly using a bluetooth remote control. If the presenter makes a mistake, they can stop the autocue and return to the previous checkpoint or slide. Once the pod recording is complete, the app saves a zip file back into the Dropbox. This contains files including the original script, subtitle files, logs, xml files for editing, as well as a folder structure to populate with the source footage, any additional media, the PowerPoint slides, and eventually the completed exported lecture pod. When the XML is imported to FinalCut Pro, AutoDesk Smoke or Premiere Pro for editing, the presenter mistakes have already been removed from the recording automatically, with slide placeholders also positioned in the sequence all ready to be linked to the pod recording file and PowerPoint slides. The editor's role becomes one of quickly finessing points rather than wading through and assessing takes.

The Peter Steele titlemaker allows all staff to generate identical video title slides, which then double as the custom thumbnail frame, sometimes call a poster frame, when the video is embedded into vUWS. The School's vUWS sites' look and feel, the result (once again) of Peter's custom code, provides buttons for the pods underneath the embedded videos. Students can select all sections of a particular module or a single section on which to concentrate, such as the lecture pods.

The lecture pods with online Zoom tutorials were at the centre of the student learning experience.

Outcomes of this TEL project include: an increase of production capacity up 300%; an increase in the quality and consistency of lecture pods produced, due to staff training and the aforementioned post production tools; reusability of content is increasingly part off normal teaching practice with a steep decline in pods requiring reedits or reshoots; in seven of the course units the lecture pods in the HCA pod rooms have provided better than the equivalent of 100% attendance at face-to-face lectures. When compared to the overall school vUWS site averages, data shows that the enhanced vUWS sites making use of lecture pods, boast impressive improvements across student access to the unit sites, student interactions once in the unit sites, and the minutes spent in the unit sites overall.

And finally, in December 2015 the Blended Learning Team, along with the academics who delivered the program, won the Western Sydney University Learning and Teaching Award for Excellence in Teaching, for the first four fully online units making use of this technology enhanced learning.

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Transformation through transition: learning through 'theory of change'

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The poster presents an overview of the 'MyUni Transform' project underway at The University of Adelaide. This involves institution-wide transition, between May 2016 and December 2017, to a single Learning Management System from three systems currently in use in the University (the move is to Instructure Canvas from, principally, Blackboard Learn and, additionally, Moodle and an in-house system). Rather than implementing transition through automated roll-across of existing learning content and design, the project is approaching the transition process as an opportunity to facilitate significant transformation in blended learning design and practice across the University, in alignment with the goals of its Strategy for Learning, Teaching and Assessment (2016-18). The poster identifies key elements of the change approach that has been adopted, and outlines a 'theory of change' impact evaluation perspective that is seen to have value for ongoing monitoring of, reflection on, and learning from, the project's early stages and beyond.

Keywords: Learning Management System, Canvas, Learning Design, Theory of Change

Strategic Context

The University of Adelaide's Strategic Plan 2013-2023 establishes an ambitious commitment to transformation of the institution's digital learning environment. It places a particularly strong focus on enhanced use of blended learning for campus-based study, to increase flexibility in modes of learning and to leverage digital technologies in support of the institution's signature pedagogical approach, the Small Group Discovery Experience (SGDE). The University's Strategy for Learning, Teaching and Assessment (2016-18) aligns with this plan and establishes goals for the use of digital technologies in enabling active, collaborative and discovery-oriented learning, including authentic assessment, and in fostering co-creation and partnership approaches to student learning. It includes a commitment to digital literacies development, both for staff and students, to greatly enhanced use of learning analytics, and to sharing and reuse of digital learning assets for example as generated through the University's AdelaideX MOOCs.

MyUni Transform

Guided by the strategic priorities outlined above and with the aim of improving student and staff satisfaction with the institutional digital learning environment, a scheduled periodic review of the University's existing LMS environment (principally Blackboard Learn and, additionally, Moodle and an in-house system) was undertaken in the second half of 2015, involving extensive user consultation and comparison of system options.[14] The decision was taken in early 2016 to move to cloud-supported Instructure Canvas as its sole Learning Management System, referred to locally as 'MyUni'. The strategic decision was taken early on to invest in the transition process as an unprecedented opportunity to facilitate significant transformation in blended and online learning design and related educational practice at the level of the whole institution.

This meant that, rather than implement transition seamlessly through minimum intervention and automated roll-across of existing learning content and design, the project instead seeks to engage all coordinators of around 2,300 courses in a developmental process of supported learning design based on a combination of at-elbow individual support for pedagogical and technical aspects, and access to peer networks for dialogue and collaborative exchange. The aim is to support adoption of best-practice blended and online learning design principles in a light touch, flexible way that teaching staff can adopt and sustain, and which addresses student feedback at the University on current use of MyUni. For example, consultation feedback showed that reasonable consistency in MyUni course interface layout was a key requirement for students. The MyUni Transform project aims to ensure that all courses meet

[14] Comparison was made between Blackboard Learn (rather than Ultra) and selected other systems.

the University's 'Guidelines for Minimum Use of MyUni' by embracing learning design uplift during the implementation; more than this, it aims to introduce all course coordinators to new ways of achieving their educational goals by drawing on the new tools and functionality at their disposal including, for example, the area of learning analytics. Implementation of the Echo360 Active Learning platform (entailing a move from the University's previous in-house lecture capture system) is incorporated into the MyUni Transform project, and learning analytics from these educational technologies are being explored. At the start of Semester 2 2016, around 200 'first wave' courses went live in Canvas and Echo, and the project timeline aims for all courses from the start of 2017 to be delivered using these platforms. Key features of the change process are:

- Seven hours individual staff support per course, through eLearning Advisors and MyUni Transform trained students working as casual staff;
- Templated interface design based on activity-focused learning design principles;
- Suite of institution-wide professional development activities to enhance active learning and assessment practices including MyUni for SDGE, plus online resources;
- Peer support (inter-faculty communities of practice; Adelaide Education Academy - Education Specialists; within-faculty academic eLearning Fellows; within-faculty peer support initiatives);
- Alignment with digital library resources support including reuse of digital assets generated at the University of Adelaide and of open access resources, plus digital literacies project;
- MyUni technical troubleshooting support plus Canvas user community and 24/7 support service.

Learning through theory of change

> Some initiatives to enhance learning and teaching in universities have limited effects because they lack a robust, well-developed and explicit change theory […] Every innovation is imbued with a theory or theories of change. However, these usually remain tacit, unchallenged and […] are often ineffective, misconceived or even counter-productive (Trowler 2015).

A theory of change is a predictive assumption about the relationship between desired outcomes of a change program and the actions and resources/enablers that may produce those changes. Approaches to the evaluation of change programs that adopt a theory of change approach focus not just on whether desired outcomes eventually are met but, iteratively, on the process factors that it is anticipated will facilitate change. These approaches usually are established through stakeholder participation from the start of change programs, and are used to guide ongoing monitoring, reflection and review. In the case of MyUni Transform, this approach to evaluation was not initiated at the project outset. However, it offers a promising framework for ongoing project monitoring and review, inviting the project team and stakeholders to consider the theories informing action and their effects, whether implicit/explicit or informal/formal. Trowler (2015) cautions against a technical-rational understanding of change in complex university environments, advocating instead a social practice perspective that focuses attention on situated social and relational practices involving agency, structure and the role of artefacts in material mediation of practice. Reflecting this perspective, he advocates a change approach based on, *inter alia*, sensitivity to context and history; 'low resolution' initial planning and vision; extensive participant engagement, discussion, consensus building; inclusive decision-making; acceptance of diversity; encouragement of challenges to *status quo;* local self-organisation; recognition of the importance of artefacts in shaping practices; permissiveness toward adaptation; high quality information; frequent feedback cycles; acceptance of variable outcomes in short term; and willingness to allow time for fundamental changes to occur. These recommendations, and the principles of compatible perspectives, such as situated learning theory (Wenger 1998), offer valuable points of reference against which to test and adjust the assumptions underpinning the MyUni Transform project in the course of project review and evaluation over the coming year and beyond.

Conclusion

MyUni Transform is a strategic, institution-wide approach to transformation of educational practice through a LMS transition process. It is hoped that ongoing monitoring and review of challenges and successes, from a theory of change perspective, will afford valuable insights not just for the University of Adelaide but for other institutions taking a similar path.

References

Trowler, P. (2015) Change theory and changing practices: Enhancing student engagement in universities. In: *Student engagement in Europe*. Strasbourg: Council of Europe Publishing, 160-171. http://eprints.lancs.ac.uk/75524/1/FINAL_Trowler_Student_Engagement_in_Europe.pdf

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge: Cambridge University Press.

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Professional identity and teachers' learning technology adoption: a review of adopter-related antecedents

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Abstract: This paper reviews adopter-related antecedents of learning technology adoption by higher education teachers. We, drawing on findings from Management and Psychology, Computing, and Education, suggest an adopter-centered perspective on teachers' learning technology adoption and identify work-related, technology-related, and teaching-related antecedents, which reflect aspects of teachers' professional identity. We further argue that teachers' professional identity shapes their perceptions of innovation characteristics, which in turn affects learning technology adoption. The paper concludes by highlighting that future research and practice should explore aspects of professional identity in order to more fully explain learning technology adoption, and should facilitate the adoption process through addressing the reconstruction of professional identity.

Keywords: learning technologies, technology adoption, teacher, professional identity, antecedents

Introduction

Learning technologies are being implemented by universities (Browne et al., 2006) with the aim of enhancing learning experience and transforming educational practice (Coates et al., 2005). The adoption of learning technologies by universities, like other organisations, occurs at two levels (Frambach and Schillewaert, 2002): at an organisational level and then at an operational unit or individual level. Universities make an institution-wide decision to invest in a learning technology and then, to varying degrees, academic staff make their own decisions regarding how they will use it. Teachers may behave differently even though they are exposed to similar technologies (Stein et al., 2011); some may leap to use new technologies while others shy away or resist identical innovations (Quinn, 2012).

Extant research on technology acceptance and teachers' integration of educational technologies takes an innovation attribute-centered perspective which propses that a technological innovation will be adopted if it is perceived to be superior to its predecessors. This approach proposes that the perceived innovations' attributes are the critical antecedents of technology adoption (Frambach and Schillewaert, 2002). Adoption failures are interpreted in terms of inadequate features and it is assumed that further developments of a technology should lead to enhanced take-up. Such an approach does not incorporate subjective interpretations and cannot explain differences in adoption between individuals who, at least on paper, have very similar work tasks to complete and very similar experiences of predecessor technologies.

In recognising subjective interpretations and individual differences in learning technology adoption, we take an adopter-centred perspective. An adopter-centred perspective acknowledges that individuals are different and actively engage with new technologies. Individuals "seek innovations, experiment with them, evaluate them, find (or fail to find) meaning in them, develop feelings (positive or negative) about them, challenge them, worry about them, complain about them, 'work around' them, gain experience with them, modify them to fit particular tasks, and try to improve or redesign them –often through dialogue with other users (Greenhalgh et al., 2004, p. 598)". This perspective highlights the individual and contextual dynamics in the adoption process, and contrasts markedly with the "early adopter" and "laggard" classification that oversimplifies the individual's adoption process (Greenhalgh et al., 2004).

In this paper, we first review adopter-related antecedents, then present the notion of professional identity and demonstrate how it can be used for understanding teachers' adoption of learning technologies.

Work-related orientations as antecedents

Work-related psychological orientations refer to consistent complex of cognitive, motivational, and moral orientations to a given situation that serves to guide behaviour (Deutsch, 2011). Four teachers' work-related orientations are considered below.

Personal innovativeness

Personal innovativeness is probably the most frequently included work-related orientation in information systems research. It refers to willingness to adopt innovations in general (Kirton, 1976), and was initially depicted as an outcome variable to segment consumers into 'innovators' and 'non-innovators'(Rogers, 1995). Later on, it was regarded as a personality trait, an antecedent of innovation adoption behaviour (Flynn and Goldsmith, 1993). Agarwal and Prasad (1998) found that personal innovativeness in IT moderated adopter's intention to use a new technology. A recent study also confirmed that personal innovativeness in IT moderated the relation between contextual triggers and system use (Sun, 2012).

Change orientation

Change-related orientations concern attitudes to alterations in practice or policy at work (Parker et al., 2006). Since technological innovations impose a change to the workplace, individual's change orientation may affect the adoption process. In organisational research, change orientation is found to be an antecedent of employees' proactive behaviour (Strauss and Parker, 2014) and employees' participation in planned organisational change (Miller et al., 1994). One empirical study in education (Vannatta and Nancy, 2004) suggests that teachers' "openness to change" affects teachers' classroom technology use.

Control orientation

Control orientation describes the general belief that one is in control of important issues at work and includes: control aspiration, perceived opportunity for control, and control self-efficacy (Frese et al., 2007). Parker et al. (2006) further propose "control appraisal" which they define as individuals' expectation on taking charge of the situation, as an alternative to measuring control orientation. Other works assess locus of control (Rotter, 1966), which is the extent that an individual perceives events to be under his or her control, or under the control of powerful others, to capture control beliefs. In general, control orientation has been found to be predictive of employees' taking charge (Morrison and Phelps, 1999) and employees' commitment to organisational change (Chen and Wang, 2007). Within information systems research, coping theory suggests that individual perception of control over the environment, along with the perception of the environment, affects employees' behaviour towards technological innovation (Beaudry and Pinsonneault, 2005; Elie-Dit-Cosaque and Straub, 2011). When an individual has lower level of perceived control, they may adopt either a self-preservation strategy or a benefits satisficing strategy. In contrast, when an individual has higher level of perceived control, they may take either a disturbance handling strategy or a benefits maximizing strategy (Beaudry and Pinsonneault, 2005). Hsia et al. (2014) integrated locus of control into the technology acceptance model. They report that locus of control was associated with perception of innovation attributes, such as usefulness and ease of use.

Autonomy

Autonomy refers to the desire for self-initiation and is purported to contribute to intrinsic motivation along with other psychological needs (Gagné and Deci, 2005). Intrinsic motivation, the motivation for doing an activity for its own sake, is associated with a number of important work outcomes such as effective performance, flexibility, and uncertainty (Gagné and Deci, 2005). Roca and Gagné (2008) incorporated autonomy into the technology acceptance model to investigate employees' e-learning continuance intention in the workplace. They found that autonomy was positively related to perceived innovation attributes, which in turn affected employees' e-learning continuance intention. Sørebø et al. (2009) included autonomy as a hypothesised antecedent of teachers' e-learning technology continuance intention. Their findings were consistent with Roca and Gagné (2008)'s research. Autonomy was positively associated with teachers' perceived usefulness of the e-learning technology and their intrinsic motivation, which affected teachers' e-learning continuance intention.

Summary

Four psychological work-related antecedents to technology adoption have been examined: personal innovativeness, change orientations, control orientations, and autonomy. They are similar in that they all concern work-related orientations which guide behaviour towards change or uncertainty. They contrast in several aspects. Personal innovativeness emphasises general tendency or attitude towards innovations whereas change orientation includes perceptions of change in organisational settings. Control orientation captures desire for and perception of control and has been found to predict change-related attitudes and behaviour towards technological innovation. Autonomy reflects intrinsic motivation and is associated with perceptions of innovation attributes. Given their predictive power and theoretical importance in change management and information systems and their relative neglect in learning technology adoption, work-related orientations warrant further investigation.

Technology-related antecedents

The section below considers technology-related antecedents. They are: attitude and emotions towards technology, experience and habit with technology, knowledge and computer self-efficacy.

Attitude towards technology

Attitude refers to the summary evaluation of an object of thought and may encompass affective, behavioural and cognitive responses (Vogel and Wanke, 2016). Attitudes are stored in memory and retrieved for evaluation of an object in question (Eagly and Chaiken, 2007). Since technological innovations are novel and adopters may not possess information to evaluate the specific innovation, they are likely to retrieve general attitudes towards technologies to assess or interpret innovation novel technology. Information systems research tends to examine attitude towards a specific technological innovation, rather than attitude towards technology in general. For instance, the technology acceptance model (Davis, 1989) incorporated attitude towards computer, a specific attitude towards technology, as an antecedent of computer use. Within education, Somekh (2008), argues that teachers' attitudes towards ICT (a general attitude), along with their confidence and competence, remained central to their adoption of technologies. Similarly, several literature reviews (e.g. Mumtaz, 2000) and empirical research (e.g. Drent and Meelissen, 2008) have demonstrated that teachers' views about ICT in education are positively related to their use of ICT.

Emotions associated with technology

Emotions tend to be short-lived and are the affect that is related to a specific object (Rosenberg, 1998). Some research has included emotions as antecedents of technology acceptance. Researchers report that feelings of anxiety around computers negatively influences computer use (Compeau and Higgins, 1995a). Beaudry and Pinsonneault (2010) classified emotions into four categories and examined the effect of four representative emotions: excitement, happiness, anger, and anxiety, on technology acceptance. They found that excitement positively affected IT use through task adaptation; happiness positively affected IT use but was negatively associated with task adaptation; anger was positively associated with seeking support which in turn positively affected IT use; anxiety was negatively associated with IT use both directly and indirectly.

Experience and habit associated with technology

Taylor and Todd (1995) compared determinants of computer usage between experienced and inexperienced users. They found that behavioural intention was a better predictor of use for the experienced group whereas perceived usefulness was a better predictor for the inexperienced group. Limayem et al. (2007) defined habit as the extent to which people tended to perform behaviours automatically because of learning. They found that habit moderated the influence of intention to use on use behaviour. With the importance of intention decreasing over time, usage behaviour takes on a more habitual nature. Similar support can be found in education where experience with computers or ICT, especially for educational purposes, is predictive of the use and integration of educational technologies in the classroom (Drent and Meelissen, 2008; Mumtaz, 2000).

Knowledge associated with technology

Aggarwal et al. (2015) examined the impact of self-perceived and actual IT knowledge on technology use. They found that self-perceived IT knowledge was predictive of individual adoption of technological innovation whereas actual IT knowledge was predictive of continuance. The research highlighted the role of general computer-related knowledge on the use of specific technological innovation. Recent studies in education have shown a similar pattern: computer knowledge and skills are associated with teachers' classroom technology use (Petko, 2012; Ertmer and Ottenbreit-Leftwich, 2010).

Computer-related self-efficacy

Self-efficacy refers to subjective assessment of capability to perform a course of action to achieve a desired outcome (Bandura, 1977). Within technology acceptance, some research (Downey and McMurtrey, 2007) viewed computer self-efficacy as a general construct, other research studied specific computer self-efficacy such as spreadsheet self-efficacy (Johnson and Marakas, 2000) and internet self-efficacy (Hsu and Chiu, 2004). Findings suggest that general computer self-efficacy is a strong predictor of computer anxiety, outcome expectation and computer use (Compeau and Higgins, 1995b). In addition, Agarwal et al. (2000) found that general computer self-efficacy is an antecedent of specific computer-related self-efficacy. Anderson et al. (2011) and Kreijns et al. (2013) found that teachers' self-efficacy beliefs about technology was positively associated with their intention and willingness to use ICT in classroom. Cigdem and Topcu (2015)'s research on learning management systems also confirmed that teachers' self-efficacy beliefs about technologies were antecedents of their intention to use learning management system.

Summary

Technology-related antecedents have been considered as variables which differ between individuals and are predictive of technology adoption. It is clear from the above that they are closely related and synergistic. Prior experience with computers or technologies serves as a source of technology-related attitudes and emotions. These attitudes and emotions will be referenced subsequently in the individual's adoption of new learning technologies. However, research has indicated that relationships among technology-related antecedents are complex. Habit may hinder technology adoption when the technological innovation requires a change of behaviour. Knowledge does not always facilitate the adoption of technological innovation either. Given their predictive power and complexity, technology-relate antecedents are worth exploring in teachers' adoption of learning technologies.

Teaching-related antecedents

This section reviews three categories of teaching-related antecedents of teachers' learning technology adoption. They are: teachers' pedagogical beliefs, approaches to teaching, and commitment to teaching.

Pedagogical beliefs

Pedagogical beliefs refer to the way teachers view teaching (Ertmer, 2005). It concerns teachers' suppositions and ideologies of teaching and resides in teacher's larger belief system (Pajares, 1992) along with other educational beliefs. Terms like "conception of teaching" (Chan and Elliott, 2004) and "teaching philosophy" (Becker, 2000) depict similar ideas as pedagogical beliefs. Research on pedagogical beliefs generally confirms that teachers hold two types of beliefs about teaching. Teachers with traditional beliefs view teaching as an information transmission process where teachers need to make sure that students acquire knowledge and apply what is learned (Becker, 2000). Teachers with constructive beliefs, on the other hand, understand teaching as a facilitation process where students construct their own knowledge and initiate conceptual change (Chan and Elliott, 2004). Research has explored the role of pedagogical beliefs on teachers' technology usage, but findings are inconsistent. Anderson et al. (2011) suggests that constructive beliefs are predictive of teachers' technology integration but reports that they did not lead to the use technology in a constructive manner. Similarly, Owens (2012) found that teachers who held constructive beliefs did not necessarily teach online in a "facilitating learning" manner. Petko (2012), however, found that teachers' constructive beliefs had a positive influence on their use of technology though the impact was small. Therefore, the impact of pedagogical beliefs on teachers' technology usage needs to be further explored.

Approaches to teaching

Approaches to teaching (Prosser and Trigwell, 2014), assesses how teachers approach teaching in practice. Two main approaches are proposed: the teacher-centred approach and the student centred approach. The teacher-centred approach emphasizes "acquisition of content and skills through drills and practice". The student-centred approach involves "the prolong engagement of the learner in relating new ideas and explanations to the learner's prior belief" (Jacobson et al., 2010). Although it is suggested that traditional beliefs are closely related to the teacher-centred approach while constructive beliefs are closely related to student-centred approach (Norton et al., 2005), pedagogical beliefs are more of teachers' orientations whereas approaches to teaching emphasize how teaching takes place in practice. Liu (2011) found that teachers' belief about teaching could be quite different from their approaches to teaching in practice. Teachers with constructive teaching beliefs adopted constructive or traditional transmisionist teaching approach and teachers with traditional teaching beliefs took traditional teaching approach. Niederhauser and Stoddart (2001) suggested that the design of educational technologies was influenced by different educational theories: instructional technologies that involve more teacher centred (information transmission) approach which requires students to master and replicate the knowledge and skills;

learning technologies that involve more learner-centred (constructive, transformative) approach which helps students to use the technology as a tool to seek and update their knowledge. They found that teachers chose different educational technologies based on their approaches to teaching although most of the educational software being chosen reflected a transmission approach. Drent and Meelissen (2008) found that student-centred approach was related to the innovative use of information communication technologies. Similarly, Tarling and Ng'ambi (2016)'s qualitative study indicated that transmission pedagogies were correlated with regulated, restrictive ways of educational technology usage; transformative pedagogies was correlated with unregulated, dispersed ways of educational technology usage.

Commitment to teaching

In organisational research, commitment refers to the psychological state that individual feels a desire to remain, an obligation to remain, a cost of leaving the organisation (Herscovitch and Meyer, 2002). Similarly, commitment to teaching could be perceived as a force that binds a teacher to a course of action deemed necessary for the effective teaching. Mumtaz (2000) proposed that teacher's motivation and commitment to student learning as an antecedent of teacher's ICT use. This is confirmed by Vannatta and Nancy (2004) who found that time spent beyond the contractual work week, along with openness to change and intensity of technologies use, was one of the best predictors of classroom technology use. The notion of time spent beyond contractual work week reflects the idea of commitment as it relates to teachers' engagement and dedication to teaching. Given that commitment has been regarded as an important predictor of workplace behaviour (Peccei et al., 2011), commitment to teaching may affect teachers' learning technology adoption.

Summary

Pedagogical beliefs and approaches to teaching are both concerned with how teachers teach and have been treated as antecedents of teachers' adoption of learning technology. However, they differ from each other as pedagogical beliefs describe how teachers view teaching whereas approaches to teaching describe how teachers teach in practice. Commitment to teaching is concerned with effective teaching but also reflects a teacher's desire to teach. It is relatively neglected in teachers' use of ICT. However, since higher education teachers are faced with competing priorities (Skelton, 2012), commitment to teaching may prove to be a powerful predictor of adoption.

Professional identity in learning technology adoption

The preceeding three sections covered individual differences in work-related, technology-related and teaching-related antecedents which are related to technology adoption. By taking an adopter-centred perspective, we move beyond innovation attributes and ask what makes individual teachers perceive introduced learning technology differently and how they form their subjective meaning of, and position themselves towards a technological innovation. However, adopter-related antecedents identified in this paper are derived from concepts borrowed from several disciplines. There is a lack of theoretically sound elaboration which can capture aspects of adopter-related antecedents and provide insights into practice.

The sections below attempts to integrate these categories of adopter-related antecedents into an adopter-centred perspective with the assistance of the notion of professional identity. We first present the notion of professional identity and discuss aspects of a teacher's professional identity. Thereafter, we highlight the way professional identity shapes educational change and its implication for learning technology adoption.

Professional identity as the image of self

Identity refers to meanings attached to a person by oneself and others (Gecas, 1982). The notion of professional identity stems from social identity theory (Ashforth and Humphrey, 1993) which suggests that identity is shaped socially. Professional identity is understood to be part of social identity and relates to work-based self-concepts (Slay and Smith, 2011). Professional identity is different from role in that roles are externally defined by others' expectations but professional identity is defined by the individual internally as they accept or reject social expectations as part of who they are (Colbeck, 2008). Trede et al. (2012) reviewed research on professional identity in higher education and found the term 'professional identity' was conceptualised in many forms. For instance, Sachs (2001) defined professional identity at the professional level as a set of attributes that were imposed on teachers. By contrast, Van Veen and Sleegers (2006) viewed professional identity as a personal conception at the individual level. Professional identity here is defined as the subjective appraisal of self-concepts (Beijaard et al., 2000). However, since self can only arise in social communication where one learns to assume the role of others, and subsequently monitor his or her own (Mead, 1934), teachers' professional identity is not entirely formed by individual's perception. This perspective echoes the idea that a teacher's professional identity is influenced by negotiations with social situations, expectations of others, and formed by the teacher's personal landscape and experiences, which eventually defines what is meaningful for himself or herself in professional work (Beijaard, 1995).

Aspects of professional identity

Teachers' professional identity is multi-dimensional and hierarchical in that it relates to aspects of the teaching profession (Beijaard et al., 2004), and is prioritised by individual preferences (Colbeck, 2008). Beijaard (1995) suggested that professional identity includes the subject of teaching, the relationship with students, and the role conception, and needs to be understood as subject experts, pedagogical experts (emotional and ethical), and didactic experts (Beijaard et al., 2000). Van Veen and Sleegers (2006) found two orientations related to professional identity. The first being the distinction between the learner-centred versus the teacher-centred orientation. The second being the restricted versus the extended orientation. A restricted orientation focuses primarily on the pedagogical content of teaching whereas an extended orientation allows the teacher to involve in the school as an organisation and takes teaching more than just within the classroom. A more recent study (Lamote and Engels, 2010) measures professional identities against four dimensions: commitment to teaching, professional orientation (the extended or restricted self), teaching methods, and teachers' self-efficacy. This implies that teachers' professional identity is about teachers' values and beliefs about teaching (commitment to teaching), how they see themselves as teachers (professional orientation), how they teach in practice (teaching methods), and capabilities required for being a teacher (self-efficacy). The hierarchy of professional identities may have more profound implications for higher education where university teachers experience with dual professional identity (Nixon, 1996). They are placed by universities as teachers with an emphasis on pedagogical and curriculum change but are also required to work as researchers, attracting external funds and carrying out and publishing research.

It might be difficult to depict what the professional identity of a university teacher should look like as professional identity as such is multi-dimensional and hierarchical, and subject to individual's perception of priorities. However, what is agreed is that professional identity is not fixed, it involves the ongoing interpretation and reinterpretation of experiences. It represents the process by which individual teacher integrates various statuses and roles into a 'coherent image of self' (Sachs, 2001).

Professional identity and educational change

Eilam and Shamir (2005) suggests that professional identity influences employees' reaction to change. A change is likely to be resisted if it is perceived as a threat to professional identity. Professional identity, therefore, in the context of resistance to change, is viewed as attempts to maintain self-image. Following this notion, resisting teachers are said to fear change (Kirkup and Kirkwood, 2005) and develop strategies to protect their professional identity from being forced to be perceived differently by themselves (Beijaard, 1995). Schilling et al. (2012) indicated the positive effect of professional identity and argued that successful organisational change depends on employees' ability to enact certain professional identities. This perspective acknowledges that change needs to be perceived in accordance with employee's professional identity. It implies that technological innovations convey structures and expectations promoted by the technology and by the organisation. However, an employee's professional identity may not necessarily align with the new structures and identity expectations. Therefore, the fit between an employee's professional identity and structures and expectations brought by the technological innovation is the key to the employee's adoption of the technological innovation.

The notion of professional identity may facilitate understanding of the reactions of higher education teachers when confronted with their university's decision to adopt learning technologies. Educational innovations may represent particular interests and expectations that are not necessarily aligned with teachers' professional identity (Goodson, 2001). This misalignment may result in the differential adoption of learning technologies because each individual teacher learns about and makes use of the technological innovation in practice through their professional identity (Trede et al., 2012). In a study of the effect of professional identity on educational innovation, Ketelaar et al. (2012) argue that teachers do not just simply accepting or rejecting what is being imposed. Instead, teachers actively position themselves in relation to the innovation. Three identity-related mechanisms are identified in teachers' adoption process: the feeling of ownership, the feeling of agency, and sense-making. Ownership refers to a sense of involvement and purpose, and is suggested to promote change as it is the fusion between the object of ownership and the self (Pierce et al., 2001). Teachers would likely to adopt technological innovation when they feel that the technology is aligned with their self-concepts. Agency refers to a sense of control and empowerment, and is strengthened by the heightened awareness of professional identity (Beauchamp and Thomas, 2009) which allows teachers to actively shapes their activities. Sense-making refers to the process by which individual teacher interprets the innovation, in which professional identity is used as a reference (Hotho, 2008).

Professional identity in learning technology adoption

We propose that professional identity may be used to understand learning technology adoption by higher education teachers. However, there seems no reason to propose that professional identity should be inevitably associated with resistance. Profession identity involves teachers evaluating who they are and where they should be (Van Veen and Sleegers, 2006), which can potentially be a source for initiating change or supporting change if the change is seen to be concordant with their "should-be" status.

Therefore it is proposed that teachers' professional identity in relation to the adoption of learning technologies should encompass work-related identity, how they prefer to work and how they see themselves as a teacher; teaching-related identity, how they perceive and conduct teaching; and technology-related identity, how they perceive the role of and use technology at work (Liu and Geertshuis, 2016). For instance, a teacher who is positive about change and seeks control over his or her work is likely to experience agency. A teacher who has an extended view about being a teacher and has a higher degree of commitment to teaching may feel a sense of involvement when adopting learning technologies. In cases where a teacher finds that the learning technology aligns with his or her pedagogical beliefs and enacts his or her desired teaching approach, sense-making is easier.

Applying professional identity theory to an analysis of behavioural differences in the take-up of technologies may afford the research enhanced explanatory power. However this approach has practice implications too. It follows that because teachers' professional identity is a combination of several sub-identities which work synergistically to shape their perceptions of the learning technology, effort to facilitate learning technology adoption need to attend to aspects of teachers' professional identity. Universities need to not only prepare teachers with capabilities to use the technology but also support teachers in changing how they view the job of a teacher and how a teacher should teach in practice.

Implications

This paper presents an alternative perspective on teachers' learning technology adoption and reveals three types of adopter-related antecedents of teachers' adoption behaviour. We argue that these adopter-related antecedents together reflect teachers' professional identity through which teachers perceive the relevance of the introduced learning technology and decide how they will make sense of, learn about and make use of the learning technology. Given the multi-dimensional and hierarchical nature of higher education teachers' professional identity, future empirical research could explore aspects of professional identity that work synergistically to teachers' learning technology adoption; how professional identity is changed over time in the context of learning technology adoption; and how universities can facilitate the professional identity reconstruction process. The notion of professional identity also suggests that training that attends at an individual level to professional identity including orientations to teaching, technology and change is likely to be more successful in facilitating take-up than training which simply briefs staff on how to operate a new tool.

Conclusion

This paper reviews adopter-related antecedents of learning technology adoption, examining work-related, technology-related, and teaching-related antecedents. We argue for a shift from the over-reliance on innovation attributes to an adopter-centred perspective which acknowledges individual agency, social influence and the dynamics in the adoption process. We present the notion of professional identity as a unifying approach to individual difference and an approach to fostering change.

References

Agarwal, R. & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research*, 9, 204-215.

Agarwal, R., Sambamurthy, V. and Stair, R.M. (2000). Research report: the evolving relationship between general and specific computer self-efficacy—an empirical assessment. *Information Systems Research*, 11, 418-430.

Aggarwal, R., Kryscynski, D., Midha, V., et al. (2015). Early to Adopt and Early to Discontinue: The Impact of Self-Perceived and Actual IT Knowledge on Technology Use Behaviors of End Users. *Information Systems Research*, 26, 127-144.

Anderson, S.E., Groulx, J.G. & Maninger, R.M. (2011). Relationships among Preservice Teachers' Technology-Related Abilities, Beliefs, and Intentions to Use Technology in Their Future Classrooms. *Journal of Educational Computing Research*, 45, 321-338.

Ashforth, B.E. & Humphrey, R.H. (1993). Emotional labor in service roles: The influence of identity. *Academy of management review*, 18, 88-115.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, 84, 191.

Beauchamp, C. & Thomas, L. (2009). Understanding teacher identity: An overview of issues in the literature and implications for teacher education. *Cambridge Journal of Education*, 39, 175-189.

Beaudry, A. & Pinsonneault, A. (2005). Understanding user responses to information technology: A coping model of user adaptation. *MIS Quarterly*, 493-524.

Beaudry, A. & Pinsonneault, A. (2010). The Other Side of Acceptance: Studying the Direct and Indirect Effects of Emotions on Information Technology use. *MIS Quarterly*, 34, 689-A683.

Becker, H.J. (2000). Findings from the teaching, learning, and computing survey. *education policy analysis archives*, 14, 51.

Beijaard, D. (1995). Teachers' prior experiences and actual perceptions of professional identity. *Teachers and Teaching: theory and practice*, 1, 281-294.

Beijaard, D., Meijer, P.C. & Verloop, N. (2004). Reconsidering research on teachers' professional identity. *Teaching and Teacher Education*, 20, 107-128.

Beijaard, D., Verloop, N. & Vermunt, J.D. (2000). Teachers' perceptions of professional identity: An exploratory study from a personal knowledge perspective. *Teaching and Teacher Education*, 16, 749-764.

Browne, T., Jenkins, M. & Walker, R. (2006). A longitudinal perspective regarding the use of VLEs by higher education institutions in the United Kingdom. *Interactive Learning Environments*, 14, 177-192.

Chan, K-W. & Elliott, R.G. (2004). Relational analysis of personal epistemology and conceptions about teaching and learning. *Teaching and Teacher Education*, 20, 817-831.

Chen, J. & Wang, L. (2007). Locus of control and the three components of commitment to change. *Personality and Individual Differences*, 42, 503-512.

Cigdem, H. & Topcu, A. (2015). Predictors of instructors' behavioral intention to use learning management system: A Turkish vocational college example. *Computers in Human Behavior*, 52, 22-28.

Coates, H., James, R. & Baldwin, G. (2005). A critical examination of the effects of learning management systems on university teaching and learning. *Tertiary education and management*, 11, 19-36.

Colbeck, C.L. (2008). Professional identity development theory and doctoral education. *New Directions for Teaching and Learning*, 2008, 9-16.

Compeau, D. & Higgins, C.A. (1995a). Application of social cognitive theory to training for computer skills. *Information Systems Research*, 6, 118-143.

Compeau, D. & Higgins, C.A. (1995b). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 189-211.

Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319-340.

Deutsch, M. (2011). Interdependence and psychological orientation. *Conflict, Interdependence, and Justice*, Springer, 247-271.

Downey, J.P. & McMurtrey, M. (2007). Introducing task-based general computer self-efficacy: An empirical comparison of three general self-efficacy instruments. *Interacting with Computers*, 19, 382-396.

Drent, M. & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education*, 51, 187-199.

Eagly, A.H. & Chaiken, S. (2007). The advantages of an inclusive definition of attitude. *Social Cognition*, 25, 582.

Eilam, G. & Shamir, B. (2005). Organizational Change and Self-Concept Threats A Theoretical Perspective and a Case Study. *The Journal of Applied Behavioral Science*, 41, 399-421.

Elie-Dit-Cosaque, C.M. & Straub, D.W. (2011). Opening the black box of system usage: user adaptation to disruptive IT. *European Journal of Information Systems*, 20, 589-607.

Ertmer, P.A. (2005) Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, 53, 25-39.

Ertmer, P.A. & Ottenbreit-Leftwich, A.T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, 42, 255-284.

Flynn, L.R. & Goldsmith, R.E. (1993). A validation of the Goldsmith and Hofacker innovativeness scale. *Educational and psychological measurement*, 53, 1105-1116.

Frambach, R.T. & Schillewaert, N. (2002). Organizational innovation adoption: A multi-level framework of determinants and opportunities for future research. *Journal of Business Research*, 55, 163-176.

Frese, M., Garst, H. & Fay, D. (2007). Making things happen: Reciprocal relationships between work characteristics and personal initiative in a four-wave longitudinal structural equation model. *Journal of applied psychology*, 92, 1084.

Gagné, M. & Deci, E.L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior*, 26, 331-362.

Gecas, V. (1982). The self-concept. *Annual review of sociology*, 1-33.

Goodson, I.F. (2001). Social histories of educational change. *Journal of Educational Change*, 2, 45-63.

Greenhalgh, T., Robert, G., Macfarlane, F., et al. (2004). Diffusion of innovations in service organizations: systematic review and recommendations. *Milbank Quarterly*, 82, 581-629.

Herscovitch, L. & Meyer, J.P. (2002). Commitment to organizational change: extension of a three-component model. *Journal of applied psychology*, 87, 474.

Hotho, S. (2008). Professional identity-product of structure, product of choice: Linking changing professional identity and changing professions. *Journal of Organizational Change Management,* 21, 721-742.
Hsia, J-W., Chang, C-C. & Tseng, A-H. (2014). Effects of individuals' locus of control and computer self-efficacy on their e-learning acceptance in high-tech companies. *Behaviour & Information Technology,* 33, 51-64.
Hsu, M-H. & Chiu, C-M. (2004). Internet self-efficacy and electronic service acceptance. *Decision Support Systems,* 38, 369-381.
Jacobson, M.J., So, H-J., Teo, T., et al. (2010). Epistemology and learning: Impact on pedagogical practices and technology use in Singapore schools. *Computers & Education,* 55, 1694-1706.
Johnson, R.D. & Marakas, G.M. (2000). Research report: the role of behavioral modeling in computer skills acquisition: toward refinement of the model. *Information Systems Research,* 11, 402-417.
Ketelaar, E., Beijaard, D., Boshuizen, H.P., et al. (2012). Teachers' positioning towards an educational innovation in the light of ownership, sense-making and agency. *Teaching and Teacher Education,* 28, 273-282.
Kirkup, G. & Kirkwood, A. (2005). Information and communications technologies (ICT) in higher education teaching—a tale of gradualism rather than revolution. *Learning, Media and Technology,* 30, 185-199.
Kirton, M. (1976). Adaptors and innovators: A description and measure. *Journal of applied psychology,* 61, 622.
Kreijns, K., Vermeulen, M., Kirschner, P.A., et al. (2013) Adopting the Integrative Model of Behaviour Prediction to explain teachers' willingness to use ICT: a perspective for research on teachers' ICT usage in pedagogical practices. *Technology, Pedagogy and Education,* 22, 55-71.
Lamote, C. & Engels, N. (2010). The development of student teachers' professional identity. *European Journal of Teacher Education,* 33, 3-18.
Limayem, M., Hirt, S.G. & Cheung, C.M. (2007). How habit limits the predictive power of intention: the case of information systems continuance. *MIS Quarterly*, 705-737.
Liu, S-H. (2011). Factors related to pedagogical beliefs of teachers and technology integration. *Computers & Education,* 56, 1012-1022.
Liu, Q. & Geertshuis, S. (2016). E-learning Ecosystem Awareness and Professional Identity in E-learning Technology Adoption. In *15th European Conference on E-learning proceedings*. Prague 2016.
Mead, G.H. (1934). *Mind, self and society*. Chicago University of Chicago Press.
Miller, V.D., Johnson, J.R. & Grau, J. (1994). Antecedents to willingness to participate in a planned organizational change. *Journal of Applied Communication Research*, 22(1), 59-80.
Morrison, E.W. & Phelps, C.C. (1999). Taking charge at work: Extrarole efforts to initiate workplace change. *Academy of Management Journal*, 42, 403-419.
Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: a review of the literature. *Journal of information technology for teacher education,* 9, 319-342.
Niederhauser, D.S. & Stoddart, T. (2001). Teachers' instructional perspectives and use of educational software. *Teaching and Teacher Education,* 17, 15-31.
Nixon, J. (1996). Professional identity and the restructuring of higher education. *Studies in Higher Education,* 21, 5-16.
Norton, L., Richardson, T., Hartley, J., et al. (2005). Teachers' beliefs and intentions concerning teaching in higher education. *Higher Education*, 50, 537-571.
Owens, T. (2012). Hitting the nail on the head: The importance of specific staff development for effective blended learning. *Innovations in Education and Teaching International*, 49(4), 389-400.
Pajares, M.F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of educational research,* 62, 307-332.
Parker, S.K., Williams, H.M. & Turner, N. (2006). Modeling the antecedents of proactive behavior at work. *Journal of applied psychology,* 91, 636.
Peccei, R., Giangreco, A. & Sebastiano, A. (2011). The role of organisational commitment in the analysis of resistance to change: Co-predictor and moderator effects. *Personnel Review,* 40, 185-204.
Petko, D. (2012). Teachers' pedagogical beliefs and their use of digital media in classrooms: Sharpening the focus of the 'will, skill, tool'model and integrating teachers' constructivist orientations. *Computers & Education,* 58, 1351-1359.
Pierce, J.L., Kostova, T. & Dirks, K.T. (2001). Toward a theory of psychological ownership in organizations. *Academy of management review*, 26, 298-310.
Prosser, M. & Trigwell, K. (2014). Qualitative variation in approaches to university teaching and learning in large first-year classes. *Higher Education,* 67, 783-795.
Quinn, L. (2012). Understanding resistance: an analysis of discourses in academic staff development. *Studies in Higher Education,* 37, 69-83.
Ramsden, P. & Moses, I. (1992). Associations between research and teaching in Australian higher education. *Higher Education,* 23, 273-295.
Roca, J.C. & Gagné, M. (2008). Understanding e-learning continuance intention in the workplace: A self-determination theory perspective. *Computers in Human Behavior,* 24, 1585-1604.
Rogers, E.M. (1995). Diffusion of innovations. *New York*: The Free Press.
Rosenberg, E.L. (1998). Levels of analysis and the organization of affect. *Review of General Psychology,* 2, 247-270.

Rotter, J.B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological monographs: General and applied,* 80, 1.
Sachs, J. (2001). Teacher professional identity: Competing discourses, competing outcomes. *Journal of education policy,* 16, 149-161.
Schilling, A., Werr, A., Gand, S., et al. (2012). Understanding professionals' reactions to strategic change: the role of threatened professional identities. *The Service Industries Journal,* 32, 1229-1245.
Skelton, A. (2012). Teacher identities in a research-led institution: in the ascendancy or on the retreat? *British Educational Research Journal,* 38, 23-39.
Slay, H.S. & Smith, D.A. (2011). Professional identity construction: Using narrative to understand the negotiation of professional and stigmatized cultural identities. *Human relations,* 64, 85-107.
Somekh, B. (2008). Factors affecting teachers’ pedagogical adoption of ICT. *International handbook of information technology in primary and secondary education.* Springer, 449-460.
Sørebø, Ø., Halvari, H., Gulli, V.F., et al. (2009). The role of self-determination theory in explaining teachers’ motivation to continue to use e-learning technology. *Computers & Education*, 53, 1177-1187.
Stein, S.J., Shephard, K. & Harris, I. (2011). Conceptions of e-learning and professional development for e-learning held by tertiary educators in New Zealand. *British Journal of Educational Technology,* 42, 145-165.
Straub, E.T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of educational research*, 79, 625-649.
Strauss, K. & Parker, S.K. (2014). Effective and sustained proactivity in the workplace: a self-determination theory perspective. *The Oxford Handbook of Work Engagement, Motivation, and Self-Determination Theory*, 50-71.
Sun, H. (2012). Understanding user revisions when using information system features: adaptive system use and triggers. *MIS Quarterly*, 36, 453-478.
Tarling, I. & Ng'ambi, D. (2016). Teachers pedagogical change framework: a diagnostic tool for changing teachers’ uses of emerging technologies. *British Journal of Educational Technology,* 47, 554-572.
Taylor, S. & Todd, P.A. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly*, 561-570.
Trede, F., Macklin, R. & Bridges, D. (2012). Professional identity development: a review of the higher education literature. *Studies in Higher Education*, 37, 365-384.
Van Veen, K. & Sleegers, P. (2006). How does it feel? Teachers' emotions in a context of change. *Journal of Curriculum studies,* 38, 85-111.
Vannatta, R.A. & Nancy, F. (2004). Teacher dispositions as predictors of classroom technology use. *Journal of Research on Technology in Education,* 36, 253-271.
Vogel, T. & Wanke, M. (2016) *Attitudes and attitude change*. Psychology Press.

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How to engage students in blended learning in a mathematics course: The students' views

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Blended learning strategies are employed at many Australian universities to modernise teaching approaches. However, blended learning implementations may not take into account the views of students during the development process. In this paper, we discuss how students think we, as educators, can engage students in both face-to-face learning and online learning, as components of blended learning. We also report on student suggestions regarding how to build in opportunities to recover if a student has either missed a class, or not completed time-critical online work before coming to a class taught in flipped mode. These are two of a set of seven questions we posed two years ago at this conference, in the context of teaching mathematics in blended mode.

Keywords: flipped classroom, blended learning, mathematics education, engagement.

Introduction

While blended learning has been rolled out at universities across Australia in the last few years, there are few studies of how individual disciplines have implemented these approaches, what challenges they have faced, and how they overcame these challenges. At the 2014 ASCILITE conference, we presented a paper (Loch and Borland, 2014) describing the challenges the discipline of mathematics is facing when blended or flipped learning is introduced on a wider scale. We highlighted the special circumstances of teaching mathematics: the lecture is still the predominant mode of teaching for several well founded reasons; and teaching mathematics online is challenging because it is a visual discipline which requires advanced typesetting skills or manual writing to communicate in the mathematical language. The literature on blending in the mathematics classroom is mostly focused on pre-university teaching, and emerging studies in a university context describe individual lecturers' experiences. While contributing to the knowledge base on what has or has not worked successfully, such studies have limited value for implementations on a wider scale (for example across a whole department, school or faculty), particularly when changes in teaching staff need to be factored in. In our 2014 ASCILITE paper we concluded with a list of seven research questions to guide future research. In our 2015 ASCILITE paper (Borland, Loch and McManus, 2015), we addressed question six, looking at the best approach on a departmental level to support teaching staff in developing and implementing innovative approaches, promoting digital content creation and using technology to enhance learning and teaching outcomes. Questions one and three were:

What can we do to ensure students engage with both online content and classroom activities?
3. How can we build in redundancies, e.g. enable students to recover if they have not watched a video beforehand or have not attended class?

In this paper, we don't take the usual approach by answering these questions based on our experiences as lecturers. Instead, we provide preliminary results of students' views regarding how engagement of their peers with online and classroom activities could be achieved, and how opportunities for students to recover when they have missed components of the delivery could be built in. The students we interviewed had just completed a traditional second year engineering mathematics course, while students who responded to the survey had just completed the first offering of this same course in blended mode in the following year. The purpose of this paper is therefore not to provide guidelines for others on successful approaches, but to explore the student perspective.

Blended and flipped learning in mathematics

Blended learning is the careful alignment of online and face to face learning, where both components complement and enhance each other. There are various levels to which a blended learning approach can be taken (Alammary, Sheard and Carbone, 2014). The flipped classroom is one approach which requires students to watch videos explaining concepts before they come to class. Traditional lectures are then transformed into interactive problem-solving sessions. Blended and flipped learning places the onus on students to engage with online material and encourages students to take ownership of their learning. 'To be successful, the model requires students to "develop the skills to self-regulate their own performance and become aware of the gaps in their understanding of complex conceptual tasks"' (Loch and Borland, 2014). Thus, the designer of online learning resources has a responsibility to produce components that promote self-directed or self-regulated learning, as discussed by Loch and McLoughlin (2011). This model of learning may or may not be achievable for weak students who lack prerequisite skills, an issue that has occupied mathematics educators for some time (Rylands & Codie, 2009). Below, we revisit the literature relating to the two research questions.

Engaging students in online and face-to-face components of blended learning

Engaging students in face-to-face classes requires them, first of all, to come to class. So why do students attend classes? Loch (2010) reported that mathematics students who were given the choice to be online or face-to-face students, and had chosen face-to-face mode, commented that they attended classes so they could ask questions and benefit from immediate feedback and interaction with the lecturer. This is not possible when learning from video. It appears that these students were intrinsically motivated to attend because of the interaction with teaching staff. There are strong arguments from the literature for the implementation of active learning in the classroom. Freeman et al (2014) undertook a meta-analysis of 225 studies on active learning versus traditional lecturing in STEM disciplines and found that exam scores and the likelihood of passing increase in active learning classes compared to traditional lectures. Prince (2004) reviewed the literature on active learning and demonstrated that student-centred face-to-face sessions, where students learn by doing, lead to active learning. This strategy is employed in the flipped classroom approach to create more engaging face-to-face learning events than transmissive lectures. We indicated in our 2014 ASCILITE paper (Loch and Borland, 2014) that peer-instruction strategies have been used successfully for active student learning (Caldwell, 2007). An example is using audience response systems to collect immediate feedback from students which allows lecturers to judge in real time where students are at, so misconceptions can be addressed (Kowalski, Kowalski & Gardner, 2009). Other findings confirm that students react positively to highly interactive, technology-enhanced mathematics classes where they are able to contribute to the discussion (Donovan & Loch, 2013).

Strategies to engage students in the online content are also needed. McGivney-Burelle & Xue (2013), reported on higher performance when they compared flipped calculus classrooms to traditional teaching. However, with 22% of students not engaging at all with the online content that was expected to be studied before class, one may wonder how these students performed, and how much learning they missed out on. The strategy to have an in class entrance quiz as well as problem-solving group work based on the videos did not work. Brame (2013) suggests providing additional marks as an incentive for students to complete pre-class preparation, while Bagley (2014) suggests students be held accountable for pre-class activities.

Enabling students to recover if they have not engaged with one of the components

If a student has not attended a class, one possible way for them to recover is to watch a recording of this class. Indeed, universities commonly mandate recording of lectures to assist this and allow additional revision opportunities. To investigate the effect of lecture recordings on student performance, Yoon and Sneddon (2011) undertook an investigation into how recorded lectures were used by students in two large undergraduate mathematics courses. Student feedback via online surveys was analysed, and they found that the availability of lecture recordings can have a detrimental effect on the grades of some groups of students: those who did not attend lectures because they knew the recordings were available, and those who 'intended to watch more recorded lectures than they actually did'. These students achieved significantly lower grades than students who were exposed to the whole lecture series. This is an issue that needs to be considered when designing catch-up mechanisms in blended learning.

Non-engagement with the online material, for example, not watching a video before attending class, may of course be addressed through brief revision of the video content in class. Again, we caution that this revision may have the opposite effect. Watching the videos becomes no longer 'time-critical' if students know they can recover in class when they haven't watched the video. Hence they may never go back to watching all content or working through all online quizzes – or they may never seriously consider engaging with these tasks before class. We call for further investigation of this topic.

Engineering Mathematics 3M

Engineering Mathematics 3M is the third in the series of mathematics courses offered to mechanical engineering students at our university. Prior to this implementation, it was taught in a traditional mode, with summative assessment, distributed across three in-semester classroom tests worth 35% and one post-semester final exam worth 65%. There were no regular assignments. The learning management system was used to provide typeset study notes and tutorial sheets, to make announcements to students, and to upload additional documents as needed. Students attended three hours of lectures, one tutorial hour, and one computer lab hour per week.

When we redesigned this course, we concentrated on improvements we wanted to make where blended learning could assist. Since this paper focuses on the students' views of blended and online learning, not the redesign of the course into blended mode, we will provide only a brief overview of how the course was changed. Weekly online summative assignments were introduced to reduce the reliance on invigilated assessment from 100% to 62%. Online material for revision of prerequisites was developed, as well as resources helping students to understand why they needed to study the topics covered in the course (Loch and Lamborn, 2016). Online and face-to-face components were aligned to complement each other, incorporating more active learning in the classroom and videos explaining particular concepts, but no lecture recording. Navigation was made easier with weekly overviews to guide student learning. Students received clear communication to explain the changes made. This approach was guided by feedback received from students before commencing the redesign, some of which is discussed below.

Methodology

Before we embarked on the redesign of the course, we recruited three students who had recently completed the course to a focus group interview to gauge their views of online and blended learning and gather information about how we could implement it in the course. The focus group discussion was recorded and professionally transcribed. After the first offering in blended mode and as part of evaluation of the new mode, we surveyed students enrolled in the course. Of the 114 students enrolled, 23 responded to the anonymous end-of-semester survey. While this is not a high percentage, the number of responses is sufficient to gain an overview of what students were thinking. With a view to finding answers to the two research questions, we undertook an analysis of the focus group transcript and typed survey responses. The summary of outcomes is described below.

A preliminary analysis of the data to answer the two research questions

What can we do to ensure students engage with both online content and classroom activities?

Focus group in 2014

We asked students what they thought about having more online content. They agreed that there was a need for more online learning, mainly for revision purposes or in case a student could not attend. Students commented 'we definitely need online learning', and 'you don't miss anything if it's online'. Students appeared to have a preconception that online learning is limited to learning from videos and that online learning is a mere convenience, recapping content from the face-to-face classes, rather than a vital component of a blended learning approach. On the other hand, there was concern that, although they wanted them created, students might not watch long lecture recordings and that short videos would be preferred. At the same time, students seemed to be very clear that they did not want increased online material at the expense of face-to-face contact hours, as illustrated by this student comment: 'I prefer to be coming in, seeing a teacher face-to-face and learning from them'. Students said they preferred more interaction in the classroom, together with online learning. When we asked what we could do to encourage more students to attend lectures, one student commented pragmatically: 'some people aren't going to turn up… no matter what'.

We feel we need to moderate these students' views, as these students had just completed the course in the traditional mode, and had not had the chance to experience a blended course. However, we acknowledge the point made that it is the student's choice to attend face-to-face classes, and also to engage with online material. We cannot force students to engage with teaching activities if they don't want to.

Survey in 2015
In the context of the flipped classroom requiring videos to be watched before attending class, we asked the students under what conditions they would watch all videos their lecturer suggested to watch. While one commented 'you can never achieve this as some students will and some won't always', others tried to think of incentives. These included:

- 'Constantly tell us that it will be on the exam'
- Provide marks for viewing videos
- 'Only videos under 10 min, easy to get distracted otherwise'
- Provide videos for revision after the lecture, not before
- Send a reminder to students to watch videos before lecture
- 'If perhaps there was a communal screening of the video' in the lecture
- Dedicate 20 minutes in each lecture to go through which videos to watch

One student commented on the difficulty of continuing to work through mathematical concepts if there are steps that weren't understood. This is due to the nature of mathematics learning where content is built hierarchically. It is also important to understand all steps in a solution to be able to reproduce such a solution: 'the annoying part is you do not understand what you are watching and you will spend one hour to watch them all, and if you don't understand, it will be one useless hour'. This comment, and our observations of student learning from online videos (McLoughlin and Loch, 2013) and help-seeking in mathematics support centres (Loch and Elliott, 2012) indicate that to teach mathematics effectively in blended mode, additional support mechanisms need to be made available to students who are stuck, e.g. through specialised face-to-face or online support.

Providing additional online material increases the time students spend on their studies. We considered reducing face-to-face hours, and asked students what they thought of this approach. We were surprised to hear that only four of the 22 students who responded (one skipped this question) were in favour of reducing hours. Nearly all of the 18 students who did not want contact hours reduced voiced strong opinions on the importance of being able to interact with teaching staff, and stated that they can cope with the additional time taken by studying online content. In fact, several of these students asked for more face-to-face time, particularly tutorial time. A comment made was: 'Increase face-to-face hours since it's easier to understand concepts if questions can be asked immediately'.

How can we build in redundancies, e.g. enable students to recover if they have not watched a video beforehand or have not attended class?

Focus group in 2014
To build in opportunities to recover if a student has not watched a video beforehand, students liked the idea of recapping content at the start of class so it is worth attending for everyone. Participants also suggested providing a plan for what is covered in each class so it is easier for students to catch up if classes are missed.

Survey in 2015
A straightforward way to provide opportunities to recover would be to record all classes, as suggested in the survey. However, students may not actually watch long recordings that are made available as indicated in the focus group, and found by Yoon and Sneddon (2011). This option still requires students to self-regulate their learning and engage with the recordings.

Discussion and Conclusions

It appears that many students think that blended or online learning is limited to watching videos of recorded live classes. If they suspect that these videos are provided to replace face-to-face classes and cut costs, students get upset. It is therefore crucial to communicate clearly with students what blended learning is, why it is being introduced, how it works, how they are benefitting, and what is expected from students. A study plan such as a weekly overview to guide student learning is a good way of explaining the interlinking between the online and face-to-face components of a course, enabling students to catch up on material they may have missed. It would also be useful to constantly refer between the online and face-to-face components, such as mentioning videos and online activities to be completed in class, and suggesting that further explanation of material studied online will be given in class.

Students thought that short videos were preferable to long lecture recordings, however they also wanted lecture recordings, despite the suggestion that they would not be watched. This implies that the students wanted a safety blanket, to recover if they could not attend a class. While we have observed that students comment strongly on the lack of lecture recording in teaching evaluation surveys, our evidence indicates that if short, targeted videos and long lecture recordings are provided, students will favour the short recordings (unpublished work).

The issue of students getting stuck while watching videos, with nobody available to ask for help, is one that requires further investigation. A suggestion made by Herbert (2015) may be a solution— to organise computer lab sessions with a tutor on-campus to give students an opportunity to work through the videos and seek help immediately if they get stuck. However, this requires students to be on-campus, and limits the flexibility blended learning offers. Another approach we would suggest is to schedule synchronous online support sessions.

Students, both in the focus group and via the survey, commented that assessment is what drives student behaviour and learning, even suggesting that marks should be provided for watching videos. One comment from a student in the focus group summarised this rather confronting view: “you are aiming for marks, not for understanding”. This observation is worrying, as it indicates that learning is less important than passing; education has become a commodity that is purchased and achieved with minimum effort, rather than acquired through inquiry and deep engagement with the material.

In this paper, we have started to answer two of the seven questions we posed two years ago, from the student perspective: how to engage students better online and in the classroom, and how to build recovery opportunities for students who have not completed online activities before class, or who have not attended class. Much more work remains to be done to identify the best approaches for creating effective blended learning environments in mathematics education. We are planning a follow up paper addressing more of the seven questions, with a particular focus on how to create a sustainable approach to developing blended learning modes in mathematics education that other lecturers in the department would feel comfortable to teach.

References

Alammary, A, Sheard, J, & Carbone, A (2014) Blended learning in higher education: Three different design approaches. Australasian Journal of Educational Technology, 30(4), 440-454.

Bagley, S. (2014). A Comparison of four Pedagogical Strategies in Calculus. RUME 2014

Borland, R., Loch, B. and McManus, L. (2015). Implementing blended learning at faculty level - Supporting staff, and the 'ripple effect'. Proceedings of ascilite 2015, Perth.

Brame, C. (2013). Flipping the classroom. http://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom

Caldwell, J. E. (2007). Clickers in the Large Classroom: Current Research and Best-Practice Tips. *CBE Life Sci Educ*, 6(1): p. 9-20

Donovan, D. & Loch, B. (2013). Closing the feedback loop: Engaging students in large first year mathematics test revision sessions using pen-enabled screens, *Int. J. Math. Educ. Sci. Technol*, 44(1), pp. 1-13.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H. and Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences

Herbert, R. (2015). Blended learning: strategies for effective content delivery. Presented at First Year in Maths Workshop, University of Melbourne, July 2015. https://fyimaths.files.wordpress.com/2015/07/rowan-herbert-blended-learning-strategies-for-effective-content-delivery.pptx

Kowalski, S.E., Kowalski, F. V. and Gardner, T.Q. (2009). Lessons Learned When Gathering Real-Time Formative Assessment in the University Classroom Using Tablet PCs. In 39th ASEE/IEEE Frontiers in Education Conference 2009. San Antonio, TX

Loch, B. (2010). What do on campus students do with mathematics lecture screencasts at a dual-mode Australian university? Conference proceedings of CETL-MSOR 2009.

Loch, B. and Borland, R. (2014). The transition from traditional face-to-face teaching to blended learning – implications and challenges from a mathematics discipline perspective. In B. Hegarty, J. McDonald, & S.-K. Loke (Eds.), Rhetoric and Reality: Critical perspectives on educational technology. Proceedings ascilite Dunedin 2014 (pp. 708-712).

Loch, B. and Elliott, D. (2012). Prototype of an Intervention Strategy with a focus on mathematics support for first year Civil Engineering students. Proceedings of AAEE2012, Melbourne, 3-5 Dec 2012. 8 pages.

Loch, B. & Lamborn, J. (2016). How to make Mathematics relevant to first–year Engineering Students: Perceptions of Students on Resources produced by Students. *Int. J. of Mathem. Edu. in Science and Technology*, Vol. 47, no. 1, pp. 29-44.

Loch, B. and McLoughlin, C. (2011). An instructional design model for screencasting: Engaging students in self-regulated learning. In G.Williams, N. Brown, M. Pittard, B. Cleland (Eds.) Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011.

McGivney-Burelle, J. & Xue, F. (2013). Flipping Calculus. *PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studies*. 23 (5)

McLoughlin, C. and Loch, B. (2013). Scaffolding conceptual learning in mathematics with technology enhanced pedagogy – a preliminary evaluation of student engagement with screencasts. Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications - ED-Media 2013. p. 259-265

Prince, M. (2004). Does Active Learning Work? A Review of the Research. *J Eng Education*, 93(3): p. 223-231

Rylands, L. & Coady, C. (2009). Performance of students with weak mathematics in first-year mathematics and science. *Int. J. Math. Educ. Sci. Technol*. 40(6), 741-753.

Yoon, C., & Sneddon, J. (2011). Student perceptions of effective use of tablet PC recorded lectures in undergraduate mathematics courses. *Int. J. of Mathem. Edu. in Science and Technology, 42*(4), 425–445.

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Student Behavioural Engagement in Self-Paced Online Learning

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It remains a challenge in online settings to engage students as independent learners without teacher presence. This has led to increasing attention investigating the factors influencing student engagement in this context. As part of a PhD study, this paper investigates students' behavioural engagement with online learning modules without teacher supervision or peer support. The study examines three key constructs of behavioural engagement: student engagement with the task, effort level the student applies to task-completion and finally, following instructions. First, the findings suggest that student engagement was high in ‘video' and 'feedback' sections as compared to ‘simulation’ activities. Second, students invested high effort in task-completion when the learning modules were delivered with instructional guidance. Finally, non-visual learners exhibit more difficulty following instructions in unsupported online settings. The results of this study will contribute to the burgeoning research field promoting the development of online modules that encourage participation of diverse learners.

Keywords: Self-paced learning, online learning, behavioural engagement

Introduction

Engagement is a construct used extensively in learning to explain a variety of behaviors that students display in the learning environment. Researchers have suggested that the meaning of student engagement is still broad and there is no concrete agreement on its meaning, definition, and measurement (Boekaerts, 2016; Harris, 2008; Parsons & Taylor, 2011). This study uses the Fredricks, Blumenfeld, and Paris (2004) theoretical framework that distinguishes student emotional, cognitive and behavioral engagement during the learning process. From these three engagement components, this study only discusses the aspects of student behavioral engagement, as it is the most common key construct in almost all definitions of engagement (Hospel, Galand, & Janosz, 2016).

Behavioral engagement is a construct with several meanings being proffered in different domains and educational settings (Hospel et al., 2016). Fredricks et al. (2004) to explain behavioral engagement as the student behavior on a learning task, which includes student persistence, effort, and their contribution towards their own learning. In recent studies, behavioral engagement is defined in terms of student participation, effort, attention, persistence and positive conduct towards the learning activity (Fredricks et al., 2016). Wang, Fredricks, Ye, Hofkens, and Linn (2016) define it within the context of a domain specific engagement in terms of asking and answering questions, participation, persistence or giving up easily and not to paying attention. Though the understanding of behavioral engagement is well developed and has been investigated in face-to-face contexts in many studies, student behaviors are found to be different in the online settings (Louwrens & Hartnett, 2015). This different behavior in online settings received less attention so far and our study investigates this conferred issue considering the absence of teacher and peer support. However, the nature of engagement in online learning does not differ noticeably from that delineated by key definitions of the construct as applied in traditional educational settings (Casimiro, 2015). Therefore, in online self-paced settings, this study does not differ from the constructs of behavioral engagement articulated by Fredricks et al. (2016). It measures student behavioral engagement in terms of time-on-task, student persistence in doing the allocated work and the level of effort the student invested toward the completion of the task. In addition, we consider student behavior in following the instructions when studying and engaging online (McGowan & Gunderson, 2010).

The Study Environment, Data collection and Data Analysis

The total number of participants in this study was 30; these participants were first-year science students from an Australian university. The online modules were designed to engage students for about 50-60 minutes. During the learning activities, students were required to interact with a range of visual media such as simulations, videos, animations and pictures to understand the given concepts. Interactive visual media, especially simulations were the centre of the learning activities. All the learning modules were developed, deployed and delivered as web contents. Students were invited to engage in the learning activity with a pre-setup computer in a study room. While the students were interacting with the online web content, their computer screen activity was monitored and recorded by the pre-installed software. Each student's computer screen activity was live casting so that the researcher was able to monitor the progress of the investigation, noting points for discussion. Once students finished the activity, the researcher conducted a stimulated recall interview using the recorded student activity as the stimulus (O'Brien, 1993).

The data derived from the recorded student activity, observational notes and interviews were examined and coded to find the patterns and relationships across the data sets. The findings were further interpreted with the focus on the construct of student behavioural engagement. In addition, some basic quantitative data analysis has been shown to support the findings whenever necessary.

Findings

In this study, we investigated student engagement based on the constructs of behavioral engagement with a focus on student engagement with the allocated work, the degree of effort to complete the task and following the instructions.

Engagement with the allocated work

Engagement with the allocated work refers to student time-on-task behavior. Students were required to engage by undertaking a number of activities in the module. To measure the level of engagement, whether it is 'High' or 'Satisfactory', a minimum time has been set for each activity. Students who engaged below the minimum threshold time set for 'satisfactory' were coded 'Low'. It should be noted however that 'High' engagement does not necessarily mean a deeper understanding of the concepts. In this study, the core activities required students to interact with the simulations to understand the concepts. In addition, students were required to understand the concepts demonstrated in the videos. These concepts, supported by pictures and text, were embedded in the activity. Finally, the students were required to answer concept check questions to demonstrate their understanding. At the end of the submission of their responses, students were given the opportunity to clarify their answer from the immediate online feedback provided. The following *figure 1* illustrates the percentage of student engagement across the different sections of the online module.

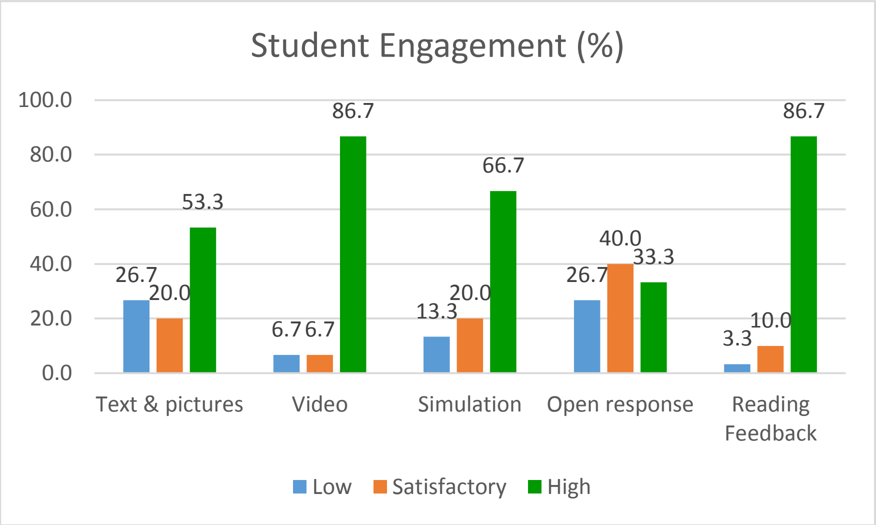

Figure 1: Student engagement across different visual media and events during the online module

Student engagement was found to be *high* on the *video* activities and *reading the feedback* of their responses compared to the core simulation activities. Student revealed several reasons for the higher engagement with the video compared to simulations in the interviews. Some of the key reasons that were identified from the student interviews include the simplicity of the video content by focusing only on a specific concept; it took less time and did not speak about a volume of information; and the video talked about real life misconceptions but it did not require students to give input or expect interaction with the content.

Feedback on different activities is another section where student demonstrated high engagement. They found this feature to be very useful for learning. For example, from the feedback when students realized their presumed understanding was incorrect; they re-visited the simulation model and re-explored the concepts. It assisted them to further enhance understanding of what was happening at the molecular level. According to one student-

> "When I got it wrong, I went up again (to the simulation). And then I cooled it down. OK, now I understand how the intermolecular bonds like just expand and contract." [htsem104]

Figure 1 above also revealed that where an answer to an open response question was expected, this type of response proved to be the least engaging requirement in the modules. The result suggests that, because an open response required student input where an explanation of their understanding, or a possible explanation of the problems in the given text box, was required, this created a cognitive workload (and perhaps overload), demanding physical effort of students as well requiring them to provide written, explanatory input. Similarly, in the case of concept check questions, the student also needed to provide a written explanation of their understanding. Overall, the demands of the open-response format impacted on the level of student engagement. On the other hand, the feedback sections, where the misconceptions and clarification student answers were given, elicited high engagement.

The degree of effort students put to complete the task

Student degree of effort was investigated in different instructional conditions by varying the level of teacher guidance. The *systematic investigation* of student *persistence* has been pursued to understand the degree of student effort while undertaking the task activity (Fredricks et al., 2016; Wang et al., 2016). In this study, student *persistence* refers to the continuation of exploring the simulation for a prolonged time even when the consequence of this exploration does not contribute significantly to the learning of a concept. Sometimes a student wants to explore all features and functionalities of the simulation in spite of having difficulties in understanding how these contribute towards learning the concepts. However, this exploration might not involve a systematic or organized study of the concepts. Student persistence was coded as 'High' or 'Low' depending on their attempt to explore all the functionalities of the simulation irrespective of their understanding of the concept. On the other hand, systematic investigation refers to the structured exploration of the concepts, that is, student attempts to understand a particular concept by exploring it in detail. This type of exploration might engage a student for a prolonged period in endeavouring to understand a specific concept. This concentrated focus appeared to relate to a student forfeiting the opportunity to explore the other possible activities pertaining to the simulation. Student behaviour was coded as 'High' or 'Low' depending on their attempt to understand a specific concept in an organized exploratory way.

To explore and understand the student persistence and effort towards the task, a simulation activity was studied. The simulation 'States of Matter: Basics' was taken from the PhET Interactive Simulations project developed by the University of Colorado Boulder (PhET, 2016). This simulation comprises multiple concepts with multiple variables that the student can manipulate. Students might, for example, be involved in an organised effort to explore the concepts without demonstrating persistence throughout the activity. Students' behaviour was considered 'High' when they demonstrated at least one systematic investigation to understand a concept. The simulation activities were provided to students in different instructional settings. Students were randomly assigned to each activity. The following tables reveal how much effort students put towards the systematic investigation and how persistent they were in undertaking the activity.

Table 1: Student effort level towards the simulation activity

Simulation name	Student ID	Persistence	Systematic Investigation	Overall Effort Level	Types of guidance (Adams, Paulson, and Wieman (2008))
States of Matter Basics (PhET) This is a multi-concepts simulation	Student 1	Low	High (1 concept)	Low	Open Exploration (No guidance)
	Student 2	Low	Low	Low	
	Student 3	Low	High (1 Concept)	Low	
	Student 4	Low	Low	Low	
	Student 5	Low	High (2 concepts)	Moderate	
	Student 6	Low	Low	Low	
	Student 7	Low	High (2 concepts)	Moderate	
	Student 8	High	High (2 concepts)	High	Moderately Guided: Initial instruction to lead open exploration and then some guidance in the form of questions
	Student 9	Low	High (1 concept)	Low	
	Student 10	High	High (1 concept)	High	
	Student 11	High	High (More than 2 concepts)	High	
	Student 12	High	High (More than 2 concepts)	High	
	Student 13	Low	High (1 concept)	Low	
	Student 14	High	High (All concepts)	High	Strongly Guided: Instructions have been provided to investigate four specific concepts.
	Student 15	High	High (All concepts)	High	
	Student 16	Low	High (2 concepts)	Moderate	
	Student 17	High	High (All concepts)	High	

The data from *Table 1* illustrates that the degree of effort is 'High' when the activity is either moderately or strongly guided. In a self-paced environment, an open exploration does not offer any stimulus for students to invest high effort in completing the interactive activity.

Following the instructions

Instructions embedded in the online module are vital components for students to attend to and follow if they are to become successful learners in the self-paced learning context. As there was no teacher supervision, instructions helped to guide students interacting with the learning module. They directed students' involvement in productive activity and helped them to regulate their thinking to learn systematically. Due to the varied capacities of students and their diverse learning needs, it was a challenge to deliver a structured online learning module that could provide the best learning requirements for each individual. In this section, each student's behavioral perspective of following the instructions has been studied under two broad categories of students, namely visual and non-visual learner. The students were classified as visual and non-visual based on their own self-assessment; this was also supported by observing their performance in the learning module. Students were asked in the interview to give their opinions and preferences on different instructional settings. The difficulties in following the instruction was measured from the observation. Table 2 below summarizes the student's behavioral approach in following the instructions.

Table 2: Student behavioral approach towards the instruction

Behavioral construct	Visual learners (21 students)	Non-Visual learners (9 students)
Instructional preference (multiple preferences are considered)	Forms of instruction: -Prefer initial instructions and then open exploration: 19% of the students -Step by Step Instructions/ prefer instructions throughout: 5% of the students -Prefer instruction on important things/ prefer specific instruction on what to learn from each activity (Not throughout): 33% of the students -Prefer open exploration (No instruction or less instruction): 14 % of the students -Prefer combination of instruction and independent learning: 33% of the students Medium of instructions: Prefer visual instruction to textual instruction: 5% of the students	Forms of instruction: -Prefer initial instructions and then open exploration: 11% of the students -Step by Step Instructions/ prefer instructions throughout: 22% of the students -Prefer instruction on important things/ Prefer specific instruction on what to learn from each activity (Not throughout): 56% of the students -Prefer open exploration (No instruction or less instruction): 0% of the students -Prefer combination of instruction and independent learning: 11% of the students Medium of instructions: Prefer voice instructions (Audio instruction): 11% of the students
Difficulties in following instructions	Difficulties in following instructions: 24% of the students	Difficulties in following instructions: 44% of the students

The above table shows that the most of the visual learners did not want either step-by-step instructions or the open exploration. In fact, the least percentages of visual learners wanted step-by-step instructions. The other perspective of this finding suggests that most of the visual learners indicated that they wanted some sort of instructions, and only a few (14% of students) wanted an open exploration with no instruction or less instruction. On the contrary, all the non-visual learners want some sort of instruction. In following the instructions, the majority of the visual learners did not reveal any difficulties. In contrast, a significant number of the non-visual learners experienced difficulties following the instructions.

Discussion

High student engagement with the video in contrast to the simulation suggested that the video format provided a less cognitive load in the learning process as students were not required to interact with the video during the learning process. The video provided less information to process during learning. Nor were students required to give input thus allowing students to become passive learners in the learning process. In contrast, learning with the simulations required active participation. Students need to invest initial time to explore the simulation environment before engaging with the concepts. Therefore, students found the simulation activity much more demanding than viewing the video. Another dimension of student high engagement with the video was that it created student interest by generating cognitive conflict. All the videos in the module began by addressing misconceptions commonly held by learners. This piqued student interest and helped them to engage in clarifying their misconceptions. In the simulation format, the elements that created cognitive conflict were provided before starting the simulation activity in the form of questions. Questions were posed that addressed misconceptions. Students needed to investigate the simulation to clear up their misconceptions. The entire process of investigating and learning from the simulations was found to be less engaging than the videos.

Student task effort increased when instructions and guidance were provided. During the open exploration, no student demonstrated high effort level. This behaviour was supported by the student statement of preferences for different forms of instruction. The majority of the students wanted some sort of guidance in doing the tasks. Therefore, student effort level towards the task was affected when no instruction or guidance was provided. The challenge that remains a challenge is that many students still found it difficult to follow instructions even in their preferable instructional settings. Especially the non-visual learners face greater difficulties in following the instructions. This opens another dimension of research to investigate, that is, the expert vs novice learner performance in online settings and is the key focus of one author's PhD thesis.

Conclusion

A possible drawback of providing heavily guided instructions is that it will lessen the independence of student learning. The main purpose of providing a self-paced learning environment is to make the student an independent learner. Therefore, a balance between personalized instruction and open learning is always preferable when appropriate scaffolding techniques are provided in both formats. In addition, the online content needs to be developed in consideration of the competency level of diverse learners. Both the visual and non-visual learners exhibit differences in their learning preferences. This points to the importance of providing a variety of ways for students to address learning when using online learning resources.

References

Adams, W., Paulson, A., & Wieman, C. (2008). *What levels of guidance promote engaged exploration with interactive simulations?* Paper presented at the AIP Conference Proceedings.

Boekaerts, M. (2016). Engagement as an inherent aspect of the learning process. *Learning and Instruction, 43*, 76-83. doi: http://dx.doi.org/10.1016/j.learninstruc.2016.02.001

Casimiro, L. (2015). *Engagement-for-Achievement: Creating a Model for Online Student Engagement*. Paper presented at the EdMedia: World Conference on Educational Media and Technology 2015, Montreal, Quebec, Canada. https://www.learntechlib.org/p/151597

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research, 74*(1), 59-109. doi: 10.3102/00346543074001059

Fredricks, J. A., Wang, M.-T., Schall Linn, J., Hofkens, T. L., Sung, H., Parr, A., & Allerton, J. (2016). Using qualitative methods to develop a survey measure of math and science engagement. *Learning and Instruction, 43*, 5-15. doi: http://dx.doi.org/10.1016/j.learninstruc.2016.01.009

Harris, L. R. (2008). A phenomenographic investigation of teacher conceptions of student engagement in learning. *The Australian Educational Researcher, 35*(1), 57-79. doi: 10.1007/bf03216875

Henrie, C. R., Halverson, L. R., & Graham, C. R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers & Education, 90*, 36-53. doi: http://dx.doi.org/10.1016/j.compedu.2015.09.005

Hospel, V., Galand, B., & Janosz, M. (2016). Multidimensionality of behavioural engagement: Empirical support and implications. *International Journal of Educational Research, 77*, 37-49. doi: http://dx.doi.org/10.1016/j.ijer.2016.02.007

Louwrens, N., & Hartnett, M. (2015). Student and teacher perceptions of online student engagement in an online middle school. *Journal of Open, Flexible and Distance Learning, 19*(1), 27.

McGowan, H. M., & Gunderson, B. K. (2010). A Randomized Experiment Exploring How Certain Features of Clicker Use Effect Undergraduate Students' Engagement and Learning in Statistics. *Technology Innovations in Statistics Education, 4*(1).

O'Brien, J. (1993). Action research through stimulated recall. *Research in Science Education, 23*(1), 214-221. doi: 10.1007/BF02357063

Parsons, J., & Taylor, L. (Cartographer). (2011). Student Engagement: What do we know and what should we do? Retrieved from http://docplayer.net/237109-Student-engagement-what-do-we-know-and-what-should-we-do.html

PhET. (2016). States of Matter: Basics. *PhET interactive simulations.* Retrieved July, 2016, from https://phet.colorado.edu/en/simulation/states-of-matter-basics

Wang, M.-T., Fredricks, J. A., Ye, F., Hofkens, T. L., & Linn, J. S. (2016). The Math and Science Engagement Scales: Scale development, validation, and psychometric properties. *Learning and Instruction, 43*, 16-26. doi: http://dx.doi.org/10.1016/j.learninstruc.2016.01.008

Please cite as: Mammun, M.A., Lawrie, G. & Wright, T. (2016). Student Behavioural Engagement in Self-Paced Online Learning g. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 381-386).

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PST Online: Learner voices guiding learning design

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Online teaching has become more pervasive throughout the 21st century, partly a result of new technologies allowing for interactive online learning environments and partly to meet the needs of students who cannot access traditional face-to-face classrooms for all or part of their schooling. Pre-service teacher education has lagged behind this uptake in online teaching, failing to prepare new graduate teachers for the possibility of teaching wholly online to students in a range of learning environments. Pre-Service Teachers Online is a website designed to address this gap by providing pre-service teachers with resources to assist in building online teaching skills. Current pre-service teachers' awareness of online teaching skills were sought, providing the foundation for the website. Presented is how the website was designed to meet identified pre-service teachers' needs allowing participants to reflectively consider how their current perceptions of teaching practices could apply in a blended or fully online classroom model.

Keywords: virtual schools, online teaching, pre-service teacher education, website design

Introduction

The ways in which students across all sectors (early childhood, primary, secondary and tertiary) engage in learning, both formal and informal, have changed considerably in the last few decades. Improvements in available technologies, the development of new technologies and an increased acceptance of online learning spaces have all contributed to this change. Online learning spaces are particularly important for distance education learning and the rise in virtual schools in the primary and secondary sectors is an indication of this. These schools and other online learning environments such as blended learning classrooms provide significant opportunities to deliver education to students who might otherwise be unable to pursue their studies due to a range of factors including isolation, mobility (such as with military families), health issues, imprisonment, or emotional issues such as bullying (Roblyer, 2006; Toppin & Toppin, 2015; Vasquez & Straub, 2012).

These changes in teaching and learning environments are occurring at a rapid pace. It has become increasingly important to reflect these new changes in teacher education courses. Teaching online has its own separate skillset in order to provide meaningful and rich learning experiences. Pre-Service Teachers Online (PST Online) is a website funded through an Office for Learning and Teaching (OLT) grant designed to assist in the development of this skillset. The website design, as a learning environment, was underpinned by comments from the pre-service teachers it is primarily designed to assist. Feedback from a survey conducted to pre-service teachers provided ideas for the content of the website. The themes emerging from the survey informed the design of an open source website with resources specifically addressing pre-service teacher defined needs.

Background and context

New South Wales implemented its first virtual high school, *xsel*, in 2010, catering for gifted and talented students in English, Mathematics and Science. *xsel* acted as a blueprint for its replacement, Aurora College, which was opened in 2015 (New South Wales Department of Education and Communities, 2013). Existing teachers were employed to teach the students virtually (wholly online). The authors, staff members of the School of Education at the University of New England (UNE), believed that the development of virtual high schools would require a change in pre-service teacher education to accommodate this new teaching environment and the skills that would be required to undertake this teaching. They received OLT funding in 2015 to explore resources required to assist in developing these online teaching skills and to build a website for such resources. The authors have a range of areas of expertise: Lecturers in Professional Classroom Practice and Information and Communication Technology Education, and an Educational Designer.

Literature Review

Online learning is increasing globally but research, teacher practices and learning design for virtual schooling is dominated by what is happening in the United States of America (U.S.A.). All 50 states in the U.S.A. provide some type of online learning opportunity for K-12 students and 26 states partially fund state-established virtual schools, with well over a million students learning online each year. Accordingly, the majority of research in relation to online or virtual learning emanates from the U.S.A.

In developing this project, the researchers drew on the currently available literature about best practice in online teaching. In Australia, very little has been written about such teaching in schools and it is necessary, for the Australian context, to draw on the literature around online teaching in higher education institutions (Downing & Dyment, 2013; Gregory & Salmon, 2013). The 2009, OLT "The Learning to Teach Online" project (McIntyre, 2011), was designed to assist academics with online teaching. Resources developed by McIntyre (2011) provided background and context to complement the suite of resources created in this research project.

An important discussion raised by virtual schooling is the capacity of the teachers to deliver in an online environment. Miller and Ribble (2010, p. 5) argue that not all teachers "have the skills or temperament to be online instructors. Just as some people are not destined to be classroom teachers, there are some who should not be online teachers as well". The literature also intimates that teaching online necessitates a different range of skills from those currently covered in teacher education programs (Bull, 2010; Corry & Stella, 2012). Murphy and Manzanares (2008, p. 1070) argue that there are contradictions in moving from face-to-face teaching in a conventional classroom to teaching online and that teachers "may benefit from opportunities to develop new skills, techniques and strategies".

This discussion on teacher capacity has raised further debate about pre-service teacher education for online teaching (DiPietro, Ferdig, Black, & Preston, 2010) which "prepare individuals for traditional classrooms, and they do so in isolated silos of pedagogy, content, field experiences, and to a lesser extent, technology" (Archambault, 2011, p. 74). These programs focus almost exclusively on face-to-face teaching with technology being a tool for learning. Given that online learning is increasing in the K-12 sector, teacher education programs will need to adapt to prepare pre-service teachers for this new milieu (Archambault, 2011). The design of the website, informed by pre-service teacher voices, is discussed more fully throughout this paper. In seeking to redress the gap through the development of an open source website of resources, the authors drew on aspects of web design that have been raised as important for educational websites:

> Web designers should put high emphasis to ease users' browsing experience by providing a good web navigation system. The educational website should also be appealing by appropriately manipulating multimedia elements including color, graphics, fonts and typography (Ng, 2014).

Method

The first phase of the project was a survey of pre-service teachers at UNE to gauge their awareness of, and readiness for, virtual schools and online teaching. In this way, the project team could respond to needs raised by the participants in their development of the project website and resources. The survey received ethics approval and an invitation to participate was sent to 2,567 students. Two hundred and thirty-one students completed the survey, a response rate of 9%. This low overall response rate could be due to the invitation coinciding with the end of trimester. However, the data collected was rich in detail and provided a snapshot of pre-service teacher understandings across a wide array of backgrounds, locations and subject areas.

A series of demographic questions such as age, gender, place of residence were asked in the survey, some questions in relation to their studies (ie year, mode) and some questions on a Likert scale questions to gain their perception of their technology skills, how often they use technology and how prepared they were to teach in online environments. Pre-service teachers were then asked some open ended questions in relation to their challenges in teaching online and resources required. Preparatory to commencing website development, the responses from the survey were manually coded for themes. Particular attention was paid to the concerns of the participants in regards to online teaching and also to the needs articulated. These concerns (or challenges) and needs then formed the basis for the website resources.

The website design formed the second phase of the project. The website, hosting a range of resources, was the main output of the project. This choice of output modelled the online teaching framework that the team wished to present. An open-access website also enabled a wider audience who could progress through the resources at their own pace. The hosting of the website needed to be cost effective, reliable and with an option for an extended length of time. The website domain name, http://pstonline.info/, was chosen to be short, evocative of the project purpose, and easy to remember.

Findings

While the main output for this project is the website, the findings from the survey provided vital data to enable the website to be relevant to pre-service teachers. Virtual schools are relatively new in Australia, although there is a long tradition of School of the Air, and the survey highlighted the lack of knowledge of these schools as well some interesting attitudes to teaching in such schools. The findings have been reported elsewhere (Grono, Masters & Gregory, 2015; Masters, Gregory & Grono, 2015a; Masters, Gregory & Grono, 2015b), however, they are reported briefly to provide insight into the need to pursue online teaching skills in teacher education.

Four themes were clearly dominant based on the number of responses: engagement, technology, development of community/relationship, and teaching skills. A strong emphasis in the data across these themes was on making connections, using appropriate resources and activities to engage students and these main areas of concern became the main resource modules on the website (technology per se was outside the purview of the project). The participants demonstrated their concerns through comments such as:

> *The ability to ensure that students don't feel alone and isolated whilst using on-line technology to learn. As a student myself this can be a very hard hurdle to overcome* (Participant).
>
> *How do you get to know your students? How do you find out how they learn in order to differentiate your lessons? How do you differentiate your lessons?* (Participant).
>
> *Learning new online skills, and ensuring that the course is not impersonal* (Participant).

The authors used the participant voices to provide a website that was relevant to their needs and which modelled ways of engaging students and facilitated finding resources. The following discussion about the design of the website demonstrates how the initial research translated into learning potential for preservice teachers.

Discussion

For the PST Online website, the decision was made to utilise open source software, in particular WordPress and Moodle, because of their customisation capabilities, zero cost, range of features and online support community. As free platforms they also model their features as easily accessible learning tools available to teachers. This focus on free-to-use tools that could be used by the learner to assist their own teaching was also applied to project dissemination through choice of social media and etools used, including YouTube for video hosting.

WordPress, an open source blogging platform, provided an intentionally uncluttered and quick to navigate 'homepage' to present the project. The website was customisable with the ability to include the project's logo and menu of project goals, dissemination, links and contacts.

Moodle, an open source Learning Management System (LMS), provided a suite of learning tools with which to build the learning modules. These were customised to suit the specific purposes of the project, and allow for the easy development of a range of self-paced interactive activities as the website expanded. This platform also allowed an optional approach to site registration for users. It provided the opportunity to access teaching modules and the information within, without registration to the site, therefore keeping the site accessible to everyone and unobtrusive. It also permitted the ability to register if individuals wanted to track their progress through the topics, engage in reflective activities and earn badges demonstrating that they had engaged in modules in relation to teaching online and receive recognition for their time. Moodle is used by many universities, including UNE, as well as being often the LMS used in schools. This meant that it had the advantage of being familiar for the designer, project participants and many other visitors to the site. Moodle also allows access to rich analytics and reports to track visitor access and progress to assist with further development after the project finished.

Originally, it was planned that the project website would house a range of files that provided information about online teaching as well as activities that visitors could complete to enhance their learning. It was decided that short videos addressing a range of topics would be more engaging for visitors. All academic staff in the school were invited, as experts in online teaching, to be recorded for uploading on the project website. Five academics (plus the project team) became the 'talking head' videos. The videos were recorded using an iPad as it was less intimidating for the person being videoed. Videos also took place in the academics' offices providing a known, and therefore more relaxed, environment. The videos were transcribed and included on the website for greater accessibility. YouTube's video platform was used for hosting. Again, modelling the use of free etools to pre-service teachers, allowed for embedding of videos and scalable video qualities to support users on both high and lower levels of connectivity. Further accessibility was also provided by including subtitles on the videos.

The videos, serendipitously, divided into three main themes: resources for teaching online, making connections online, and activities for online teaching. A decision was made to use these themes as the main modules for the website, with readings linked to the specific theme being included in the same topic block as the respective videos. The themes of the video blocks (sections) were mapped against the responses made by the survey participants in terms of their needs and concerns.

Each of the three blocks included a reflective activity for registered visitors to complete resulting in the award of a digital badge, utilising Moodle’s support for the Mozilla Open Badges service. A final badge can then be awarded for completion of all three activities, allowing the earner to “demonstrate skill development” (Hurst, 2015, p. 185), and encouraging users to interact with all the modules available within the PST Online website. The graphic for each badge was designed to be clearly identified through the use of the websites logo and the name of the topic area (see Figure 1). The intent of the badges was to demonstrate that engagement around the topic of online teaching occurred and the participant had provided their own self-reflective response on the topic, rather than demonstrate a qualitative level of competence. This approach was taken to allow instant recognition and reward for the user, regardless of time or location, without requiring manual grading on the part of a marker. It is intended that as more resources are developed and/or found that these will be added to the website.

Figure 1: Badges awarded for completion of activities

The three main learning modules supplement several other Moodle blocks. These are:

- *Introduction* - designed to present an introduction to the concept of virtual schools.
- *Frameworks, Standards and Guidelines* - contains links to frameworks/standards for online teaching.
- *Professional Development possibilities* - Links to some professional development that is available.

Following the launch of the PST Online website, a focus group of interested pre-service teachers attended an evening workshop, including inclusive education and science specialists. The inclusive education teachers felt it was important that they know how to teach online because their students were those who appreciate the opportunity to learn with a ‘level playing field’, that is, they (their future students) would not be judged by their peers because their peers did not know of their disability. The science teachers felt that being able to teach online was important so that they could demonstrate experiments that could be harmful to undertake in a face-to-face environment. They also felt that there were many resources available that could demonstrate different scientific experiments better than they could through the use of YouTube or TeacherTube. It was evident that these pre-service teachers believed online teaching skills are important for their teaching careers and that they appreciated being able to find out more about online teaching.

Future directions

The analytics embedded in the website, via Google Analytics and ClustrMaps, in addition to Moodle’s own inbuilt reporting tools, indicate the project has raised awareness of the development of virtual schools and of the need to gain expertise in digital pedagogies. Although the website is live and populated with a range of resources, there is scope for further development. The mapping of the pre-service teacher survey responses helped to frame the current modules. Over time, these responses will be used as the basis of future content, both new modules and additional sub-sections in existing modules in order to cover each area of need identified.

Another important direction is the intent to develop a follow-on project that will be a cross-institutional project in partnership with the New South Wales Department of Education and Training (DET). The new project will involve pre-service teachers practising their online teaching skills based on this project. This new project will be dependent on funding support and also the co-operation of the DET and other higher education institutions.

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References

Archambault, L. (2011). The practitioner's perspective on teacher education: Preparing for the K-12 online classroom. *Journal of Technology and Teacher Education, 19*(1), 73–91.

Bull, G. (2010). The always connected generation. *Learning and Leading with Technology, 38*(3), 28–29.

Corry, M., & Stella, J. (2012). Developing a framework for research in online K-12 distance education. *Quarterly Review of Distance Education, 13*(3), 133–151.

DiPietro, M., Ferdig, R. E., Black, E. W., & Preston, M. (2010). Best practices in teaching K-12 online: Lessons learned from Michigan Virtual School teachers. *Journal of Interactive Online Learning, 9*(3), 10–35.

Downing, J. J., & Dyment, J. E. (2013). Teacher educators' readiness, preparation, and perceptions of preparing preservice teachers in a fully online environment: An exploratory study. *The Teacher Educator, 48*(2), 96–109.

Gregory, J., & Salmon, G. (2013). Professional development for online university teaching. *Distance Education, 34*(3), 256–270.

Grono, S., Masters, Y., & Gregory, S. (2015). PST Online: Preparing pre-service teachers for teaching in virtual schools. In T. Reiners, B.R. von Konsky, D. Gibson, V. Chang, L. Irving, & K. Clarke (Eds.), Globally connected, digitally enabled. Proceedings ascilite 2015 in Perth (pp. CP:98-CP:102).

Hurst, E. J., (2015). Digital Badges: Beyond Learning Incentives. *Journal of Electronic Resources in Medical Libraries, 12*(3), 182-189.

McIntyre, S. (2011). Learning to teach online: Developing high-quality video and text resources to help educators teach online. Final Report. Sydney: University of NSW. Retrieved from http://www.olt.gov.au/resource-learning-teach-online-unsw-2011.

Masters, Y., Gregory, S., & Grono, S. (2015a). PST Online: Meeting the need for teaching innovation for virtual schools. *International Journal of Learning, Teaching and Educational Research, 14(2)*, 1-16.

Masters, Y., Gregory, S., & Grono, S. (2015b). PST Online: Meeting the need for teaching innovation for virtual schools. Presented at AARE, 29 November - 4 December, Fremantle, Western Australia.

Miller, T., & Ribble, M. (2010). Moving beyond bricks and mortar: Changing the conversation on online education. *Educational Considerations, 37*(2), 3–6.

Murphy, E., & Manzanares, M. A. R. (2008). Contradictions between the virtual and physical high school classroom: A third-generation Activity Theory perspective. *British Journal of Educational Technology, 39*(6), 1061–1072.

New South Wales Department of Education and Communities. (2013). Rural and remote education: A blueprint for action. Sydney, NSW: Department of Education and Communities. Retrieved from https://www.det.nsw.edu.au/...us/.../rural...education/randr-blueprint.pdf.

Ng, W.-S. (2014). Critical design factors of developing a high-quality educational website: perspectives of pre-service teachers. *Issues in Informing Science and Information Technology, 11*, 101–113.

Roblyer, M. D. (2006). Virtually successful: Defeating the dropout problem through online school programs. *The Phi Delta Kappan, 88*(1), 31–36.

Toppin, I. N., & Toppin, S. M. (2015). Virtual schools: The changing landscape of K-12 education in the U.S. *Education and Information Technologies*, 1–11.

Vasquez III, E., & Straub, C. (2012). Online instruction for K-12 Special Education: A review of the empirical literature. Journal of Special Education Technology, 27(3), 31–40.

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From practitioner-producers to knowledge co-creators: An early view of a design-based research project to foster insight generation into MOOCs

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The University of Adelaide established its MOOC initiative, AdelaideX, in 2014 with goals including generating and sharing insights into effective practice in open online learning. Our professional and teaching staff are amassing valuable experience in conceptualising, designing, developing, delivering and evaluating MOOCs and are part of an emerging knowledge community among MOOC-active universities. In 2016, AdelaideX is running a Creating Insights Project, with the goals of feeding innovation at the University, enabling our people to fulfil aspirations towards capturing and sharing their ideas about MOOC making, and securing rich insights which can be fed formatively into future course and program activities. To do so, we have begun to experiment with a design-based model for practice research. In this way, we are positioning the relationship between academics and professionals as investigative partners, a promising means to develop capacity for insight generation in the open learning space.

Keywords: Open learning, professional practice, evidence, collaboration, design-based research, innovation, MOOCs

AdelaideX and the need for insights

AdelaideX is the University of Adelaide's open online learning initiative, formed in 2014 when the University entered into a partnership with MOOC platform edX. Among our strategic goals is fostering effective practice in digital learning and teaching, through exposing Adelaide educators to design and development activities geared towards release of a MOOC – a Massive Open Online Course – at the edX.org site. As such, the need for insight generation at AdelaideX comes from three main directions:

Institutional need to derive practice-based insights from core MOOC-making activities to feed innovation;
Desire of our people to share insights from their collaborative experiences making MOOCs;
Practical need to ensure program/course enhancements are recognised and adopted, where appropriate.

On the first of these, AdelaideX also has a remit to feed innovation at the University of Adelaide more generally, in the area of online learning and teaching with MOOCs. With this in mind, there is a clear need to establish insight generation as part of our 'business as usual' across our professional and educator groups, and at the same time there is an opportunity for AdelaideX to explore, evaluate and model for others some new ways of deriving and working with evaluations, surveys, qualitative feedback, and other forms of potentially insight-rich data. We have many reflective practitioners in our midst, with limited opportunity to reflect. And we have a still young program which will surely develop and mature, which we think should be based on evidence of what works. For all these reasons, we are now trialling a Creating Insights Project as an approach to enable insight-generation to be integrated into the program team's armoury of skills, marking a new stage of our development as we add to our existing roles as producers to become co-creators of knowledge relating to organisation, design, development, implementation and evaluation of MOOCs.

The Creating Insights project will complete its first cycle of activity in late 2016 and therefore this paper is offered as a snapshot of a live experiment, geared towards developmental ends. If we are successful, we hope to establish the models for investigation, recommendation and adoption we outline here, as an ongoing element of the AdelaideX group's work on innovation through MOOCs.

The challenge: Introducing reflection into a production-oriented setting

The key challenge associated with introducing a 'systematic educational design process' (Plomp, 2013, p. 17) for MOOCs is in traversing the production workload associated with designing and developing them. An AdelaideX MOOC typically comprises up to 6 weeks of learning material, containing 50-80 videos, around which learning sequences are structured. In this context, the effort to increase AdelaideX's capacity for reflective practice has been a gradual one, as we have grown from an initial focus on establishing and producing MOOCs, towards deeper exploration, learning and communication of what we are learning. It is a privilege that perhaps comes with AdelaideX's transition from an initial establishment phase during which we designed and implemented the systems, supports and practices that would reliably produce MOOCs, into a more mature phase in which our program's implementation no longer needs to be designed from the ground up.

We should not underestimate the challenge involved in seeking to make this type of transition, at a time when MOOCs remain highly resource-intensive and few universities have successfully specified a sustainable development model (Fischer et al., 2014). Reflective practice, after all, requires a workload model that contains some time for it, and a commonly encountered drawback of MOOC-making today is that when a course team embarks on the "on-ramp" towards a specified release date, the production schedule comes to dominate over more reflective activities – though there is usually more leisure later to reflect and learn from the MOOC we have made, this places the work of reflection firmly in a summative role, where it can only drive enhancements after the fact.

With this in mind, it is significant that AdelaideX initially had a fairly strong production orientation, charged as it was with delivering 5 MOOCs within the first 12 months of the edX partnership – a not-unusual requirement for universities entering into MOOC partnerships – and thus in our immediate context there was a strong need to bring our collective focus onto a method that would support a movement towards reflective practice alongside undoubtedly intensive work on course production.

An overview of the Creating Insights Project

The Creating Insights Project was established in Semester 1 2016, after a period of initial scoping of possible approaches to supporting innovation in learning and teaching with MOOCs, conducted by members of the AdelaideX Operational Group, representing stakeholders of the program. The group made two critical decisions:

4. To establish three MOOC Mentors roles – to support the AdelaideX professional team with an initial phase of education development work, including investigations;
5. To form the Creating Insights Project – to provide a forum for development of investigative projects which could be led by the AdelaideX program team in 2016.

The work of the project was to be focused on trialling a method for the AdelaideX team and collaborators to pursue insights into design and development practice, so that they could actively inform innovation at Adelaide.

Table 1: Creating Insights Project: Key Ideas

What?
• Ideas for planned investigations into learning and teaching with MOOCs • Input on pilots that may emerge in relation to the AdelaideX program
Why?
• Generating insights into AdelaideX's work, while we work • Supporting the whole team to investigate things we want to know about MOOCs • Engaging in reflective practice, we are constantly learning • Feeding potential innovations at Adelaide related to open online learning
What are we not?
• The 'gatekeeper' for research relating to AdelaideX (but we will support colleagues conducting research) • Authorisers of research to be done by faculty course teams (but again, we will support them as needed) • About generating change for change's sake – we want to base future decisions about program and course design on evidence of what works
What can we do?
• We can reflect and learn from our practice with MOOCs, working collaboratively • We can raise the profile of what the team are learning through our work with decision-makers • Our group has the power to communicate with influence about MOOCs, at UoA and externally • We can use a practice-oriented research model to structure our investigations
What's a good investigation topic?
• It's timely – it speaks to a current need, problem or challenge we have noticed in our own practice • It's relevant to our university – it speaks to challenges in our strategy for learning, teaching and assessment • It's instrumental – it may help us to improve our program or course level practices, through description and communication of a solution to others

We held two workshops with AdelaideX team members and the MOOC Mentor team. At the first, we introduced the principles of design-based research (Reeves, 2006; Amiel & Reeves, 2008) and discussed the DBR model, from analysis of practical problems through development of initial solutions, iterative testing and refinement of practical solutions, and reflection to produce new design principles or recommended solutions. The output of that workshop was a list of 19 possible topics suggested by the group, which the co-chairs grouped thematically and prioritised according to our three principles for good investigation topics (labelled 'TRI' – timely, relevant, instrumental). At a second workshop, we formed project teams around 4 chosen topics, and provided templates based on Herrington's DBR one-page templates (n.d.) for the teams to use to flesh out their challenge or problem on one page, and to establish an initial plan of attack for each team.

The topics we identified for 2016 align with the strategic priorities for learning and teaching at Adelaide: around student-centred design; demonstrating the value of MOOCs to learners; understanding factors that enable MOOCs to be reused; and investigating how communities and groups form in MOOCs. These core topics can be supplemented by other investigations which arise from our community, as needed.

Importantly, our project is intended to distribute the roles of initiating and driving shared investigation among peer-collaborators, whether a project is formally led by a professional or academic staff member. In this way, we can begin to involve all who have a connection with our MOOC practice to develop and communicate their insights, and so we hope to gently challenge teaching staff to engage in this work alongside collaborators with a professional interest (Figure 1).

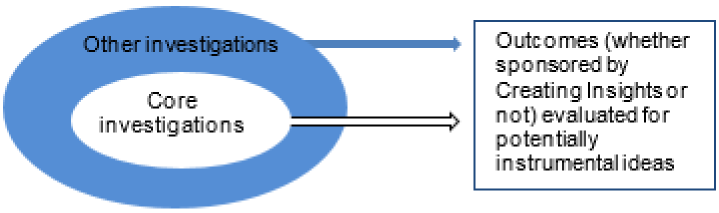

Figure 1: How core and other projects will feed into decision-making

This we think is a promising method to build confidence and skills in practice-based research, from within the core team who will be in a position to model this practice for future colleagues and collaborators as their exposure to this way of working grows.

Views of our knowledge network

We have described AdelaideX as initially a heavily production-oriented group, although, with an ADDIE-style overarching course lifecycle in place guiding course development, insights from evaluative activities (such as post-delivery debriefings and student surveys) were put in place at an early stage. Using data provided by our technology provider edX, in 2015 several educators wrote scholarly papers and conference presentations, and the AdelaideX program team conducted program and course improvement activities with an internal focus. This was no bad thing in itself, of course, since it demonstrated the interest and ability of each 'stream' to contribute to reflective practice, albeit mostly in a summative way. In 2015, we also benefited from the creation of a Community of Practice focused on MOOCs, where many MOOC-active colleagues were able to share knowledge. We describe this early work as largely following traditional pathways to dissemination, with two distinct research/scholarship of learning and teaching and evaluative/improvement tracks. Figure 2 (below) shows a way of visualising this initial version of our internal knowledge network.

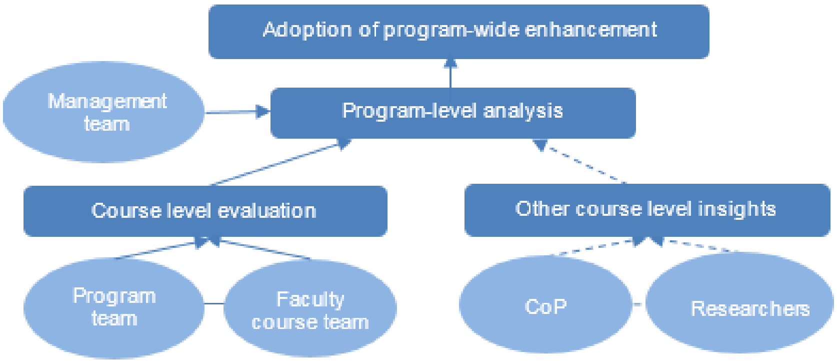

Figure 2: Original pathways for MOOC insights

Figure 2 shows gaps between 'improvement' work (internally focused) and 'evidence' work (focused on publication and dissemination), and a gap too between course-level evaluations (involving faculty and program teams) and program-level decision-making. With the introduction of a more connective method through Creating Insights, we can see this changing. Figure 3 (below) shows a revised network view of the insight-generating structure of AdelaideX, with a stronger connection between course evaluations and investigations fed through Creating Insights. Both sets of evidence feed into program-level analysis, which is conducted, and enhancements decided upon, by AdelaideX's stakeholder group and our management team. Faculty and professional collaborators are able to access advice and support from Creating Insights, and vice versa, so that both evaluative and investigative aspects of the work now connect. This, we think, provides a sounder basis for flow of insights between people working on course design/development and those working on scholarship of learning and teaching, as well as a two-way flow into and out of affinity groups (CoPs and others).

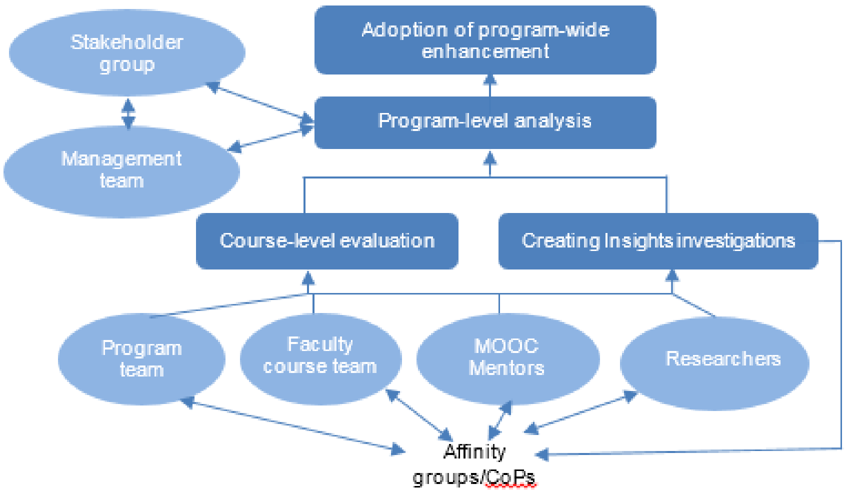

Figure 3: New pathways for MOOC insights

Conclusion

The Creating Insights Project's 2016 activities will be evaluated on the basis of participation by academic and professional peers; by engagement as well as production of solutions arising from the DBR process; and by an assessment of the applicability of the insight-generating model to the future needs of the AdelaideX program. Implementation improvements arising from the first cycle of Creating Insights will be explored in a future paper.

References

Amiel, T., & Reeves, T. C. (2008). Design-based research and educational technology: Rethinking technology and the research agenda. *Educational Technology & Society*, 11 (4), 29–40.

H. Fischer, S. Dreisiebner, O. Franken, M. Ebner, M. Kopp, T. Köhler (2014). Revenue vs. costs of MOOC platforms: Discussion of business models for xMOOC providers, based on empirical findings and experiences during implementation of the project IMOOX (pp. 2991–3000). *ICERI2014 Proceedings*, 7th International Conference of Education, Research and Innovation, Seville (Spain) 17-19 November.

Herrington, J. (n.d.). One-page design template. www.authenticlearning.info/DesignBasedResearch/Design-based_research_files/Design%20template_2.docx, accessed 25 July 2016.

Plomp, T. (2013). Educational design research: An introduction. In T. Plomp & N. Nieveen (Eds), *Education Design Research* (pp. 1–50), 2nd edn. Netherlands: SLO.

Reeves, T.C. (2006). Design research from a technology perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds), *Educational design research* (pp. 52–66). London: Routledge.

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Cross-institutional collaboration to support student engagement: SRES version 2

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Descriptions of cross-institutional, educational technology development initiatives that emphasise what actually works in real-world classrooms are rare. In this paper, we describe a multi-institution collaboration that grew from grassroots classroom needs and proved resilient in the face of institutional change. We explain how the initiative came about, how it survived unanticipated change, and how it led to the development of a new open source learning analytics tool for student engagement. We provide some reflections on the first pilot study of the tool and describe future plans. The authors welcome new collaborators and invite interested readers to evaluate and extend the tool for themselves.

Keywords: Educational technology, collaboration, open source software development, student engagement

Background

In the first edition of Rethinking University Teaching, published in 1993, Diana Laurillard remarked that educational technology “has an odd mix of engines driving it – technological pull, commercial empire-building, financial drag, logistical imperatives, pedagogical pleas” (Laurillard, 1993, p. 99). More than two decades later, the odd mix of engines has arguably become louder, faster and even more diverse. Higher education institutions today are under increased pressure to demonstrate effective return on investment for students, particularly in areas of technology-enhanced teaching and learning (O'Flaherty & Phillips, 2015). Central to enhancing teaching and learning with technology is the educational technologist.

The role of the educational technologist falls into what Whitchurch (2008) has described as the *third space*; a challenge to the prevailing binary view of university employees as either academic or professional (sometimes general) staff. Gornall (1999) identified that educational technologists play strategically significant roles within the institution, yet seldom occupy mainstream academic roles. Oliver (2002) characterised the growing number of educational technologists as people who work collaboratively and responsibly, but without specific authority, on curriculum-centred projects. In this respect, they arguably share a similar uncomfortable space to academic developers (Kensington-Miller, Renc-Roe, & Morón-García, 2015). Indeed, in the Australasian context, they are often co-located within centres for academic development (Hicks, 1999), may have designated academic or professional roles and are often at the mercy of repeated cycles of restructuring (Palmer, Holt, & Challis, 2011).

Paradoxically, as educational technologists and academic developers navigate their liminal third space in the face of measures which privilege individual academic specialisation (e.g. in New Zealand the Performance Based Research Fund, or PBRF), collaborative, pedagogically-motivated, institutional projects, and the place of educational technologies have arguably become pivotal to the very future of higher education. The notion that a technological 'silver bullet' or 'killer app' will come along to revolutionise education has largely been put to bed (Pinto, 2016) and the focus of educational technology has shifted to collaborative, multi-perspective initiatives, with an emphasis on what actually works in real-world classrooms (Latchem, 2014).

In Laurillard's terms, the ASCILITE 2016 conference theme, *Show me the learning,* is a clear "pedagogical plea" to demonstrate what works in the classroom. Recently, learning analytics researchers have echoed this theme and suggested that learning analytics is occurring in a theoretical vacuum; the problems being solved are seldom informed by pedagogical theory and solutions fail to generalise beyond local contexts (Kirschner, 2016). In this paper, we respond to the ASCILITE conference theme by describing a cross-institutional collaboration that began following ASCILITE 2015. The learning we describe is that of the authors with respect to the cross-institutional development of a pedagogically-motivated learning analytics tool for student engagement. In-class case studies are currently underway to evaluate the tool in a range of pedagogical and institutional contexts and will be reported elsewhere. While cross-institutional collaboration is not novel (e.g. Apereo foundation projects such as Opencast and Sakai; JISC Learning Analytics project), developmental collaborations that grow from grassroots are rare and narratives around how to embark on this kind of collaboration, and how such collaborations progress, are seldom discussed in the literature. This paper aims to address that gap and begins with the motivation for developing a learning analytics tool for student engagement.

Hatching a development plan

The retention and progression of diverse, first-year student cohorts are issues facing many higher education institutions (Tinto, 2006; West et al., 2015). Exacerbating this is the inertia and disconnectedness that students often feel, which could be in part alleviated through targeted support (Krause, 2005). Therefore, regular, personalised communication and feedback between teachers and students can be central to enhancing student engagement and supporting students (Chickering & Gamson, 1987; Kift, Nelson, & Clarke, 2010). Fundamentally, this should never just be about the at-risk cohort or for the purposes of retention, but rather improving the experience for all students. However, the ability for teachers to connect with their students is being increasingly diluted through massification, a problem that a pedagogically-motivated tool could address. The Student Relationship Engagement System (SRES), developed by author Liu from the University of Sydney, is a web-based system which combines a central repository of student data with a means to efficiently bring in data and then utilise these data at scale to personalise support and interactions with students (Liu, Bartimote-Aufflick, Pardo, & Bridgeman, 2016, forthcoming). Data can be imported from existing sources (e.g. LMS, spreadsheets) or entered *in situ* using a mobile application (e.g. attendance in a lab, comments in a tutorial). Data can be easily collated and combined by teaching staff for a range of purposes. For example, to automatically identify and send a personalised email or text to students who have: missed more than two labs in a row; or submitted assignments late; or performed poorly in early summative tests etc. Underpinning the SRES is a belief in 'bottom-up' learning analytics, empowering teachers to gain actionable insights from their own local data (Liu, Taylor, Bridgeman, Bartimote-Aufflick, & Pardo, 2016) instead of having learning analytics delivered to them from centrally-managed projects.

Use of the SRES has grown rapidly at one university (55+ courses across 14 departments since 2012) and key to its success has been direct engagement with teaching staff and meeting specific in-class needs. In addition, early results suggest increased student retention within courses where the SRES has been deployed (Liu et al., 2016, forthcoming). Authors McDonald and Gunn met with author Liu at ASCILITE 2015 and seeing the potential for SRES use at their own institutions invited him to visit in February 2016, following the conference. Author Liu gave workshops/seminars at the University of Otago and the University of Auckland, each of which was attended by around 30 teaching staff from the host and other local institutions.

Although the SRES was built as an open source project that could be transferred to other institutions with a small amount of customisation, it was developed on a dated web application platform and hard-wired into university systems. Together, the authors agreed that the ideal approach would be to redevelop SRES from the ground up as an open source project utilising a modern scalable architecture. In this way, project partners could develop SRES v2 to meet their own specific needs but benefit from sharing a flexible data architecture and common components. For example, data import or barcode scanning interfaces for data input, or messaging components and visualisation tools for data output. Furthermore, this approach lent itself to bringing new partners into the project, sharing the development load, ensuring sustainability and increasing the benefits for all. As Latchem (2014, p. 5) notes, educational technology 'failures' tend to result from "too little attention being paid to the pedagogical, organisational, cultural and other factors that determine what fails, what works and what transfers successfully into other contexts".

One remaining issue was how to fund the redevelopment. Authors Gunn and McDonald were fortunate to have been awarded an Ako Aotearoa National Project Fund Grant in 2015 from the New Zealand government, and were able to include SRES v2 development and evaluation as a case study in this research. SRES v2 development began at the University of Otago and for reasons that will be discussed, has continued at the University of Auckland.

Development and implementation progress so far

From the outset, the authors were committed to maintaining the philosophy of the original SRES, which was to work in partnership with teaching staff to create a system that would help them to increase student engagement. One criticism lobbed at today's educational technology is of being driven by "issues of enhanced organizational effectiveness and efficiency, rather than individual or collective empowerment" (Selwyn, 2013, p. 34). For example, this year the University of Auckland moved from a largely home-grown and bespoke learning management system (LMS) to a cloud-hosted solution. The move brought with it a heightened expectation from various stakeholders to leverage the new LMS to gain insight, in a more user-friendly way, into how students learn and perform. Our approach with SRES v2 deliberately sought to empower teachers by including them early and often in the development process, specifically formulating use cases around their current in-class teaching practices. In the case of the University of Auckland, this involved working with data from the new LMS.

Working with teachers to build use cases

Preliminary discussion with the teachers who had expressed an interest in being involved in a pilot study identified two high-level system requirements: 1) directly support student engagement; and 2) support teachers to teach. Using these as guiding principles, specific use cases were developed with these teachers in four courses across two institutions, based on their in-class experiences.

Use cases were categorised as either 'input' or 'output' cases: input cases typically involved inserting data into the SRES v2 (e.g. via uploading a spreadsheet of student data, or using a mobile app to record data *in situ* during class, such as attendance), while output cases were centred on reading, displaying and communicating data contained within SRES v2 (e.g. filtering student data based on certain criteria and then sending a personalised email to the students concerned). Cases were written in a standardised format using active language, along the lines of "As a [teacher/demonstrator/course coordinator/etc], I want to [do something/see something]" to encapsulate the value the system would add, and how interaction would take place (Paetsch, Eberlein, & Maurer, 2003). Two example use cases are shown below:

University of Otago
Two first-year biological science classes (~150 and ~300 students) and one second-year biological science class (~130 students)

- Example input use case: As course coordinator, I wish the [course] teaching fellows to be able to record student assignment grades and submission dates via the University LMS to check for progress and late assignments. This data should be imported from the LMS.
- Example output use case: In large classes it is often impractical to personalise communication to students and offer support before it is too late. Ideally, as course coordinator, I wish the [course] teaching fellows to be able to identify students who have not checked their grades on Blackboard by week X, notify them and offer follow up via email or text message.

University of Auckland
First-year statistics class (1700+ students)

- Example input use case: The [course] team would like to record students' use of LMS resources (specifically their participation in diagnostic quizzes and looking at a previous statistics test) in order to monitor activities in preparation for their first assignment. This data should be imported from the LMS.
- Example output use case: As [course] academic student adviser, I'd like to encourage student participation and offer further assistance. Therefore, I wish to identify students that have not accessed either the diagnostic quiz, or the iNZight quiz or looked at the first assignment by the end of week 2 in order to send an email or text message to those students

Working from these use cases, Figure 1 illustrates potential action triggers for an email or text intervention, based on students' use of specific course materials. It is envisaged to not only monitor students' engagement with the LMS but to also closely monitor students' performance during the course of the semester. For example, a teacher can filter students who correctly answered less than 5 out of 8 questions in the diagnostic quiz and then send a personalised email message to those students offering extra statistics support.

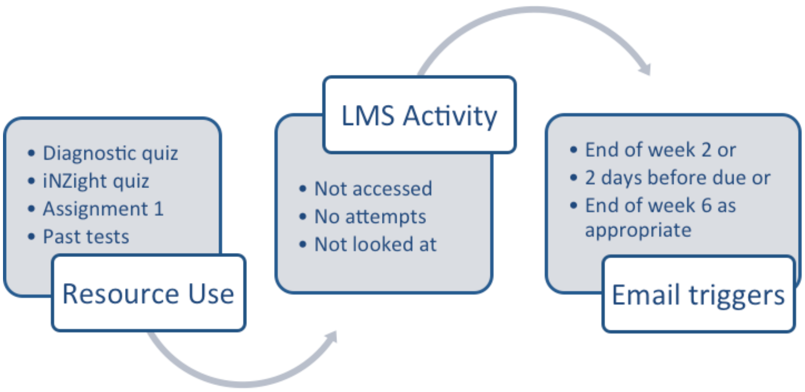

Figure 1: Process diagram of possible data triggers to monitor students' engagement for follow-up

The collection of use cases, developed in partnership with teaching staff, informed the development of SRES v2 and through an iterative development process culminated in the development of the minimum viable product (i.e. the minimum functionality of the software which could be used in practice by the target users) for SRES v2.

Building the minimum viable product – SRES v2

We were encouraged by recent reports of learning analytics initiatives at Australasian institutions which highlighted the need to provide teachers with flexible, user-friendly tools that met their pedagogical needs and the desire for teachers to be in contact with their students (Colvin et al., 2016; West et al., 2015). Specifically, Colvin et al. (2016) espoused a 'rapid innovation cycle' approach where small-scale learning analytics initiatives could be trialed, and evidence of their impact collected, before scaling up. Our development of SRES v2 closely reflected these themes, working together with teachers to build up to a minimum viable product that would meet their most pressing needs.

Based on the philosophy of the original SRES which took a human- and teacher-centered approach on a platform capable of flexibly absorbing data and producing customised learner support (Liu et al., 2016, forthcoming) a key initial step in SRES v2 development was to establish a flexible system architecture which could be simultaneously institution agnostic, but eminently understandable by teachers. The core database architecture therefore consists of collections of courses, users (students and teachers belonging to courses), columns (belonging to courses), and data (information in the columns) (Figure 2).

For instance, student data are represented in the system as 'columns', chosen for compatibility with existing information paradigms to which teachers are accustomed; that is, spreadsheets with the ability to customise as many columns as needed. Experience with the original SRES gave us confidence that this was effective at bridging the gap for teachers. To enable this flexibility on a modern programming architecture, MongoDB was selected due to its exceptionally flexible key-object data representation. This meant that each teacher could have entirely different sets of columns (and data) for each course. This flexibility was important as others have identified that course context is critical in meaningfully applying learning analytics (Graf, Ives, Rahman, & Ferri, 2011; West et al., 2015).

The system architecture (Figure 2) was designed around key input, output, and input/output programmatic and user interfaces. For example, based on our use cases, teachers wanted to collate grades and attendance from spreadsheets and class sessions, which needed import functionality as well as a mobile app, respectively. Using these data, teachers wanted to identify particular segments of their cohort and engage with those students, which needed filtering and messaging functionality. At the time of writing, the majority of the core system architecture is implemented in the minimum viable product, while the student views, machine learning, and complex visualisations have yet to be developed.

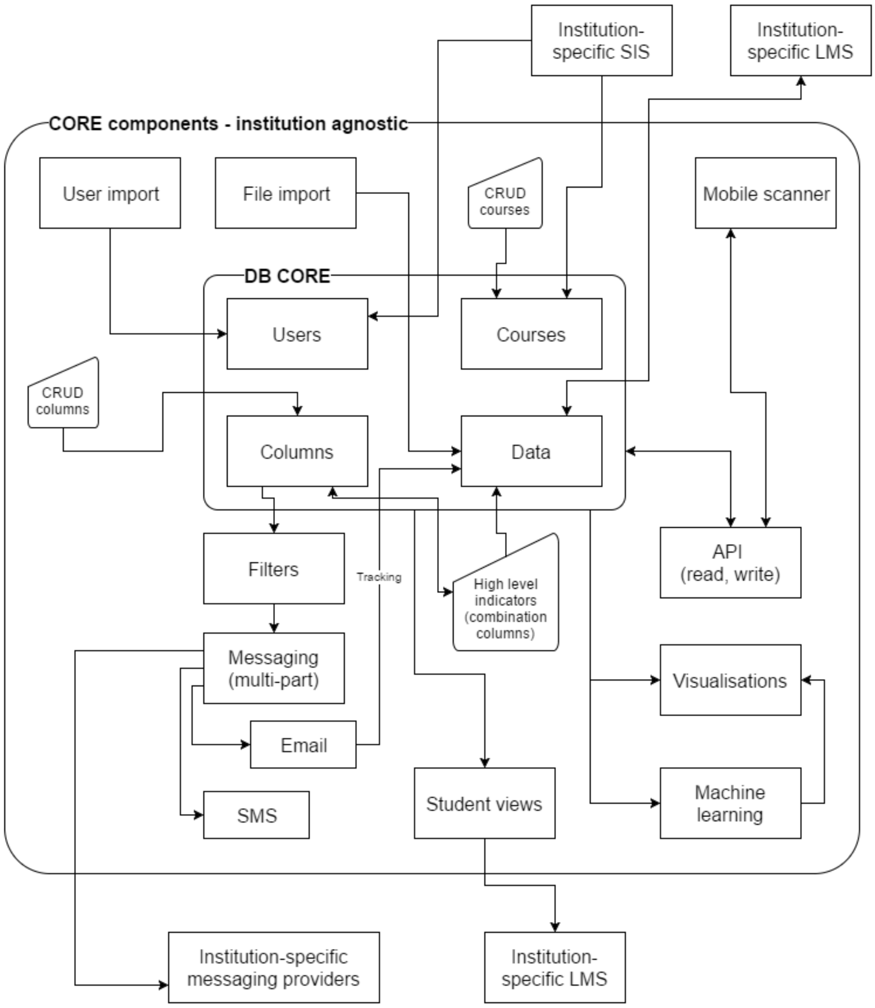

Figure 2: System architecture for SRES v2. Input and output interfaces are shown with arrows leading into, or arising from, the database core, respectively. Input/output interfaces are shown as double-ended arrows.

The SRES v2 user interface provides a step-by-step guide to setting up a class, importing or entering data, selecting students according to pedagogically-informed and -relevant criteria and setting up easily customised email templates. Student enrolments and data can be imported into SRES v2 through uploading spreadsheets, and additionally we are developing a mobile app that allows instructors to enter data on the go directly into the system. The main interface revolves around the student list which consists of rows of students and columns of data, which is familiar to all teachers (Figure 3). From this interface, teachers can directly apply ‘filters’ to the data to generate a subset of the list, and then contact the filtered students. These filters are based on simple operators such as ‘equals’, ‘less than’, etc. This dashboard also has simple visualisations which display the relative frequency of data in each column, as well as a log of the messages (interventions) that have been delivered to students. When teachers compose messages to students (Figure 4), any data that are stored in the list can be brought into the message. By incorporating ‘shortcodes’ into the messages, teachers can write personalised messages addressed to individual students and include specific data about that student. Messages can be additionally personalised by adding ‘conditional paragraphs’ that only appear to a subset of the filtered students, when specified conditions are met. Together, SRES v2 allows teachers to efficiently collate and process data in a web-based environment to compose and distribute highly personalised feedback and support to students at scale.

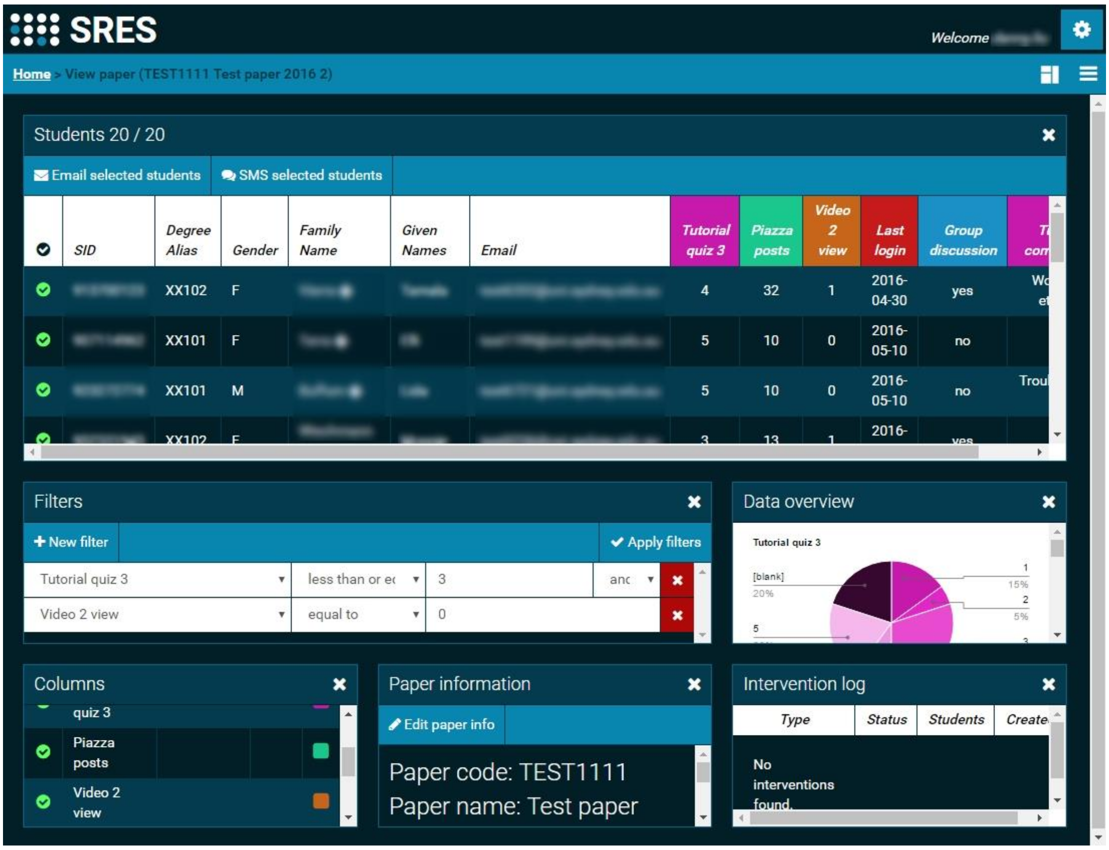

Figure 3. Main interface of SRES v2 showing student list, filters that can be applied to the list, and overview panels.

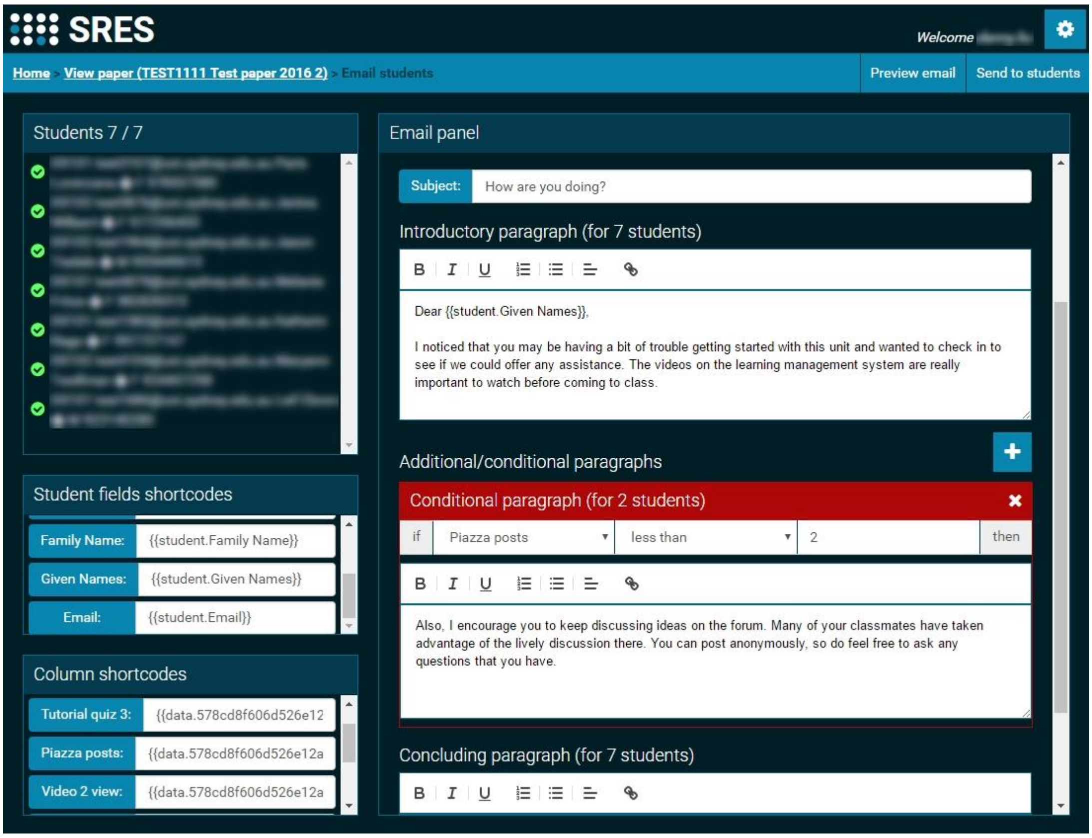

Figure 4. Email composition screen of SRES v2. Messages are fully customisable, and sub-messages can be included to a subset of students.

From inception, we intended SRES v2 to afford cross-institutional collaboration and application, and as such licensed it under the GNU Public License v3. The SRES v2 source code is freely available at https://github.com/atomsheep/sres. The similarly-licensed supporting mobile app (leveraging the Phonegap platform for device agnosticism) is available from https://github.com/atomsheep/sres-app.

Hitting the head winds of institutional change

The SRES v2 emphasis on 'bottom-up' analytics support served us well in terms of teacher buy-in for the project. Working directly with staff at the coalface of classroom and laboratory teaching propelled development of the software forward at an impressive rate, and preliminary feedback from the early demonstration of SRES v2 to teaching staff was overwhelmingly positive. However, the need for 'top-down' support is also critical for sustaining educational technology projects, and integrating new technologies into ingrained institutional culture (Lisewski, 2004). Indeed, it has been noted that traditionally educational technologists do not hold positions of leadership in higher education institutions (Kowch, 2005) and as such, their efforts in sustaining developments are often at the mercy of others. With this caveat in mind, support from senior IT and teaching and learning staff for the project was solicited early on.

Just a few weeks shy of the planned pilot of SRES v2 in real classrooms an unanticipated organisational change at the University of Otago meant that the principal developers were deployed elsewhere at short notice. The lack of availability of developer support meant that the classroom pilot studies at Otago could not proceed as planned for semester two. The only option for the project was to continue development and pilot SRES v2 at a partner institution; it was at this point that the real strength of cross-institutional collaboration on an open source project became apparent. From the outset, all use cases, code and project documentation had been shared on Github, and regular Skype meetings between educational technologists and academic developers from all three institutions meant all involved were familiar with the project objectives. With some consulting and handover from the developers at the University of Otago, developers at the University of Auckland, with ongoing support from the original SRES team at the University of Sydney, were able to pick up the system and complete it ready to pilot at the University of Auckland. A pilot study at Auckland is currently underway. The evaluation plan for this is described in brief in the next section.

Pilot evaluation plan

Process evaluation
The recent implementation of a new LMS environment at the University of Auckland prompted the re-examination of existing teaching and learning processes and services, including new opportunities for evidence based practice in the use of learning analytics data. As a result, adoption of SRES v2 as a pilot for the identification of potential ongoing use in the new LMS, was supported by multiple stakeholders, including the office of the Deputy Vice-Chancellor (Academic), Chief Information Officer, IT Services and teaching staff in three large first-year undergraduate classes.

Evaluation of the development process involved project sign-off, technical set-up, data security, staff training, and development work to adapt SRES v2 to current institutional systems (e.g. Student Information System, authentication services, the new LMS). Obtaining institutional sign off for a grass roots learning technology project is extremely rare in the current centralised environment. Commitment to support the SRES v2 was therefore accepted as positive feedback on both the product and the negotiating skills of the project leader. In addition, the identification of further development opportunities for SRES v2 and the testing of the tool itself are part of the process evaluation.

Product evaluation
Existing ethics approvals were able to be amended to cover the SRES v2 pilot work focusing on 1) the use of learning analytics to build an evidence base for course design, and 2) the monitoring of students' engagement with their courses in the LMS to support a first year student experience programme during the semester. From an institutional perspective, the new LMS has resulted in a review of several policies and guidelines on the security and confidentiality of university information as well as the ethical handling of student data. The DVCA's Office at the University of Auckland has recently formed a working group to advise on the descriptive, diagnostic, predictive and prescriptive analytics requirements of a diverse group of stakeholders with different expectations.

Our current ethics approval allows us to obtain direct feedback from all stakeholders except students. We plan to interview teachers, academic leaders, developers and IT staff to explore the case for the sustained use and wider adoption of SRES v2. If we proceed, it is anticipated that future evaluations will focus on implementation, functionality and ease of use by staff as well as the student experience.

In-class evaluation
At this stage, subject to a successful pilot, we anticipate in-class evaluation of the SRES v2 tool in 2017 at the University of Sydney and possibly the University of Auckland. The current pilot study aims to develop the SRES v2 into an efficient and user-friendly tool.

Reflections, next steps and recommendations

At the time of writing, the pilot at the University of Auckland has just begun. The development team built on an existing relationship to work closely with teaching staff in a large statistics course (1734 students) to pilot SRES v2. The system is being used to send personalised emails to students based on criteria set by, and important to, teaching staff. Each context is unique and thus triggers for action will vary depending on the teaching and learning requirements; SRES v2 has been designed to accommodate this variation. Our experience of the pilot thus far is perhaps best summed up in the following excerpt from an email circulated to all team members from the project leader at the University of Auckland after the first communication was sent to students:

> …over 900 personalised emails [were sent] to students. The students [were] assigned to five different teaching streams and received a unique message from four different teachers in the course. All up we spent about 5 hours working through LMS data access, data wrangling, technical issues with our server, bug and enhancement issues for the SRES v2 tool, as well as quality control of the communication. It was a huge learning curve but exciting nonetheless…

Team members from all three Universities responded to the news with encouragement and an eagerness to see the project progress to a point where the impact of SRES v2 on student engagement and learning can be evaluated. A further email from another University of Auckland team member who was present for part of the mail out process, commented on the collaborative nature of the project:

> I sat in on part of the session and was impressed by the teamwork, the generous sharing of complementary skills and the powerful logic that made the process a success at the end of the day.

In many ways, this encapsulates the ethos of the SRES v2 project to date. Crucially, the ‘generous sharing’ of skills and ideas has played a pivotal role, not only in getting SRES v2 development underway in the first place but also in sustaining its development and providing a buffer against the winds of individual institutional change.

Descriptions of collaborative, educational technology initiatives that emphasise what actually works in real-world classrooms are rare. In this paper, we described a multi-institution collaboration that grew from grassroots classroom needs and proved resilient in the face of institutional change. We explained how the initiative came about, how it survived unanticipated change and how it led to the development of a new open-source learning analytics tool for student engagement. Planned future work involves reporting on the first pilot of the tool with teaching staff at one institution, as well as evaluating the impact of SRES v2 on student engagement and learning at partner institutions. The authors welcome new collaborators and invite interested readers to evaluate and extend SRES v2 for themselves.

Acknowledgements

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References

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin, 39*(7), 3-7.

Colvin, C., Rogers, T., Wade, A., Dawson, S., Gašević, D., Buckingham Shum, S., . . . Fisher, J. (2016). Student retention and learning analytics: a snapshot of Australian practices and a framework for advancement. Canberra, ACT: Australian Government Office for Learning and Teaching.

Gornall, L. (1999). 'New professionals': Change and occupational roles in higher education. *Perspectives: Policy & Practice in Higher Education, 3*(2), 44-49.

Graf, S., Ives, C., Rahman, N., & Ferri, A. (2011). *AAT: a tool for accessing and analysing students' behaviour data in learning systems.* Paper presented at the First International Conference on Learning Analytics and Knowledge, Banff.

Hicks, O. (1999). Integration of central and departmental development - reflections from Australian universities. *International Journal for Academic Development, 4*(1), 43-51. doi:10.1080/1360144990040107

Kensington-Miller, B., Renc-Roe, J., & Morón-García, S. (2015). The chameleon on a tartan rug: adaptations of three academic developers' professional identities. *International Journal for Academic Development*, *20*(3), 279-290.
Kift, S. M., Nelson, K. J., & Clarke, J. A. (2010). Transition pedagogy: a third generation approach to FYE: a case study of policy and practice for the higher education sector. *The International Journal of the First Year in Higher Education*, *1*(1), 1-20.
Kirschner, P. (2016). *Learning analytics: utopia or dystopia,*. Paper presented at the Learning Analytics and Knowledge LAK 16, Edinburgh. https://youtu.be/8OjmnOiMIKI?list=PLOF7tBP24lAf2uyB6SEZ3_foM51rULkSR
Kowch, E. G. (2005). Do we plan the journey or read the compass? An argument for preparing educational technologists to lead organisational change. *British Journal of Educational Technology, 36*(6), 1067-1070.
Krause, K. (2005). Understanding and promoting student engagement in university learning communities. *Paper presented as keynote address: Engaged, Inert or Otherwise Occupied*, 21-22.
Latchem, C. (2014). BJET Editorial: Opening up the educational technology research agenda. *British Journal of Educational Technology*, *45*(1), 3-11.
Laurillard, D. (1993). *Rethinking University Teaching: a framework for the effective use of educational technology*. London: Routledge.
Lisewski, B. (2004). Implementing a learning technology strategy: top–down strategy meets bottom–up culture. *Research in Learning Technology*, *12*(2).
Liu, D. Y.T., Taylor, C. E., Bridgeman, A. J., Bartimote-Aufflick, K., & Pardo, A. (2016). *Empowering instructors through customizable collection and analyses of actionable information.* Paper presented at the 1st Learning Analytics for Curriculum and Program Quality Improvement Workshop, Edinburgh.
Liu, D. Y.T., Bartimote-Aufflick, K., Pardo, A., & Bridgeman, A. (2016, forthcoming). Data-driven Personalization of Student Learning Support in Higher Education *Learning analytics: Fundamentals, applications and trends*: *A view of the current state of the art.* Springer.
O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education*, *25*, 85-95.
Oliver, M. (2002). What do learning technologists do? *Innovations in Education and Teaching International, 39*(4), 245-252.
Paetsch, F., Eberlein, A., & Maurer, F. (2003). *Requirements Engineering and Agile Software Development.* Paper presented at the 12th IEEE International Workshops on Enabling Technologies: Infrastructures for Collaborative Enterprises, Linz, Austria.
Palmer, S., Holt, D., & Challis, D. (2011). Strategic leadership of Teaching and Learning Centres: from reality to ideal. *Higher Education Research and Development, 30*(6), 807-821. doi:10.1080/07294360.2010.539600
Pinto, L. E. (2016). Spectres of Educational Technology: Ghost-Busting as a Curricular Response. *Antistasis, 6*(1), 8-11.
Selwyn, N. (2013). *Distrusting educational technology: Critical questions for changing times*: Routledge.
Tinto, V. (2006). Research and practice of student retention: what next? *Journal of College Student Retention: Research, Theory & Practice*, *8*(1), 1-19.
West, D., Huijser, H., Lizzio, A., Toohey, D., Miles, C., Searle, B., & Bronnimann, J. (2015). Learning Analytics: Assisting Universities with Student Retention, Final Report (Part 1): Australian Government Office for Learning and Teaching.
Whitchurch, C. (2008). Shifting identities and blurring boundaries: The emergence of third space professionals in UK higher education. *Higher Education Quarterly*, *62*(4), 377-396.

Please cite as: McDonald, J., Liu, D., Moskal, A., Zeng, R., Blumenstein, M., Gunn, C., Leichtweis, S & Pardo, A. (2016). Cross-institutional collaboration to support student engagement: SRES version 2. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 397-405).

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Exploring the unknown: Designing a serious game for tertiary education from scratch, a case study

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Serious games offer educators the opportunity to enhance student motivation and engagement, setting the stage for authentic and productive learning (Coates, 2005). Anecdotal evidence suggests barriers to adoption of serious games in education include perceptions of the need for technological expertise and high costs of development. The author created a serious game to assist post graduate professional psychology students to manage the transition from theoretical knowledge to professional practice. This demanding stage of development is key to graduate competence, perceptions of self-efficacy and employability (De Stefano, D'Iuso, Blake, Fitzpatrick, Drapeau, & Chamodraka, 2007; & Skovholt & Ronnestad, 2003). During this developmental stage, serious games provide an opportunity for safe and engaging learning opportunities. This case study provides insight into the theory and principles to be considered when developing a serious game.

Keywords: Serious games in Tertiary education, Innovation and design, professional skills training, serious games development, serious games design

Background

The education of healthcare professionals is critical for the safe delivery of services to patients (Ricciardi & de Paolis, 2014). Post graduate psychology students undertaking a professional degree encounter a steep learning curve when transitioning from theoretical knowledge to professional practice. The beginning student stage of development is fraught with anxiety and high stress levels with implications for both student and client wellbeing (Skovholt & Ronnestad, 2003). Successful navigation of this phase is critical to psychology graduate competence and employability, with potentially lasting consequences for psychologists' perceptions of self-efficacy (De Stefano, et. Al., 2007; & Skovholt & Ronnestad, 2003). Serious games can provide an opportunity for safe practice opportunities in an engaging and entertaining manner. Serious games can be defined as games which have a primary purpose of educating and training players, whilst entertaining them at the same time (Stokes, 2005). Within the field of health, serious games have been identified as providing an additional means of encouraging interest in training, education and assessment of performance (Wattanasoontorn, Boada, Garcia, & Sbert, 2013). The author developed a suite of serious games, named Laurus, with the intention of providing students with increased and more convenient opportunities to practice psychological competencies. The process of conceptualising, designing, developing and implementing a serious game for education is explored and solutions for overcoming perceived barriers are highlighted.

Aim

To create a serious game for the training of professional psychological competencies in postgraduate training of psychologists.

Theoretical underpinnings
The author sought to develop a serious game with a minimal budget. An inter institutional and inter professional collaborative approach was used. The author collaborated with several final year Game Design students at SAE Institute, Brisbane. The students were provided with the opportunity of undertaking their final year project with a real world client and the game was developed out of this mutually beneficial relationship.

Development of the game was underpinned by the theoretical framework of Experiential Learning Theory (ELT) (Kolb, 1984). ELT highlights the central role of experience in the process of learning. Serious games create a vehicle for such experiences. In terms of the process and content involved in development, a combination of a programmatic and participatory framework were used in the creation of Laurus (Russ, 2010). The expert (programmatic) content of the case scenarios created were based on the psychological competencies, guidelines and policies for practice established by the Australian Psychological Accreditation Council (APAC), the Psychology Board of Australia (PsyBA) and The Australian Psychological Society (APS). The purpose of such an approach is to communicate specific knowledge in a top down manner, in order to generate a desired outcome. In this context, the desired outcome is one of competent and qualified practitioners (Russ, 2010).

A participatory approach was also used in order to ensure that the Laurus games were relevant and useful to the end users and stakeholders. This approach engages stakeholders to generate and incorporate their knowledge and ideas into the final product (Russ, 2010). A focus group was conducted with students at the beginning of the development process to seek to understand the needs of the students from their own perspective. Three user testing sessions were held over the course of development, to obtain insight into how students interacted with the games. This use of the collective intelligence of students, academic and professional staff helped to define what their needs were and what would best support the users (Clochesy, Buchner, Hickman, Pinto, & Znamenak, 2015).

A number of design elements were considered when creating Laurus (Brox, Fernandez-Luque, & Tollefsen, 2011; & Lewis, 2007). These elements are the foundation upon which the user experience is built and in which learning occurs (Caine, Caine, McClintic, & Klimek, 2009; & Skalski & Whitbred, 2010).

Table 1: Design considerations for Laurus

Element	Considerations	Laurus implementation
Experience	Problem solving strategies chosen	Role playing; choose-your-own adventure; drag and drop; and quiz features employed
Facilitate engagement and immersion	Graphics, animation and sound	Realistic 3-d images, rigged for animation; realistic clinic environment with reception and consultation rooms. Natural sounding, varied, recorded voices with closed captioning; and background environmental sounds e.g. walking down hallway and rain on window.
Feedback and reward mechanisms	Immediate feedback	Feedback provided through client's responses to choices player makes; earning points and tokens for progression; review of performance; comparison to other players.
Levels of play	Multiple levels of play	Each time a player completes a scenario, they progress to the next client. As the levels progress, the clients present with increasingly complex difficulties.
Evaluation	Game analytics	Data collected includes time spent playing and user choices.
User interface	Ease of access	Desktop / PC, and mobile devices, including smart phones and tablet. Both android and iOS versions were created.

References

Brox, E., Fernandez-Luque, L., &Tollefsen, T. (2011). Healthy gaming – Video game design to promote health. *Applied Clinical Informatics,* 2, 128-142.

Caine, R.M., Caine, G., McClintec, C., & Klimek, KJ. (2009). *12 Brain/mind learning principles in action* (2nd ed.). Thousand Oaks CA: Corwin Press/Sage Publications.

Coates, H. (2005). The value of student engagement for higher education quality assurance. *Quality in Higher Education, 11*(1), 25-36.

Crocco, F., Offenholley, K. & Hernandez, C. (2016). A proof-of-concept study of game based learning in higher education. Simulation & Gaming, *47(4),* 403-422.

Clochesy, J.M., Buchner, M., Hickman, R.L., Pinto, M.D., & Znamenak, K. (2015). Creating a serious game for health. *Journal of Health and Human Services Administration, 38(2),* 162-173.

De Stefano, J., D"Iuso, N., Blake, E., Fitzpatrick, M., Drapeau, M., & Chamodraka, M. (2007). Trainees' experiences of impasses in counselling and the impact of group supervision on their resolution: A pilot study. Counselling and Psychotherapy Research, 7 (1), 42-47.

Kolb, D.A. (1984). Experiential learning: Experience as the source of learning and development. Prentice Hall, New Jersey.

Lewis, M.W. (2007). Analysis of the roles of "Serious Games" in helping teach health-related knowledge and skills and in changing behaviour. *Journal of Diabetes Science and Technology, 1,* 918-920.

Ricciardi, F., & de Paolis, L.t. (2014). A comprehensive review of serious games in health professions. *International Journal of Computer Games Technology, 2014(2014).* http://dx.doi.org/10.1155/2014/787968

Russ, T.L. (2010). Programmatic and participatory: Two frameworks for classifying experiential change implementation methods. *Simulation & Gaming*, *41(5)*, 767-786.

Skalski, P., & Whitbred, R. (2010). Image versus sound: A comparison of formal feature effects on presence and video game enjoyment. *PsychNology Journal*, 8(1), 37-84.

Skovholt, T.M., & Ronnestad, M.H. (2003). Struggles of the novice counsellor and therapist. *Journal of Career Development*, *30(1)*, 45-58.

Wattanasoontorn, V., Boada, I., Garcia, R., & Sbert,M., (2013). Serious games for health. *Entertainment Computing*, *vol4(4)*, 231 – 247.

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Serious games in education: Fact or fad?

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The use of serious games in education is growing, particularly within the field of health professional training (Graafland, Schraagen, & Schijven, 2012; Wattanasoontorn, Boada, Garcia, & Sbert, 2013). Serious games aim to teach or train whilst simultaneously entertaining and engaging users (Hawn, 2009). Serious games are viewed as a useful methodology for enhancing student motivation for learning and engagement with material (Coates, 2005). Despite being heralded as a cutting edge innovation, research validating the efficacy of serious games demonstrates mixed results (Susi, Johannesson, & Backlund, 2007). A serious game to support training of professional post graduate psychology students was developed by the first author. This paper presents the results of two pilot studies comparing the learning and training experiences of students using the serious game as compared to those using a control serious game and teaching as usual, as an example of an application of serious games in post graduate education.

Keywords: Innovation and design, serious games, education, validation, efficacy

Background

Serious games appear to be generating a lot of interest as an exciting methodology for enhancing teaching, learning, assessment and feedback in the educational sector (Graafland, et al., 2012; & Wattanasoontorn, et al., 2013). Despite this rise in the use of serious games in education, research demonstrating efficacy reports mixed results (Crocco, Offenholly, & Hernandez, 2016; Fuchslocher, Niesenhaus & Kramer, 2011; & Rodriguez, Susi, et al., 2007; & Teesson, & Newton, 2013). Post graduate psychology students undertaking a professional degree encounter a steep learning curve when transitioning from theoretical knowledge to professional practice. This stage of development is characterized by the presence of anxiety with the potential to impact on both client and practitioner wellbeing (Skovholt & Ronnestad, 2003). Serious games provide an opportunity for safe practice opportunities in health related disciplines. The first author developed Laurus games with the intention of providing students with increased safe opportunities to practice psychological competencies. To date the game has been trialed in two, modest pilot studies with Master's Degree Psychology students. In the first pilot study the game was trialed with 37 students to compare learning, interaction and training experiences of students using the serious game as compared to those students using a control serious game and those undertaking teaching as usual. The research sought to explore whether the game had an impact on the early training experiences of students. Specifically, the study focused on perceptions of opportunity for practice, preparedness for practice, anxiety levels and self-efficacy. The second pilot study involved the trial of the game in a classroom setting with 38 Masters of Psychology students. This pilot study sought to understand whether the game had value as a classroom tool for group discussion. Specifically, this pilot explored student engagement and enjoyment of learning with the game as compared to static, paper based scenarios.

Methods

Two modest pilot studies were conducted to explore the use of the Laurus serious games in education and learning. The first pilot study was conducted with 37 Master's degree professional psychology students. A pre- and post-test study design was implemented, seven weeks apart, during semester one of the academic year. Quantitative and qualitative data were collected. The study investigated student anxiety related to practice, perceptions of self-efficacy as a psychologist, preparedness for practice, engagement with learning and perceptions of clinical competence. Participants completed the State-Trait Anxiety Inventory, STAI (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), and the Counselling Self Estimate Inventory, COSE (Larson, Suzuki, Gillespie, Potenza, Bechtel, & Toulouse, 1992). A purpose built questionnaire, containing 27 Likert scale questions and 6 open response questions, addressing engagement and preparedness for practice was also administered. Descriptive statistical analysis using SPSS 24 was conducted and qualitative data were analysed using thematic analysis.

The second pilot study aimed to explore student engagement, participation and enjoyment of learning when using the Laurus games in an ethics classroom setting as compared to static paper based scenarios. This study was conducted with 38 Master's degree students undertaking a Professional Psychology Ethics course. Students completed a self-report measure after engaging with the serious game and again completed the self-report measure one week later when engaging with a paper based scenario and discussion. Quantitative and qualitative data were collected using Likert scale and open response questions. Quantitative data were analysed using SPSS 24, and qualitative data were analysed using thematic analysis.

Results and discussion
Results are to be interpreted with caution as the sample size was small for both studies.
Study 1

- Significant difference between experimental and control group in terms of engagement, enjoyment of learning, and opportunity for practice of skills
- Significant difference in perceptions of clinical competence between experimental group and teaching as usual group compared with placebo control group
- Serious games appear to have a valuable contribution to make in enhancing student engagement
- Serious games appear to contribute towards preparing provisional psychologists for practice
- Serious games appear to contribute towards teaching and learning of specific clinical psychological competencies
- Qualitative responses indicate the potential value of serious games for learning

Study 2

- Students significantly more engaged with serious game than static scenario
- Majority of students indicated a preference for undertaking the scenario based learning and group discussion using serious games as compared to static scenarios

Qualitative findings:
Qualitative data from both studies indicate that students valued the games for in the following ways:

- Being able to see therapy in action and experiencing this as validating
- How to phrase and address difficult topics
- Being able to make mistakes and take risks safely
- Seeing what would happen if you got it wrong without worrying about harming the client
- Being able to review content in the form of an interactive quiz after each scenario
- Engaging with theoretical knowledge in a fun and interactive manner

These initial results are cautiously encouraging and indicate the need for further, more rigorous studies with larger sample sizes. It is hoped that the lessons learned from these pilot studies will be used to inform the development of future, larger scale studies of the Laurus games and ultimately contribute to the literature on the efficacy of serious games in health education.

References

Coates, H. (2005). The value of student engagement for higher education quality assurance. *Quality in Higher Education*, *vol.11*(1), pp. 25-36.

Crocco, F., Offenholley, K., & Hernandez, C. (2016). A proof of concept study of game based learning in higher education. *Simulation & Gaming, 26,* 1-20.

Fuchslocher, A., Niesenhaus, J., & Kramer, N. (2011). Serious games for health: An empirical study of the game "Balance" for teenagers with diabetes mellitus. *Entertainment Computing, 2,* 87-101.

Graafland, M., Schraagen, J.M., Schijven, M.P. (2012). Systematic review of serious games for medical education and surgical skills training. *British Journal of Surgery, 99(10),* 1322-1330.

Hawn, C. (2009). Games for health: The latest tool in the medical care arsenal. *Health Affairs (Millwood), 38, 824-848.*

Larson, L.M., Suzuki, L.A., Gillespie, K.N., Potenza, M.T, Bechtel., M.A., & Toulouse, A.L. (1992). Development and validation of the Counseling Self-Estimate Inventory. *Journal of Counseling Psychology, 39(1),* 105-120.

Skovholt, T.M., & Ronnestad, M.H. (2003). Struggles of the novice counsellor and therapist. *Journal of Career Development*, *30(1),* 45-58.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Susi, T., Jahannesson, M., Backlund. P. (2007). *Serious games: An overview* (HS-IKI-TR-07-001). Sweden: University of Skovde.

Wattanasoontorn, V., Boada, I., Garcia, R., & Sbert,M., (2013). Serious games for health. *Entertainment Computing*, vol4(4), 231 – 247.

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Building cognitive bridges in mathematics: exploring the role of screencasting in scaffolding flexible learning and engagement

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Conceptual learning in mathematics can be made more accessible with mathscasts, which are dynamic, digitally recorded playbacks of worked examples and mathematical problem-solving on a computer screen, accompanied by audio narration. Mathscasts aim to enable students to develop deeper understanding of key foundational concepts in order to equip them to undertake degrees in Science, technology, engineering and mathematics (STEM). Previous research has indicated the success of maths screencasts to provide explanations of complex concepts and reinforcement of concepts previously learnt. The project presented here extends current research by demonstrating the value of visual, interactive screencasts for learning of mathematics, and investigates students' perceptions. A survey of student use of screencasts identifies learners' usage patterns, the significance of offering mathematics support via mathscasts in flexible mode, and students' integration of mathscasts into their study strategies. The results show positive implications for the integration of multimodal learning resources in STEM environments.

Keywords: screencasts, mathscasts, STEM, mathematics, multimodal learning, digital learning objects, conceptual understanding, learning sciences

Mathscasts and screencasts: digital learning objects

A key focus in the learning of sciences is to discover principles that determine the optimal amount of instructional scaffolding needed to support effective learning (Stylianides & Stylianides, 2013). Teachers of mathematics and STEM disciplines face the challenge of enabling students to understand and apply complex abstract principles and rules. For over a decade, visual representations have played a role in enhancing learning in science, technology, engineering and mathematics (Fletcher & Tobias, 2005). Research in educational psychology has quite clearly demonstrated that integrating visual and multimedia elements in teaching abstract concepts can enhance learning. This paper addresses the question of how screencasts of solutions to mathematical problems are accessed and used by students and whether they can be considered as cognitive scaffolds that can be integrated into learning environments to support productive learning and study strategies.

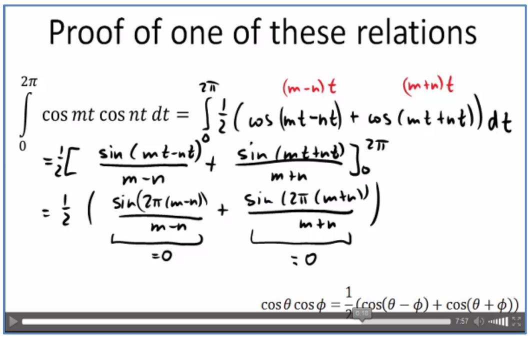

Figure 1: **Screenshot of a mathscast showing a worked out solution to a problem.**

Screencasts are video recordings of screen activities, including mouse movements and clicks. An audio commentary is often included with the video to explain the process or problem, thereby providing explicit step-by-step explanation of key topics. While screencasting was originally described by Udell (2005), mathematical screencasts are typically narrated by a lecturer or tutor while handwritten diagrams or figures on the screen are being recorded. Figure 1 shows an example of a mathscast in which a teacher narrates a solution to a problem while simultaneously displaying in writing the process of problem solving in a step-by-step narrative. Mathscasts are produced in a video format (MP4) that may be played back on a wide variety of devices, including those that do not support the Flash format. This decision impacts on the design of the mathscasts. They are compressed heavily to produce file sizes that can be downloaded fast on mobile devices, and usually only part of the screen is recorded, acknowledging that a recording from a full screen of high definition may be difficult to see on a small smartphone screen.

Mathscasts are, in short, typically multimedia demonstrations that explain problem solving with examples of complex equations that aim to accommodate various learning styles (Trail & Hadley, 2010). Mathscasts can be delivered live, in synchronous learning contexts or captured on video and shared, e-mailed, or downloaded from a website (Yee & Hargis, 2010). Mathscasts are also available via iTunes U and YouTube (Loch et al, 2012). Screencasting software allows teachers to record the mathematical activity on a computer screen, draw figures, symbols and graphs, and narrate an explanation while showing the actual working out of a solution. Often tablet PCs are used to enable the instructor to write symbolic and graphical information electronically (Loch, 2012). In view of the international trend to develop learning goals not only in terms of content and procedures, but also in terms of mathematical competencies, mathscasts are intended to develop students' ability and willingness to use mathematical modes of thought (logical and spatial thinking) and presentation (formulas, models, constructs, graphs, and charts) (Lithner et al., 2010).

Multiple Representations support learning: evidence from learning theory

Many learning resources offer multiple representations that can enable comprehension and learning. Textbooks, for example, often use photographic images or diagrams to illustrate and explain parts of the text. In early computer-based learning environments, texts and images were applied in the same way as in textbooks, namely as static images (Lowe & Sweller, 2005). While research on representations in textbooks was relevant for early computer-based learning environments, in contemporary learning settings many dynamic representations are available, including audio, video, animations, and interactive dynamic visuals (Mayer, 2005). With recent developments in eLearning, new opportunities for presenting and engaging learners though dynamic visualisations are evident, and research to study the implications for learning with multi-representational resources is a flourishing area.

Several theories provide principles that explain how to promote learning in multimodal learning environments. Theories emerging for educational psychology relating to cognitive load (Mayer, 2005; Moreno, 2006) are relevant here as they focus on how students process information and they also describe the implications of using visual and interactive media to reduce cognitive load. Typically, as in the case of mathscasts, students are presented with a verbal explanation of the process and a corresponding visual representation of the content. Modality refers to the senses used by the students who receive the information – for example visual, auditory. The research of Fletcher & Tobias (2005) shows that students' understanding can be enhanced by the addition of nonverbal knowledge representations, such as visualisations along with verbal explanations. The research of Lowe & Sweller (2005) provides evidence that the most effective learning environments are those using mixed modality representations. The explanation for this is that mental processing capacity while learning complex concepts can lead to cognitive overload and to reduced retention of new materials. Screencasts provide for the five types of interactivity described by Moreno & Valdez (2005), and are thus considered as powerful supports for learning. Table 1 shows the different types of interactivity enabled in mathscasts and screencasts.

Constructivist learning theory is also relevant in discussing the benefits of multimodal resources as it distinguishes between two views of learning: information acquisition and knowledge construction. In the information acquisition view, learning involves adding information to the learner's memory. Teaching as instructivism involves presenting information and the learner's role is to receive the information. In contrast, in the knowledge construction view, learning involves building a mental representation through active processing of information. From a constructivist perspective, a learner is a sense-maker who works to select, organize, and integrate new information with existing knowledge. According to a knowledge construction approach to learning, the goal of instruction is to guide the learner to actively make sense of the instructional materials, and the instructional design of the mathscasts in this project follows these principles (Bransford et al, 1999).

Table 1: Types of interactivity for learners viewing mathscasts

Type of interactivity	Description	Example
Dialoguing	Learner receives a response to input	Seek help from screencast, click on a hyperlink to get additional information
Controlling	Learner determines pace and/or order of presentation	Use pause/play key or forward/rewind button while watching a mathscast
Searching	Learner finds new content material by entering a query, receiving options, and selecting an option	Seek information on a maths problem or procedures
Navigating	Learner moves to different content areas by selecting from various available information sources	Click on a menu to move from one mathscast to another

When integrating screencasts in synchronous teaching situations, the tools allow the teacher to explore and display different paths to a solution, or modify the explanation in response to feedback from the audience of learners (Galligan et al, 2010). Mathscasts add value as pedagogical learning objects as they provide opportunities for vicarious learning, while offering both visual and auditory demonstrations of solutions to mathematics problems. Mathscasts can be converted to short downloadable video files for use during review and reflection.

An advantage for teachers is that screencasts are relatively quick to prepare and easy to update and change, add narration and visuals to demonstrate and invite students to problem solve, or present various problem solving strategies. Examples abound in sites such as Khan Academy or iTunes U, though some of these present non-interactive worked examples. Most screencasts are short 3-5 minutes' productions that focus on a single concept, sometimes followed by a quiz or other student-centered activity (Seery, 2010). A further advantage is that while online instruction relies on text and lacks paralinguistic cues such as voice intonation and a sense of social presence, screencasts have narration, often by an instructor and this adds personalisation and audiovisual stimulation (Matheison, 2012). The model of screencasting as an information dump to be accessed and digested is not considered to be pedagogically sound, and instructional design of screencasts needs to ensure that it engages students and provides scope for activity.

Literature review on screencasting in mathematics education

The computer and library science fields were early adopters of screencasting, but educators and researchers later recognized the potential applications of screencasting to online education (Peterson 2007; Sugar et al, 2010). Screencasts allow instructors to model behaviours and display operations and allow learners to view the content multiple times at their convenience (Sugar et al, 2010). In addition, there is a wide variety of screencasting software available, much of it free (Yee & Hargis 2010), and creating screencasts is fast and easy. Recent research has identified a need for more research on how to design mathematical screencasts that focus on student engagement, and that more generally take into account best practice in instructional design (Galligan et al., 2010), as most literature on the effectiveness of screencasting in higher education is limited to investigations of student's perceptions and their use of the recordings. Sugar et al (2010) have undertaken an analysis of common structural elements and instructional strategies in screencasts that support their discussion of the anatomy of a screencast. However, it is questionable whether their findings would be applicable to the design of mathematical screencasts that aim to support problem solving.

An overview of the podcasting literature may be found in (Heilesen, 2010), suggesting that positive outcomes may sometimes be achieved not by the technology itself, but when the technology supports approaches such as active learning or revision of concepts that are known to improve student learning. Heilesen recognises that screencasting "has opened up for new ways of integrating classroom teaching and net-based learning on the basis of pedagogical concerns rather than mere administrative convenience". (Sutton-Brady et al, 2009) emphasise the need to focus on pedagogical design when producing short screencasts targeting individual topics to distinguish them from a repeat of lecture content. For example, screencasts may be designed to allow students to personalise their learning, listen at their own pace, and to highlight important information. Oud (2009) provides guidelines for the production of effective online screencasts, in a library instruction context and investigates software-walkthrough screencasts that show how to perform searches on the Web. She also argues that screencasts should contain a level of interactivity, e.g. control over pace such as pausing and fast forwarding. Although research on screencasting in the online environment is still emerging, there is preliminary evidence that screencasts may improve learning (Evans, 2011) and evidence in the mathematical context (Jordan et al, 2012; Loch et al, 2014).

In teaching students mathematical concepts, mathscasts aim to capture the progressive steps towards the solution of a problem. By doing this in a visual multimodal format, the mathscast acts as a form of scaffolding, reaching students' zones of understanding. Mullamphy et al (2010) concluded that screencasts capturing narration and mathematical handwriting on a computer were more engaging than a video recording of writing on a blackboard, a narrated PowerPoint recording or audio-only podcasts.

Beyond empowering students to learn complex concepts in a flexible, self-paced manner, the current research sought students' feedback on aspects of their learning experience in accessing and using mathscasts. Research has indicated that gaps in students' knowledge are often drivers for learning, and that for learning support to be optimally effective it needs to relate to learner interests, goals and strategies (Dron, 2007). For this reason, it is important that the screencasts target problematic, or threshold concepts that students need in order to advance their knowledge, of "troublemsome knowledge" in mathematics (Loch & McLoughlin, 2012).

Pedagogical design of screencasts: Rationale and context for this study

By accessing video based instruction that combines multiple media formats, students can choose when and how often to access the mathscasts, and it is expected that enhanced motivation and positive learning outcomes will be achieved. Nevertheless, the instructional format of most screencasts has often relied upon a didactic model of pedagogy, and typically follows a well-established pattern of teacher demonstration, worked examples followed by student practice. Even in lectures, direct student interaction is limited due to the need for time-efficient delivery of content to large numbers of students. Instruction tends not to make use of technological interactivity and often does not intentionally include scaffolds to ensure the active engagement and participation of the learner. In short, pedagogically driven design of screencasts for deep conceptual understanding has been limited in the literature, and screencasts do not typically involve interaction or activity on the part of the student. The learning paradigm tends to be quite teacher-centred, with students as viewers rather than active participants.

When learning complex and abstract concepts and problem solving, learner support is often crucial, as it is in the case of mathematical concepts and logical reasoning skills. This has been recognised widely in Australia, where most universities offer mathematics support to their students in the form of face-to-face help from a tutor in a dedicated support space, during certain hours (Oliver & Goerke, 2007). Students today often work part time while also studying, and they rely on mobile devices and technology mediated tools for learning off-campus. They also seek more flexibility and choice in the place and pace of their learning, so there is growing demand for virtual, self-paced access to learning. Many first year students entering the sciences and related disciplines such as engineering need a strong foundation in mathematics thinking, and they often seek assistance in their first year of study if mathematics is not their major field.

To provide such more flexible options accessible around the clock and from anywhere with connection to the web, several maths support centres in Australia produce short screencasts for students to access online. Topics recorded range from the revision of prerequisites at middle to higher high school level, transition that some students may be missing, up to second year university level mathematics currently taught in engineering mathematics units and that students struggle with regularly. A particular collection of these screencasts of mathematical concepts and skills, labeled "MathsCasts", is produced collaboratively by the mathematics support centres at The University of Limerick (Ireland) and Loughborough University (UK) (Loch et al, 2012). The MathsCasts are usually of 5-10 minutes' duration, intentionally kept short to focus the learner's attention on one particular concept or problem, whilst showing all steps in the derivation of a solution. More than 400 MathsCasts covering first and second year mathematics are available as open educational resources, carrying a creative commons license (MathsCasts, 2016). These MathsCasts and other mathematical screencasts are also available on iTunes U and YouTube. Therefore technology supported instruction is now readily available for most universities in Australia where maths support centres provide academic assistance to students. The MathsCasts discussed in this study were developed and delivered at Swinburne University through the Maths and Statistics Help (MASH) Centre.

To address the issue of passive learning, the current project considered several instructional design approaches, based on self-regulated learning (SRL) theory, in order to foster and enhance active learning and develop students' engagements in understanding complex mathematical concepts. The primary goal of the work has been to support active students' cognition as they seek to understand abstract concepts. In addition to the lack of clear guidelines on how to design effective mathematical screencasts, there is little evidence of how students integrate these videos with their study, how often they view them and with whom, and what device they use to view them.

Research questions and methodology

Knowledge of student practices in relation to student use of MathsCasts can inform how these resources are created. While access to flexible learning may benefit student learning, there remain several areas that require investigation.

To inform design consideration for MathsCasts, the following research questions were asked:

1. What active learning strategies do students employ while interacting with the videos?
2. How important is the flexibility of the videos for learners, what devices are used to view the videos and, where are they watched?
3. How do students integrate MathsCasts into their studies to help them with mathematical knowledge and skills?

Student perceptions of the MathsCasts and their impact was assessed by surveying students about their experiences. As evidence of learning and study patterns, data is presented based on feedback that students have provided on how, where and when they watched MathsCasts. The researchers collected both quantitative and qualitative data to gather students' usage activities for the MathsCasts. A web-based survey was implemented at the end of the unit (Week 12), which collected students' demographic information, perceptions of value of screencasts, reporting of frequency of viewing, mode of viewing, perceptions of learning approaches used, and devices used to download the files. The survey was conducted anonymously, and 30 students participated. The data and analysis helped the researchers to answer the research questions mentioned above, including perceptions of learning supported by the Mathscasts, experiences in the various learning activities designed to help learning, and actual usage patterns. An online survey was issued to all students, asking a range of questions relating to their use of MathsCasts. Volunteer students enrolled in the first two engineering mathematics units responded to their use of the MathsCasts. Both units had sets of MathsCasts available that cover most topics taught, as well as prerequisite topics that students found challenging. The focus here was to elicit responses from students on issues such as how they watched the MathsCasts, duration of time for viewing and associated study strategies. Note that the university's learning management system did not provide reliable data on student access to the videos.

Results for research question 1: Active learning strategies

Students were asked an open-ended question "How do you watch MathsCasts?" Thefeedback (Table 2) indicates that students used the opportunity to skip forward to concentrate on sections of most relevance (33%), to control the video by pausing to think about an explanation (more than a third), but also to rewind and replay a section (>33%).

Table 2: How do you watch MathsCasts? (Multiple answers possible; n=30)

Answer Choice	Number of respondents (%)
I usually watch a complete MathsCast from start to end.	21 (70%)
I skip sections by fast-forwarding to concentrate on sections that are most helpful.	10 (33%)
I rewind to watch some sections again.	16 (53%)
I pause playback to think about an explanation.	11 (37%)
I pause playback before an explanation to attempt the maths myself.	7 (23%)
I watch an explanation then try the problem myself.	16 (53%)

Results indicate that there is active engagement with the MathsCasts. An impressive 70% watch the complete video, which shows that our concept of recording short (5-10 minutes), targeted videos is working. Students appreciate the control over the place, pace and the frequency of their individual use of the MathsCasts.

Results for question 2: flexibility of MathsCasts in supporting student learning

Participants were asked: “Where and when do you watch MathsCasts?” The responses (Table 3) confirmed expectations that students valued the flexibility of having mathematics support without setting foot on campus. One of the strong motivators for producing MathsCasts is to provide students with anywhere, anytime mathematics support, not limited to support centre opening hours (Loch et al, 2012). Students are clearly taking advantage of this flexibility to access help: Nearly 90% watch the videos when they are off campus. This finding is significant insofar as it indicates that flexible delivery of mathematics support thought maths casts means that students are learning at their own pace, in any place. Neverthess, we had an expectation that students would multi-task and that a greater number would view them while travelling. The majority of those accessing the videos when on campus are doing so from the library which provides computers for individual students as well as group study environments.

Table 3: Where and when do you watch MathsCasts? (Multiple answers possible; n=28)

Answer Choice	Number of respondents (%)
When I’m off campus.	25 (89%)
When I’m on campus.	9 (32%)
When I’m in the library on campus.	9 (32%)
When I’m travelling.	2 (7%)
While I’m eating.	3 (11%)
While I’m watching TV.	0 (0%)
While I’m listening to music.	4 (14%)

Results for research question 3: Integration of Mathscasts into personal study

Another question investigated student perceptions of the learning support via MathsCasts and the strategies used by students. To find out whether students used the MathsCasts strategically, we asked the question: “Please tell us about your use of MathsCasts” in order to gain insight into usage patterns and motivation. Table 4 shows that some students are selective as 70% watch only those MathsCasts that relate to topics they struggle with. They also take strategic approaches as some view MathsCasts when they are studying, others when they are working on assignments and some to prepare for a test.

Table 4: Comments on when, how & how often MathsCasts were accessed (Multiple answers possible; n=30)

Answer Choice	Number of responses (%)
I watch all MathsCasts that are made available for my unit.	10 (33%)
I watch only the MathsCasts on topics I find difficult to understand in my unit.	21 (70%)
I watch MathsCasts from other units if they cover topics relevant to my unit.	5 (17%)
I watch MathsCasts from other units out of interest.	3 (10%)
I watch MathsCasts when I’m studying.	15 (50%)
I watch MathsCasts to help me work out assignment problems.	20 (67%)
I watch MathsCasts before the topics are explained to me in lectures.	3 (10%)
I watch MathsCasts after lectures to see another explanation of working a problem.	11 (37%)
I watch MathsCasts when I prepare for a test.	16 (53%)
I watch some MathsCasts more than once.	19 (63%)
I watch MathsCasts together with other students.	1 (3%)
I watch MathsCasts by myself.	25 (83%)
I discuss the MathsCasts I’ve watched with other students.	4 (13%)

Over a third (37%) watch MathsCasts after lectures for a different explanation of how to work through, and solve a problem. Few respondents watch MathsCasts before lectures, indicating that they do not regard them as preparatory resources, but instead use them to review and revise concepts. Students tend to watch MathsCasts by themselves, with some viewing with other students or engaging in peer collaboration. Nearly two thirds of the students watch MathsCasts more than once, attesting to the perceived usefulness of these resources to support learning.

Discussion of results and limitations of the study

The results provide insights into students' learning modes and their reasons for accessing the mathscasts, with the majority viewing them more than once and most frequently to complete assignments. The majority of students select episodes that focus on competencies and topics that are either unknown to students or that need to be developed further. The MathsCasts episodes demonstrate how to deal with a problem and discuss strategies and possible solutions, only 37% of students watch them after class to review content and processes, and a smaller percentage watch the MathsCasts before class, as advance organisers. This indicated that students perceive MathsCasts as a useful resource when completing assessment tasks and revising unfamiliar problem solving strategies. This aspect of cognitive scaffolding could be addressed by the teacher inviting the students to participate in a practice task so that they apply the skills demonstrated.

There is evidence in the results that screencasts support independent learning, and enable students to study flexibly off campus. The results also affirm that students actively engage in mathematics tasks while they are viewing, with approximately a quarter of the students responding that they pause the video before watching an explanation, and more than half trying the problem themselves after watching. This shows that MathsCasts are not consumed passively as one would watch TV but are integrated into students' learning routines. In addition, students are quite strategic and focussed in the timing and purpose of their viewing, with the majority preferring to use them for assignment preparation, fine-tuning of their knowledge for tests and for review of complex topics.

No bold claims are being made for the results described here as the project was a small-scale exploratory study that yielded limited data. Nevertheless, the study provides baseline evidence that students accessed the resources at various times in order or revise or complete assessment tasks. They expressed the view that accessing the MathsCasts online to reviews concepts and procedures was a good complement to regular classroom work.

Conclusions and future research

In this study, we presented a case study of students' learning experiences and perceptions of supplementary mathematics support offered via screencasting. Overall, the results show that the students were positive about the impact of MathsCasts on their learning. They also appreciated the flexibility afforded by the screencasts, which enabled individual study and reflection on challenging concepts. The MathsCasts resources supplemented, but did not replace face-to-face lectures and support sessions. In addition, students valued the sense of freedom in being able to access the screencasts on demand, study anywhere and anytime, and view the screencasts in their own daily personal and professional settings. While there are strong arguments for the provision of screencasts for mathematical support, there is no guarantee that students will either access these or learn from them. It cannot be assumed that all students will have the skills to self-regulate their learning when presented with complex mathematical concepts. In applying a design based approach, we adopted several iterations at the initial design stage to produce screencasts that allowed students to access explanatory screencasts based on worked examples and we then progressed to developing instructional design models to enhance engagement of students with mathematics. Initial evaluation of student feedback indicates that the students who responded to the voluntary survey have the skills to include MathsCasts as active support resources into their study strategies.

The study builds on the work of research of Loch & McLoughlin, (2011) who have begun to develop a strategies to develop self-regulated skills among students with screencasts. These authors encourage more research to further explore development of mathematical competencies through instructionally interventions and how digital tools can be used to support students' interest in learning in STEM subjects.

Our research continues to investigate the optimum design principles for MathsCasts that are aimed to increase student understanding of complex mathematical procedures, and to scaffold students' comprehension of threshold and complex concepts and problem solving in mathematics. This research provides evidence of active student engagement with MathsCasts and demonstrates that MathsCasts can act as cognitive bridges to extend understanding and develop mathematical competencies.

References

Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn*. Washington, DC: National Academy Press.

Dron, J. (2007). Control and Constraint in E-Learning: Choosing When to Choose. Hershey, PA, Idea Group International.

Evans, D. J. R. 2011. Using embryology screencasts: A useful addition to the student learning experience? *Anatomical Sciences Education* 4 (2): 57–63.

Fletcher, J. D., & Tobias, S. (2005). The multimedia principle. In R. E. Mayer (Ed.), *Cambridge handbook of multimedia learning* (pp. 117–133). New York: Cambridge University Press.

Galligan, L., Loch, B., McDonald, C. and Taylor, J. (2010). The use of Tablet and related technologies in mathematics teaching. *Australian Senior Mathematics Journal* 24(1), pp. 38-51.

Heilesen, S. (2010). What is the academic efficacy of podcasting? *Computers & Education* 55, 1063–1068.

Jordan, C., Loch, B., Lowe, T., Mestel, B. and Wilkins, C. (2012). Do short screencasts improve student learning of mathematics? *MSOR Connections*, Vol. 12 No. 1. http://mathstore.ac.uk/headocs/Connections_12_1_Jordan.pdf

Lithner, J., Bergqvist, E., Bergqvist, T., Boesen, J., Palm, T., & Palmberg, B. (2010, January 26–27). *Mathematical competencies – A research framework*. Paper presented at the mathematics and mathematics education: Cultural and social dimensions. Proceedings of MADIF-7, the seventh mathematics education research seminar, Stockholm.Retrieved

Loch, B. (2012). Screencasting for mathematics online learning – a case study of a first year Operations Research course at a dual delivery mode Australian university. Chapter in: *Teaching Mathematics Online: Emergent Technologies and Methodologies*. A. A. Juan, M. A. Huertas, S. Trenholm & C. Steegman. Advances in Distance Education Technologies (ADET) Book Series. IGI Global.

Loch, B., Gill, O.& Croft, A. (2012). Complementing mathematics support with online Mathscasts. ANZIAM J., Vol. 53 (EMAC2011), C561-C575, http://journal.austms.org.au/ojs/index.php/ANZIAMJ/article/view/4984/1649

Loch, B., Jordan, C., Lowe, T. and Mestel, B. (2014). Do screencasts help to revise prerequisite mathematics? An investigation of student performance and perception. *International Journal of Mathematical Education in Science and Technology*, Vol. 45, Issue 2, pp. 256-268. DOI: 10.1080/0020739X.2013.822581

Loch, B. &McLoughlin, C. (2012). Teaching threshold concepts in engineering mathematics using Mathscasts. Proceedings of AAEE2012, Melbourne, 3-5 Dec 2012.

Loch, B. & McLoughlin, C. (2011). An instructional design model for screencasting: Engaging students in self-regulated learning. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011*. (pp.816-821).

Low, R., & Sweller, J. (2005). The modality principle in multimedia learning. In R. Mayer (Ed.), *Cambridge handbook of multimedia learning* (pp. 147–158). New York: Cambridge University Press.

Mathieson, K. (2012) Exploring Student Perceptions of Audiovisual Feedback via Screencasting in Online Courses. *American Journal of Distance Education*, 26, 3, 143-156

MathsCasts. (2016). Collaboration between Mathematics Support Centres at Swinburne University of Technology, University of Limerick and Loughborough University, and with SIGMA. http://commons.swinburne.edu.au, search for MathsCasts.

Mayer, R. E. (2005). Cognitive theory of multimedia learning. In R. Mayer (Ed.), *Cambridge handbook of multimedia learning* (pp. 31–48). New York: Cambridge University Press.

Moreno, R. (2006). Does the modality principle hold for different media? A test of the method affects learning hypothesis. *Journal of Computer Assisted Learning, 22*, 149–158.

Mullamphy, D., Higgins, P., Belward, S. & Ward, L. (2010). To screencast or not to screencast. ANZIAM J. 51 (EMAC2009), pp. C446-C460.

Oliver, B. & Goerke, V. (2007). Australian undergraduates' use and ownership of emerging technologies: Implications and opportunities for creating engaging learning experiences for the Net Generation. *Australasian Journal of Educational Technology*, 23(2), 171-186. http://www.ascilite.org.au/ajet/ajet23/oliver.html

Oud, J. (2009) Guidelines for effective online instruction using multimedia screencasts. *Reference Services Review*, 37(2): p. 164-177.

Peterson, E. 2007. Incorporating screencasts in online teaching. *International Review of Research in Open and Distance Learning* 8 (3): 1–4.

Seery, M (2010). Podcasting and screencasting for supporting lectures, Retrieved July 2, 2016 at http://michaelseery.com/home/?p=779

Sugar, W., Brown, A. & Luterbach, K. (2010). Examining the Anatomy of a Screencast: Uncovering Common Elements and Instructional Strategies. *International Review of Research in Open and Distance Learning*, 11(3).

Sutton-Brady, C., Scott, K., Taylor, L., Carabetta, G. & Clark, S. (2009). The value of using short-format podcasts to enhance learning and teaching, *ALT-J*, 17: 3, 219 — 232.

Stylianides, A.J., Stylianides, J.G. (2013).Seeking research-grounded solutions to problems of practice: Classroom-based interventions in mathematics education**.** *ZDM–The International Journal on Mathematics Education*, 45 (3), pp. 333–341
Trail, M. A., & Hadley, A. (2010). Assessing the integration of information literacy into a hybrid course using screencasting. *Journal of Online Teaching and Learning* 6 (3): 647–654.
Udell, J. 2005. Strategic developer: Let's hear it for screencasting. New medium offers unprecedented avenues for training, discussion. *InfoWorld* 2(7). Available online at http://www.infoworld.com/d/developer-world/letshear-it-screencasting-725
Yee, K., & Hargis, J. (2010). Screencasts. *Turkish Online Journal of Distance Education* 11 (1): 9–12.

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Evaluation of a learning outcomes taxonomy to support autonomous classification of instructional activities

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With an increased focus on assuring the quality of student achievement in higher education, there is a commensurate need for tools to assist academics in understanding the nature of assessment and how it can provide evidence of student learning outcomes. This paper describes research conducted the Instructional Activity Matrix; a taxonomy that was developed as the basis of a learning support tool, *Maestro*, that automatically analyses outcomes and assessment statements to show the cognitive level and nature of knowledge inherent in them. Findings indicate that the matrix is a valid tool for defining the nature of learning outcomes and had value in clarifying the nature of assessment and outcomes. However, issues identified with the inherent ambiguity of some instructional statements and their contextually-laden language provided insights into how Maestro will need to be refined to provide appropriate support for teachers, with a range of experience across multiple disciplines.

Keywords: learning outcomes, taxonomies, learning management systems, assessment

Introduction

The Australian tertiary education sector is currently undergoing a period of transformation, characterised by an increased regulatory impost on universities with regard to the demonstration of quality standards across a range of higher education functions. In 2009, following the Bradley Review of Australian Higher Education (Bradley, Noonan, Nugent, & Scales, 2008) and accommodating the expansion of the sector through the establishment of the Tertiary Education Quality and Standards Agency, TEQSA, the Australian government heralded a 'new era of quality in Australian Tertiary Education' (DEEWR, 2009). This has resulted in the a revised Higher Education Standards Framework, which from January 2017 defines the thresholds that universities and other tertiary institutions need to achieve for provider registration, course accreditation and qualifications (Birmingham, 2015).

This formalization of standards has evolved from the recent extension of national outcomes for university degrees through Australian Qualifications Framework to all levels of post-secondary education, including undergraduate and postgraduate qualifications and higher degrees by research (Australian Qualifications Framework Council, 2013), which has led many universities to develop course or program level outcomes as well as specifications for evidence needed to demonstrate these. However, simply having a set of learning outcomes does not ensure quality, nor does it necessarily lead to improved outcomes for graduates. Thompson-Whiteside (2012) noted the risk of national standards restricting innovation and good practice and argued, 'academic staff need to individually and collectively, within their disciplines, have the autonomy to set and assess their own standards' (p. 35).

While empowering teachers to be the sentinels of quality in higher education is a noble ideal, it does raise questions about the ability, and perhaps more importantly the capacity, of academics in terms of their available time to assure this quality. While there are a number of systems that have been developed to assist in the management of learning outcomes such within the Blackboard Learning Management System (Blackboard Inc., 2016), these predominantly take the form of instruments to map outcomes to assessments and act as repositories for evidence. This compliance focus may make the process of managing outcomes and assessment easier but there is little to assist the educators themselves in understanding the nature of their outcomes and whether their approaches to assessment are achieving those.

This type of support is the focus of *Virtuoso,* an enterprise learning and instructional support platform that is currently under development to support quality learning in secondary and tertiary educational environments. This paper reports on research undertaken to design and develop an autonomous system within *Virtuoso* for classifying instructional activities such as outcomes and assessment according to their cognitive level and type of knowledge. This system, *Maestro*, makes use of an underpinning learning outcome taxonomy, the Instructional Activity Matrix.

The Instructional Activity Matrix and Autonomous Classification

Identifying learning outcomes is an important initial process in developing assessment and approaches to learning. The use of taxonomies allow for classification to help distinguish the nature of these (Jonassen, Tessmer, & Hannum, 1999). One key aspect of taxonomies is that they are hierarchical. Those classifications that sit at the top of the taxonomy are more general, inclusive, or complex, with lower level classification often identifying subordinate or prerequisite attributes (Jonassen & Grabowski, 2012). In the development of the Instructional Activity Matrix, a range of learning taxonomies were evaluated for their ability to embrace a broad range of cognitive learning outcomes. These included Bloom's Taxonomy, Gagne's Taxonomy, Merrill's Performance-Content Matrix, the Structure of Observed Learning Outcome (SOLO) taxonomy, and the Revised Bloom's Taxonomy.

Perhaps the best known taxonomy of learning outcomes is that proposed by Bloom (1956). Its six categories in the cognitive domain progress from Knowledge to Comprehension, Application, Analysis and Synthesis, through to Evaluation. Gagne’s Taxonomy of Learning Outcomes (Gagne, 1985) differs in its focus on epistemology rather than cognitive levels, with fixed and inert Verbal Information through to Concrete and Defined Concepts through Rules and Higher Order Rules to Cognitive Strategies, the last of which supports the acquisition of new forms of knowledge independently.

The main difference between Bloom and Gagne are that the former defines cognitive levels at which something can be understood, while the latter classifies what is to be understood in terms of its type of knowledge. More contemporary taxonomies embrace both of these dimensions. Merrill’s Performance Content Matrix (Merrill, 1983), classifies outcomes according to student performance as well as subject matter content. Student performance classifications include Remember-Instance, Remember-Generality, Use, and Find, while subject matter content classifications incorporate facts, concepts, procedures, and principles. Learning outcomes can thus be classified using two separate dimensions and in multiple cells of the Performance-Content Matrix. While the Structure of the Observed Learning Outcome (SOLO) taxonomy (Biggs, 1989) maintains this complexity, the classifications themselves are more holistic, emphasizing the observation of student learning cycles to describe the structural complexity of a particular response to a learning situation through five different levels: prestructural, unistructural, multistructural, relational, and extended abstract. This makes it particularly useful for developing holistic assessment rubrics but by aggregating cognitive levels and epistemological types into types of responses it makes it more difficult to classify individual instructional statements.

The Revised Bloom's Taxonomy (Anderson et al., 2001), however, embraces the bi-dimensionality of Merrill, following a Knowledge dimension that provides similar epistemological categories to those suggested by Merrill, with the addition of a Metacognitive Knowledge category. The Cognitive-Process Dimension effectively updates Bloom’s original taxonomy, emphasising meaningful active processing of new knowledge where Knowledge becomes ‘Remember’, Synthesis is ‘Create’ and so on, with the latter of these now privileged as the most complex form of processing, above ‘Evaluate’.

The synthesis of these taxonomies resulted in the Instructional Activity Matrix (McMahon & Garrett, 2015). Like Merrill and Revised Bloom, it embraces both cognitive processing (Remember, Understand etc.) and types of Knowledge (Factual, Conceptual etc.). The Cognitive Processing dimension maintains the contemporary call to action of Revised Bloom, while the Knowledge Dimension integrates Principle Knowledge from Merrill as well as the Metacognitive Knowledge of Revised Bloom. These are distinguished from each other in that a principle, while more complex than procedural knowledge, is nevertheless of lower order than metacognitive knowledge in the latter’s capacity to generate principles through higher order skills of abstraction and generalization.

The final matrix is presented in Table 1. It provides 30 possible individual classifications for categorising instructional activities, augmenting the 24 possible classifications of the Revised Bloom’s Taxonomy through the addition of the principle knowledge classification within the Knowledge Dimension. Each cell within the Instructional Activity Matrix is the intersection of the Cognitive-Process and Knowledge Dimensions that describes the specific cognitive processes and subject-matter content involved.

Table 1: The Instructional Activity Matrix

	1. Remember	2. Understand	3. Apply	4. Analyse	5. Evaluate	6. Create
a. Factual	1a. Recall association	2a. Specify features	3a. Utilise fact	4a. Determine features	5a. Check factual accuracy	6a. Generate factual representation
b. Conceptual	1b. Recognise concept	2b. Characterise concept	3b. Enlist concept	4b. Examine concept	5b. Consider concept	6b. Evolve concept
c. Procedural	1c. Recall procedure	2c. Clarify procedure	3c. Execute procedure	4c. Scrutinise procedure	5c. Critique procedure	6c. Devise procedure
d. Principle	1d. Recognise principle	2d. Explain principle	3d. Relate principle	4d. Investigate principle	5d. Validate principle	6d. Discover principle
e. Metacognitive	1e. Recognise learning fundamentals	2e. Comprehend learning processes	3e. Implement learning strategy	4e. Explore cognitive processing	5e. Assess learning performance	6e. Develop learning abstraction

The Instructional Activity Matrix enables any instructional statement, whether framed as a learning outcome or an assessment task to be classified according to the appropriate forms of knowledge and cognitive level required to demonstrate achievement. So an outcome such as *Name the parts of the respiratory system* involves remembering factual information (1a) while *Design an infographic that shows how the respiratory system works* would require users to evolve a concept, thus intersecting 6 (Create) and b (Conceptual Knowledge).

As with any taxonomy, the Instructional Activity Matrix operates according to a number of assumptions. It assumes that one can characterise human knowledge and activity as discrete cognitive states (Jonassen et al., 1999) and that such states can be identified, specified, and measured reliably and validly (Jonassen & Grabowski, 2012). These principles underpin the implementation of the automated system, where to allow for the classification of instructional statements, each cell in the Instructional Activity Matrix is matched with classification terms within a curated lexicon. The lexicon links verbs and nouns with each of the 30 classification cells of the Instructional Activity Matrix, with verbs mapped to columns in the Cognitive-Process Dimension and nouns mapped to rows in the Knowledge Dimension. Analysing each word in a learning statement using Part-of-Speech (POS) tagging, the automated system thus looks for matching verbs within the lexicon and if it finds them notes the corresponding cells within a given column. This process is then repeated for nouns within the lexicon to identify matching cells within a given row. A final classification for the learning artefact is derived from the intersection of matching cells. Complex instructional tasks, such as those comprised of lower order sub-tasks, can be accommodated via classification in more than one cell.

The Instructional Activity Matrix has been embedded in the *Virtuoso* enterprise learning and instructional support platform currently under development. It operates as an autonomous classification tool, *Maestro*. *Maestro* is able to parse statements that define learning activities, assessments, and learning outcomes, where there is some reference to a task that students are required or should be able to undertake within certain parameters or within a specified context. It then processes those statements using a curated lexicon of verbs and nouns that are aligned to one or more cognitive levels and types of knowledge.

Figure 1 shows how *Maestro* has been embedded into a Beta build of *Virtuoso*. The menu lists outcomes defined by the Australian Curriculum and the example on the main screen demonstrates how *Maestro* has automatically classified one outcome from the Year 9 History Curriculum, displaying the outcome as a heatmap, demonstrating the extent to which the statement meets the various classification cells of the Instructional Activity Matrix. The highest number shows that the statement has the strongest correlation with the intersection between *understand* and *principle* indicating that the outcome has a focus on explaining principles.

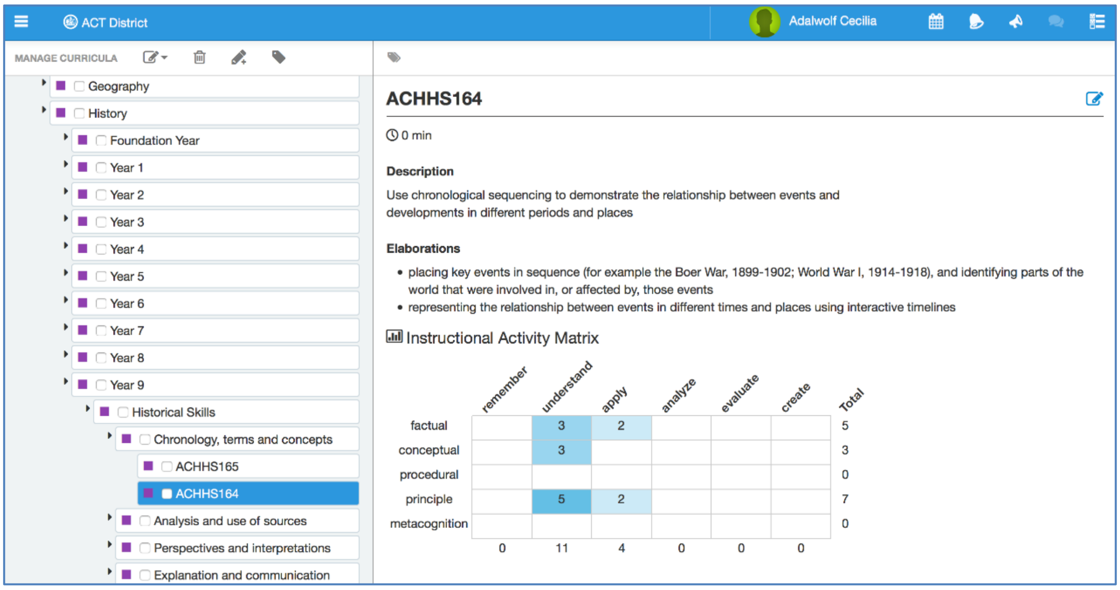

Figure 1: The Instructional Activity Matrix embedded in a beta version of *Virtuoso*

Previous research (McMahon & Garrett, 2016) has compared heatmaps of classifications undertaken by *Maestro* and human educators. Findings have indicated that there is some correspondence in terms of how humans classify compared to the autonomous classifier but also some tangible differences. To further interrogate how individuals used the Instructional Activity Matrix to classify outcomes in comparison to *Maestro*, research was undertaken to understand teachers' experiences with the taxonomy through a structured classification activity. This paper explores how teachers used the Instructional Activity Matrix and its value in terms of:

- Existing skills of teachers to understand the nature of their learning outcomes
- Ability to classify a range of outcomes with the Instructional Activity Matrix across different disciplines

Method

In order to explore teacher application of the Instructional Activity Matrix, a group of 10 teachers were recruited from amongst six schools located in New South Wales. Participants teaching experience ranged between 2 and 30 years in both primary and secondary school capacities across a range of learning areas. The ages of participants in the sample spanned 25 to 54 years old, with 9 females and 1 male.

Each participant in the study was tasked with manually classifying a series of learning outcomes taken directly from the Australian Curriculum using one or more cells in the Instructional Activity Matrix. To prepare participants for this task, the researchers led a workshop which provided background information on taxonomies of learning outcomes and the Instructional Activity Matrix and demonstrated the classification process in detail using numerous worked examples. Each worked example was explored in detail through group discussion where participants compared different perspectives and classification outcomes to clarify their understanding of the classification process. This also included the comparison of manual classifications to autonomous classifications provided by the *Maestro* system. Participants were given the opportunity to classify learning outcomes that they selected prior to attending the workshop with the researchers on hand to provide feedback and assistance to each participant as required.

After completing the workshop, participants were required to classify a series of 129 learning outcomes using the Instructional Activity Matrix. For each learning outcome, participants identified a classification using one or more cells within the matrix to denote the cognitive processes and types of knowledge involved. The first 29 learning outcomes were selected by the researchers from the Foundation to Year 10 section of Australian Curriculum within the subject areas of History, Science, Mathematics, and English. The remaining 100 learning outcomes were selected by the participants themselves from the New South Wales Curriculum. All learning outcomes were expressed in the form of an instructional statement describing the knowledge, skills, and competencies that students are expected to acquire (e.g. *Compare and order duration of events using everyday language of time)*. Once participants had classified all 129 learning outcomes, they completed an online survey designed by the researchers as a simple objective means to elicit participants' backgrounds and experience in using the Matrix. This was followed by a phone interview with the researchers.

Survey Results

With 10 participants, Likert scale responses did not provide a statistically significant sample. Nevertheless, there were noticeable trends in terms of how participants felt they had the prerequisite skills and knowledge, their experience of the workshop and the value they attributed to and reported skills in classifying outcomes according to the Instructional Activity Matrix. These results are summarised in Table 2, showing the survey questions, the most common response, the average response (from 1 to 5 in terms of level of agreement) and the percentage agreement, discounting neutral responses and comparing the number of 4s and 5s with the number of 1s and 2s.

Table 2: Instructional Activity Matrix Survey Responses

No.	Question	Mode	Average	% Agree
1	I have well developed English language skills.	Strongly Agree	4.7	100
2	I have a good understanding of grammar and sentence structure.	Agree	4.1	100
3	I can effectively identify the nouns, verbs, and adjectives within sentences.	Agree	4.4	100
4	I have an extensive vocabulary and understand the meaning of a wide variety of words.	Agree	4.2	100
5	I was familiar with taxonomies of learning outcomes prior to attending the workshop.	Agree	4	100
6	I had used taxonomies of learning outcomes as part of my teaching prior to attending the workshop.	Agree	4.3	100
7	The workshop improved my understanding of taxonomies of learning outcomes.	Agree	3.8	70
8	I understood the purpose of taxonomies of learning outcomes after completing the workshop.	Agree	4.3	100
9	I understood the purpose of the Instructional Activity Matrix after completing the workshop.	Agree	3.9	70
10	I understood the relationship between cognitive processes and types of knowledge in the Instructional Activity Matrix after completing the workshop.	Agree	4	90
11	I was able to classify learning outcomes using the Instructional Activity Matrix during the workshop.	Agree	3.8	80
12	The group discussion improved my understanding of the Instructional Activity Matrix during the workshop.	Undecided	3.7	50
13	The workshop provided with me with the necessary knowledge and understanding to classify learning outcomes using the Instructional Activity Matrix.	Agree	4.1	90
14	I understood the process for classifying learning outcomes using the Instructional Activity Matrix after completing the workshop.	Agree	4.1	90
15	I felt confident to proceed to Phase 2 of the study after completing the workshop.	Agree	4.1	80
16	I was effectively able to interpret the learning outcomes I needed to classify.	Agree	4.1	90
17	I was effectively able to classify the 30 learning outcomes that were provided to me from the Australian Curriculum.	Agree	4	90
18	I was effectively able to classify the 100 learning outcomes that I selected from the NSW Curriculum.	Agree	4	90
19	The classifications that I obtained using the Instructional Activity Matrix made sense to me.	Agree	4.1	90
20	There was a clear relationship between each learning outcome and the corresponding classification I obtained using the Instructional Activity Matrix.	Undecided	3.4	40
21	The classifications I obtained using the Instructional Activity Matrix accurately reflected the nature of the learning outcomes.	Agree	3.4	50

22	I experienced difficulty classifying the learning outcomes.	Occasionally	3.3	30
23	I encountered learning outcomes that I was unable to classify.	Occasionally	2.2	10
24	I consulted a dictionary to check the meaning of words when classifying learning outcomes.	Occasionally	2.3	10
25	I became more effective at classifying learning outcomes as I progressed through the collection.	Agree	3.9	80
26	The Instructional Activity Matrix is an effective tool for classifying learning outcomes.	Undecided	3.2	40
27	The Instructional Activity Matrix could be used to classify learning outcomes that relate to any school subject.	Undecided	3.2	30
28	I developed a better understanding of each learning outcome after classifying it with the Instructional Activity Matrix.	Agree	3.6	60
29	Learning outcomes that have been classified according to the Instructional Activity Matrix are useful to teachers.	Undecided	3.1	30
30	In the future, I would consider using the Instructional Activity Matrix to inform my teaching.	Undecided	3.2	30

As can be seen, participants reported an overall strong level of pre-existing skills in terms of their English language and understanding of grammar and sentence structure, with 100% agreement to questions 1-4, which related to their language skills. Similarly, participants rated their knowledge of learning outcomes highly; with all saying they were familiar with learning outcomes taxonomies and had used them to some extent in their own teaching.

Despite this level of self-reported familiarity with learning outcomes, there was an overall positive response to the workshop in terms of its ability to add to their understanding, with the majority agreeing that the workshop improved their understanding of taxonomies and that they felt able to classify learning outcomes after having completed it.

Weaker but still positive results were found in participants' perception of the Instructional Activity Matrix itself in terms of its capacity to support effective classification and their abilities to use it. The vast majority of participants felt that they were able to classify outcomes from both the Australian Curriculum and the New South Wales State Curriculum and that their classifications made sense to them. However, there was some uncertainty as to whether the Instructional Activity Matrix accurately reflected the nature of the learning outcomes and whether there was a clear link between the outcomes they were classifying and the classifications themselves. This was evident in the fact that several had difficulties in classifying outcomes and some encountered learning outcomes that they felt unable to classify. Despite their high level of reported skills in English and learning outcomes it is also evident that some required a dictionary at times. Nevertheless, the process seemed to get easier the further into it they went. More participants also found that they developed a better understanding of the learning outcomes by undertaking the activity. This is notable given their perceived comfort with both New South Wales and Australian Curriculum outcomes.

Overall, responses were more muted in terms of the applicability of the Instructional Activity Matrix, with most undecided as to its value and whether they would use it in their teaching. Written responses to the open ended question as to why varied greatly. For some, it was highly valuable – 'it helps to ensure that I am catering for a range of thinking skills, including higher order, and giving my students a range of opportunities to learn and represent their learning'. Others pointed to the contextually-bound nature of learning outcomes and how that can create ambiguity – 'I think it will be hard to cover the meaning of all words with the Matrix to different outcomes. I think describe in one subject area might mean something different in another subject area.' One response spoke about the practical aspect of lesson planning, where teachers develop a lesson intention with subordinate success criteria. In that context, curriculum outcomes themselves are marginalized in favour of more granular and practical ways to identify and gather evidence of student achievement.

While these results do not impact necessarily on the validity of the Instructional Activity Matrix, nor its effectiveness as a tool for classifying outcomes, the stated goal of being able to develop assessment where teachers' understandings of student achievement can be calibrated with the feedback provided by *Maestro* means that these issues warrant discussion. The next section draws recommendations for continuing the research by exploring these experiences, by triangulating these results with the deeper responses from individual interviews.

Discussion

In comparing the above results to interview responses, a number of salient themes evolved that can be used to inform future iterations of *Maestro* and how it can be used in a practical education setting. Specifically, these concern the differences between human and autonomous classification, issues around how learning outcomes themselves have been defined as the basis of curricula, and the potential for going beyond the classification of outcomes to identify the ways in which they are evident through the assessment of learning that takes place in the school setting. Each is discussed in turn.

Human vs autonomous classification.

All participants described the process of classifying outcomes as time consuming, to the extent that two specifically described the process of classifying the 29 outcomes from the Australian Curriculum in combination with the 100 that they picked from New South Wales as 'tedious'. Two participants described the classification process as 'hard' though several reinforced the survey finding that it did get easier as they went along. The actual time they took varied from approximately three to five hours, with several of them setting aside a whole day to undertake the activity. The biggest concern was the sheer number of outcomes they were required to work with. While this would not represent an authentic activity for most teachers (who would likely be working purely within their discipline and with a subset required for their specific cohort), it nevertheless identifies workload implications should teachers be required to manually classify both assessment and curricular outcomes with a view to assuring student achievement. In this sense, Maestro is highly efficient automatically processing statements is almost instantaneous and a computer never tires.

Several of the participants ended up undertaking the classification activity with others, including other participants of the research. This was perceived as highly valuable with one participant stating, 'I was able to talk about it while I was doing it. So it was good to get a different perspective as to someone else's thinking'. Another went further, arguing, 'it would have been good maybe to touch base with the other teachers who were working through the same process. That way we could be sure we were doing the right thing, though I did have one of the other participants at [the school].' This social negotiation of understanding was a powerful mediator, particularly, as one participant observed, when cross checked with the handouts and examples provided as part of the original workshop.

This highlights the potential of *Maestro* as a calibration tool. Individual teachers who may not have access to others to compare their interpretations would be able to check their understanding of an instructional activity with the classification performed by *Maestro*. While it may not fully replicate the social construction of knowledge, it would be a highly efficient source of a potentially alternative point of view.

This does raise an issue with regard to the role of *Maestro* as a teacher support. The participant who in interview expressed the least enthusiasm for the project identified specific issues with the ambiguity that was inherent in the workshop and the classification process:

> I would have liked more information and feedback in relation to the accuracy of the classification of the outcomes… more feedback when discrepancy between classifications (automated implementation in *Virtuoso* vs. people). [There was] no real discussion as to situations in which the software and participants didn't have consensus.

This participant described this ambiguity as a weakness of the workshop, requesting 'greater clarification regarding accuracy of classifications, more detailed feedback when there wasn't an obvious consensus'. This need for a single 'correct' answer is counter to the role of *Maestro* as performance support tool rather than a prescriptive one. Nevertheless, it would likely represent the attitude of many teachers and would require significant professional development in the nature of *Maestro* and its role in planning assessment. One inescapable finding was that the process of interpreting learning outcomes had an inherent subjectivity, and this was exacerbated by the ambiguity manifest in some of the outcomes themselves.

Shortcomings of learning outcomes as they pertain to different disciplines

In interview, participants were asked whether there were any outcomes that they struggled with. Overwhelmingly, the strongest response was for those outcomes from the English curriculum, with all participants mentioning that these were difficult to classify. The reasons related to the length of the statements, the tendency to include multiple outcomes in a single statement, and the ambiguity caused by common terms having specific contextual meanings. One example mentioned was the word 'discuss', which ostensibly describes a communication process but in the English discipline incorporates a range of critical and analytical skills.

Two participants were teachers of English and saw this as an inherent aspect of the discipline, with one arguing that that you could never disaggregate these outcomes as the subordinate cognitive processes are ineluctably linked. Such a statement may reflect the holistic nature of English assessment but it does problematise assessment in terms of identifying distinct criteria and measures of success. Both English and History were described by one participant as ‘abstract’.

The fact that one participant stated that it was ‘hard to work out what they’re looking for’ in the English outcomes is a reminder that they are often written by discipline experts, the result being statements that are bound to their discipline context. While it is obviously appropriate for disciplines to develop their own outcomes, it does question the transferability of language used between domains. The survey results showed that participants considered themselves to be well attuned to the outcomes in their own discipline but in interview all participants agreed that they found their own outcomes easier to classify than those of other subjects. The discipline-specific nature of outcomes also appeared to translate to how individuals engaged in the classification process. Both teachers of English took quite a holistic approach to classification. One described how she embraced the complexity of the outcomes and then tried to narrow it down in terms of what skills are ‘privileged’ in the outcome. The process for her proved to be an interesting critical experience:

> That is what I found valuable because I haven’t really read the outcome with this level of depth or understanding before. It really got me to critique the outcome and I thought, wow these outcomes are really asking me to do so much more than just teach grammar’

The approach of one of the science teachers, however, was much more methodical. When asked if she felt the process was subjective, she responded, ‘if you are of a mathematical or scientific disposition, probably not’. This is reflected in her own classifications where she would follow a similar approach to *Maestro*, in which individual verbs and nouns had discrete definitions and when she came across them repeatedly she would classify them in a consistent manner regardless of the context of the outcome.

Since *Maestro* is contextually neutral in its autonomous classification, this highlights both an advantage and a disadvantage of the system. By following a simple dictionary, its interpretation of vocabulary is not coloured by discipline bias, however it lacks the capacity to provide a nuanced classification dependent on which discipline in which the outcome sits. One way in which this could be improved would be by integrating discipline specific definitions of terms within *Maestro*. This would allow some generic words to be better honed to a subject so a verb like ‘find’, for example, may reflect how it is used to resolve problems in Mathematics but promote innovation in Design and Technology.

Outcomes vs. assessment

One key finding both in surveys and interviews was that participants found the Instructional Activity Matrix to be a valid instrument for classification. While some mention was made in interview of the difficulty of understanding the nature of procedural knowledge and the breadth of outcomes inherent in conceptual knowledge, one participant noted:

> As I’ve been doing this I’ve realized how these outcomes fit within this grid and that sort of breaks it up and I can go, Ok I see, what do I need to focus on more in my class to get my kids at the more creative and metacognitive end of the scale?

This is reinforced by several others, with one pointing to its ability to identify ‘holes’ in teaching and another noting that it highlighted the paucity of learning in the classroom that is targeted towards higher order thinking. While another participant acknowledged the potential confusion where an outcome could be classified in a couple of different places, she still maintained, ‘the actual matrix was quite easy to follow and easy to understand and we spent some time discussing that as well when we were discussing what that actually meant on the matrix’.

Given this overall positive reaction to the Instructional Activity Matrix, the less enthusiastic response to its use in the classroom was intriguing. In fact, the interviews revealed that this issue was less related to *Maestro* or the Matrix than the use of learning outcomes themselves to inform teaching. One participant claimed, ‘as teachers we don’t have a lot of time to sit the whole day and look at all the outcomes and break them apart and discuss what they mean’. When interpreted in the light of one of the survey responses which described a preference for identifying intention and success criteria, it is evident that the teachers think of learning in more granular and discrete ways and in a manner particularly targeted towards assessment. For one, the diminished focus on outcomes was because they were busy and tended to just ‘tick them off’ as a requirement, while another contended that the teacher is not able to change the syllabus. For one, the value of classifying outcomes was purely in the planning phase of instruction.

Instead, all participants specifically mentioned assessment as the key area where teachers have influence and this is where the *Maestro* and the Instructional Activity Matrix would be most powerful. One described it in the following terms:

> What that would allow you to do, particularly in my role, I can say to the Year 5 teachers in my stage 'look at your assessments, they're all over at this side of the grid, there's nothing over here that is going to get the kids to analyse, all of your assessments are knowledge based and whatever, I need you to move some of your assessments in this direction', so if it allowed me to do that, I think that would be very useful. I think that as a teacher it would allow you to look at your own assessments and kind of go 'you know what, they're all knowledge based stuff, I really need them to be a bit more challenging and open-ended' so that the kids can show me how much they really know.

This response was typical of several of the interviewees and emphasised the value of *Maestro* for the way in which it would actually be applied in the classroom. Classifying outcomes was an important initial step in testing the system, particularly as these outcomes have been developed through a significant process of expert and peer review and have an inherent authority as curriculum standards. However, these are a limited set that can be pre-classified within the *Virtuoso* system. The real strength of *Maestro* is where teachers can take their own assessments and evaluate the extent to which they address the outcome they are intending to meet.

Limitations

To put the findings of this research into an appropriate context, a number of limitations need to be acknowledged. The small number of participants means that the findings from the survey can be viewed only as trends rather than statistically significant. On the other hand, the triangulation afforded by the interviews allowed for those trends to be interrogated in significant depth. Caution is required in generalising these findings, however, as they represent a cohort of secondary teachers in a single state operating on a national and state-based curriculum. While the comments provided regarding the paucity of outcomes that addressed higher order thinking suggests that the Instructional Activity Matrix can accommodate outcomes pitched at much higher levels such as those defined for undergraduate and postgraduate degrees, further research will need to be undertaken in other settings, particularly in tertiary environments. This is important because the *Virtuoso* platform has international clients and is a scalable enterprise learning management system that is able to be implemented in universities. Finally, further research will need to be undertaken to explore the classification of actual assessment items and how they compare to their stated outcomes.

Conclusion

This study has shown that the Instructional Activity Matrix has the potential to be a useful tool to inform the design and assurance of learning outcomes and assessment. Its strength is undoubtedly in its capacity to prompt consideration of actual practice against intended goals and the potential of an automated system as an efficient prompt for teachers undertaking such activities.

To further enhance the tool, the findings from this study can be integrated into *Maestro* in a number of ways.

1. The current interface is functional but not designed specifically to promote best practice in assessment among teachers. In order for this product to be successful, usability factors will need to be integrated, particularly in terms that highlight its role as a support rather than a turnkey solution. The stated discomfort articulated by a few participants around not knowing the 'right answer' for classifying outcomes means that *Maestro* needs to be presented as a guide that leverages off the expertise of the teacher rather than providing a prescriptive solution.
2. Given most teachers' focus on assessment rather than outcomes, this interface will foreground assessment and use outcomes classification as a means to calibrate that rather than as a goal in itself. This will require further research to assess its validity as an assessment classifications tool as well as providing a workflow for educators to undertake this calibration activity.
3. Outcomes vary greatly between domains and while *Maestro*'s strength is its lack of bias, subject-specific definitions will enhance its capacity to be useful across a range of disciplines. Some curricula such as the NSW English curriculum already provide these while others can be developed via expert review. Teachers will then select the relevant discipline before submitting their assessment for classification and feedback.

These improvements will be undertaken in the next stage of the research and further development of *Maestro*. Given the traction that outcomes-based education has developed within both the secondary and tertiary sectors, and the increased focus on assuring outcomes through valid assessment, there is no doubt that a tool such as this can provide assistance in the design of assessment in a way will be highly beneficial to teachers. This needs, however, to be developed in a manner that acknowledges its role as an objective but imperfect prompt to assist in the more subjective but equally imperfect process of assessment design. Just as the teachers in this study valued the opportunity to develop their understandings of learning outcomes in a socially negotiated space, then *Maestro*'s role will be to provide support for assessment design in a manner that embraces its complexity and supports their expert decision-making, while maintaining the benefits of being an efficient and autonomous performance support system.

References

Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., & Wittrock, M. C. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives*. New York: Longman.

Australian Qualifications Framework Council. (2013). *Australian Qualifications Framework Second Edition January 2013*. Retrieved from Adelaide:

Biggs, J. (1989). Towards a Model of School-Based Curriculum Development and Assessment Using the SOLO Taxonomy. *Australian Journal of Education, 33*(2), 151-163.

Birmingham, S. (2015). Higher Education Standards Framework (Threshold Standards) 2015. [Canberra]: Commonwealth of Australia.

Blackboard Inc. (2016). ANZ Blackboard: Reimagine Education. Retrieved from http://anz.blackboard.com/

Bloom, B. S. (1956). *Taxonomy of Educational Objects, Handbook 1: The Cognitive Domain*. New York: David McKay Co Inc.

Bradley, D., Noonan, P., Nugent, H., & Scales, B. (2008). *Review of Australian Higher Education: Final Report*. Retrieved from Canberra:

DEEWR. (2009). Transforming Australia's Higher Education System. Retrieved from ACT, Australia: http://www.innovation.gov.au/highereducation/Documents/TransformingAusHigherED.pdf

Gagne, R. M. (1985). *The Conditions of Learning and Theory of Instruction*. New York: CBS College Publication.

Jonassen, D. H., & Grabowski, B. L. (2012). *Handbook of Individual Differences Learning and Instruction*. New York: Routledge.

Jonassen, D. H., Tessmer, M., & Hannum, W. H. (1999). *Task Analysis Methods for Instructional Design.* Mawwah, New Jersey: Lawrence Erlbaum.

McMahon, M., & Garrett, M. (2015). *A Classification Matrix of Examination Items to Promote Transformative Assessment*. Paper presented at the Global Learn 2015, Berlin, Germany. http://www.editlib.org/p/150861

McMahon, M., & Garrett, M. (2016). *Mind vs. Machine: A comparison between human analysis and autonomous natural language processing in the classification of learning outcomes*. Paper presented at the EdMedia: World Conference on Educational Media and Technology 2016, Vancouver, BC, Canada. https://www.learntechlib.org/p/173011

Merrill, M. D. (1983). Component Display Theory. In C. Reigeluth (Ed.), *Instructional Design Theories and Models: An overview of their current status.* (pp. 279-334). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Thompson-Whiteside, S. (2012). Setting Standards in Australian Higher Education? *Australian Association of Instittutional Research, 17*(1), 27-38.

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Gunya Online - access, engagement, retention and success for Indigenous distance students

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A cornerstone of the Indigenous Strategy at Macquarie University (MQ) is the Gunya Model. A Gunya, in Darug language, is a traditional structure used by Aboriginal peoples as a home and shelter. In building the Gunya Online program MQ is building an online culturally safe place for distance Indigenous students to come together, connect with staff, services and each other as they journey through Higher Education. This poster outlines the early development of the project presenting initial findings from a research report that draws on literature and interviews with staff and students in the development of a model of best practice.

Keywords: Distance education; Aboriginal; Indigenous; tutoring; mentoring; higher education; equity; learning communities; ITAS; access; pathways; rural; remote; eLearning; enabling course

Building a culturally safe online enabling program for Indigenous students

In 2008 a National commitment was made to increase participation for non-traditional students in Higher Education (Bradley, Noonan, Nugent, & Scales, 2008). Six years later (2012) Behrendt led a team to examine access and outcomes for Aboriginal and Torres Strait Islander people. They argue that improvements are needed to achieving parity in Higher education for Aboriginal and Torres Strait Islander staff and student including building aspiration, improving support, progression and transition models and a movement toward whole of University approaches. As a response Macquarie University (MQ) has developed an Indigenous Strategy for 2016 – 2024, *Indigenous Strategy: The Way Forward for Macquarie University* (Walanga Muru, 2014).

The Strategy incorporates a seven-part action plan to increase Indigenous student numbers, better support Indigenous students, grow the Indigenous workforce, build cultural capability, develop a cross-university Indigenous curriculum, advance Indigenous research and researchers and build Indigenous voice and leadership. Walanga Muru, Macquarie University's Office of Indigenous Strategy is leading the implementation. The Strategy draws on an Indigenous cultural model, the Gunya Model, to enhance the support for Indigenous students with a focus on Student wellbeing. This was developed in consultation with Indigenous staff and Communities and forms a key part of Macquarie University's Indigenous student engagement. The model will provide the University with a framework to guide Indigenous students in their learning journey.

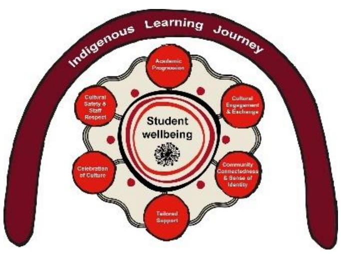

Figure: The Macquarie University Gunya Model, Indigenous Strategy, 2016 - 2024

A key challenge across Macquarie University has been attracting, retaining and graduating Indigenous students. Macquarie currently has over 300 (2016) Indigenous students studying at an Undergraduate or Post-graduate level. Students study in mixed modes including online, face-to-face and distance. Walanga Muru manages Indigenous strategy and student engagement.

A number of reports have identified leading practices that increase Indigenous student recruitment and retention. The Henderson Report (2015) argued that best chance of success is to create environments with community and family connections that build "…. connection with the institution, so that people create a history with the institution and also become part of making decisions about community related issues." (Henderson et al., 2015, p113). Whilst Indigenous Centers across Australia have proven successful in this, they often struggle to take advantage of the online information and communication technologies. Walanga Muru is developing a support Program for Macquarie's Indigenous students who study via distance, Gunya Online. It draws on the Gunya Model providing a culturally safe online support program for Indigenous students.

Macquarie University's Gunya Online model will draw on research across the sector that utilises online spaces for preparation (Hall 2015), orientation (Smyth and Lodge 2012), support (Huijser & Bronnimann (2014), retention (Heath & Leinonen-Davies 2016), tutoring (Lin, Chiang, & Lai, 2014, O'donovan & Maruthappu, 2015), peer assisted learning (Watts, Malliris, & Billingham, 2015) and online communities (Thomas, Herbert, & Teras, 2014, Carlson, 2013, Yunkaporta 2009). It will provide online course advice (pre-enrolment), tutoring support (as required throughout degree programs) and a peer support network. The model will complement existing outreach programs at Macquarie and expand the University's reach beyond current Indigenous student face-to-face recruitment, teaching and learning, and enhancement models and address the needs of prospective and current Indigenous students who may not be able to attend a University campus for all or part of their degree program. Stage 1 of Gunya Online will provide a background report on models relevant to student support, with recommendations for action.

Guiding the investigation - research study

As part of stage 1 a research study was undertaken in 2016 which will lead to the completion of the Gunya Online Report. This investigated the literature to examine appropriate models that inform the MQ context, and make recommendations for action in Stage 2. It focused on the:

- needs of current Aboriginal and Torres Strait Islander students
- external Indigenous student support models, including peer support
- online tutoring models
- culturally appropriate online space

Semi structured interviews and focus groups were undertaken in 2016 with staff, students and community as part of the consultation, engagement and development process. The interviews were guided by the following primary research question, "What factors enhance an undergraduate Indigenous student's experience studying an external unit or course at Macquarie University? Sub-questions are: What factors enhance a student's access to study? Are online support strategies, including peer-to-peer, likely to improve the student experience, if so what are they? Are there any online tutoring models that might improve academic success?

Conclusion

This presentation reports on stage 1 in the development of the Gunya Online. Through the poster presentation we will present preliminary findings and planned deployment strategy. The poster will be part of an ongoing discussion amongst educators on issues in designing culturally safe online spaces for Indigenous students in Australia. We hope to offer suggestions on good practices across Australia that are being incorporated into the Macquarie University online Gunya.

References

Bradley, D., Noonan, P., Nugent, H., & Scales, B. (2008). *Review of Australian Higher Education: final report* (Text). Canberra, ACT: Department of Education Employment and Workplace Relations.

Carlson, B. (2013). The “new frontier”: Emergent Indigenous identities and social media. *UOW Faculty of Law, Humanities and the Arts - Papers*, 147–168.

Hall, L. (2015). What are the key ingredients for an effective and successful tertiary enabling program for Aboriginal and Torres Strait Islander students? An evaluation of the evolution of one program. *Australian Journal of Adult Learning*, *55*(2), 244.

Heath, J., & Leinonen-Davies, E. (2016). An institution wide approach to learning analytics. *UOW Faculty of Social Sciences - Papers*, 73–87.

Henderson, M., Selwyn, N., & Aston, R. (2015). What works and why? Student perceptions of “useful” digital technology in university teaching and learning. *Studies in Higher Education*, 1–13.

Huijser, H., & Bronnimann, J. (2014). Exploring the opportunities of social media to build knowledge in learner-centered Indigenous learning spaces. In S. Feller & I. Yengin (Eds.), *Educating in dialog: Constructing meaning and building knowledge with dialogic technology* (pp. 97–110). Amsterdam: John Benjamins Publishing Company.

Lin, C., Chiang, Y., & Lai, W. (2014). Implementation of portal system of online tutoring for after school’s learning. In *Frontiers in Artificial Intelligence and Applications*. Taiwan.

O’donovan, J., & Maruthappu, M. (2015). Distant peer-tutoring of clinical skills, using tablets with instructional videos and Skype: A pilot study in the UK and Malaysia. *Medical Teacher*, *37*(5), 463–469.

Thomas, L., Herbert, J., & Teras, M. (2014). A sense of belonging to enhance participation, success and retention in online programs. *The International Journal of the First Year in Higher Education*, *5*(2)

Walanga Muru. (2014). *Indigenous Strategy: The way forward for Macquarie University. Green Paper 2015-2024*. Macquarie University.

Watts, H., Malliris, M., & Billingham, O. (2015). Online Peer Assisted Learning: Reporting on practice. *Journal of Peer Learning*, *8*(1), 85–104.

Yunkaporta, T. K. (2009). *Aboriginal pedagogies at the cultural interface*. James Cook University, Townsville Qld.

Please cite as: Meyers, W., Swain, A., Gili, J., Sutton, E. & Pinckham, S. (2016). Gunya Online - access, engagement, retention and success for Indigenous distance students. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 431-433).

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Natural Language Proficiency and Computational Thinking: Two linked literacies of the 21st Century

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Literacy as natural language fluency, is the primary literacy underpinning most learning but there is a new literacy gathering momentum in this information age - Computational Thinking. This paper draws connections between the two; highlighting analogs, differences, and bridges that are transforming both pedagogies while also illustrating a growing educational nexus.

Keywords: Literacies, Computational Thinking, English Language Proficiency, LACR

Introduction

What are the major literacies needed to thrive in the 21st Century? The following four are positioned as capturing key fluencies: ***L**anguage Proficiency*, ***A**rt-Design Dexterity*, ***C**omputational-Thinking Prowess*, ***R**easoning Deftness* (**LACR**). This capture also includes a further dynamic; a natural pairing of *language* and *computational thinking* working as support to another pairing, the creative literacies associated with *art-design* and *reasoning*.

The intent behind LACR's encapsulation is to promote and probe connections between existing humanities/science-like divisions in ways that recent developments suggest are becoming essential to thriving in a computer-driven society. Startling advances in machine-learning capabilities have begun to automate the acquisition of human-like *intuitions*. This is perhaps no more compellingly illustrated as in the imaginative play and learning displayed by *AlphaGo* in its recent defeat of the world's best Go players (Silver et al., 2016). Previously, automation has been about the speeding through of predictable steps but without any obvious need to invoke human-like creativity in the algorithms themselves. For example, Wing's (2014) definition of computational thinking captures this task-oriented, problem-solving nature that has characterized much of previous automation.

> Computational thinking is the thought processes involved in formulating a problem and expressing its solution(s) in such a way that a computer—human or machine—can effectively carry out. (J. Wing, 2014)

An updated version is called for, we suggest, in the wake of these technological bombshells; one that captures new imaginative, *intuitive* capabilities. A modern definition of computational thinking therefore, needs creativity and exploration to share top billing with problem solving and also have linguistic overtones attendant to both; further, in our view it also needs to explicitly incorporate *judgement*, *interpretation* and *collaboration*. Judgement is justified, since no computational solution, exploration or simulation succeeds without a prior rationale (including scenarios where it is *not* appropriate - ethically or feasibly). Interpretation is pivotal since, even without individual implementation, modern citizenry is increasingly required to make decisions based on the outcomes of computational thinking (consider internet search, advertising, recommendation systems and data-driven educational pathways). Next, melding global connectivity with computational thinking's signature reductionism has unleashed radical *collaborations* on grand, unprecedented scales. Finally, the recent explosion in the "Internet of Things" propounds broadening computers' laptop/desktop connotations to cover more general *computational devices*. Putting all these together, our updated version becomes:

> Computational thinking allows computational devices to solve problems, explore spaces and simulate systems judiciously, creatively and linguistically while also fostering interpretations of other's computational thinking.

Note that this is an operational definition of what computational thinking can *enable*; the thought processes it *embodies* is addressed later but first, some historical context in the evolution of computational thinking and natural language literacies.

Background

Almost 60 years ago Snow famously lamented the cultural division between The Arts and The Sciences (1993) while during the 2000's, links between coding and writing were tentatively explored without ever turning mainstream (Fernandez, 2007). There is however, in addition to the aforementioned machine-learning breakthroughs, another technological development forcing an imminent consilience - the emergence of more *literate* programming languages. While true artificial intelligence can't yet be claimed; equally, no longer can computers be considered as essentially dumb machines forever consigned to blindly following logical instructions (Nielsen, 2016). Instead, machines are beginning to display human-like capabilities for developing *intuition* (Berman, 2016) while new programming languages are enabling humans to naturally interface with such abilities. This has revolutionary implications no less in education and what may soon count as fundamental literacies.

If the development and use of acronyms reflect imperatives and priorities of an educational age, then we argue that modern digitization calls for a revised encapsulation of this era's necessary literacies. Periodic exhortations for 3R's back-to-basics or appeals to promote generic Literacy-Numeracy seem tired while more relevant groupings such as ICT (Information Computing Technology) and STEM (Science, Technology, Engineering and Mathematics) are less literacy-capture and more discipline-encapsulation as a means to promote greater inter-disciplinary integration. As laudable as this latter goal is, it has arguably come at a cost of neglecting those literacies themselves indispensable for achieving such cross-fertilization. This has perhaps been due to anointing mathematics - a vital STEM member in its own right - but in our view not the most apt choice as the unifying literacy.

As the oft-quoted *lingua franca* of science, mathematics was originally conceived as the foundational STEM literacy but not all members extensively employ its symbolism (notation and concepts from computer-science, for example, often assume more central roles). Conversely, *computational thinking* underpins almost all STEM activities as it marries science's reductionism, technology's innovation, engineering's design and mathematics' algorithms while also encompassing implementations on ubiquitous computing devices.

Another, somewhat controversial, but potentially useful recent movement has sought to expand STEM to STEAM by way of adding **A**rt/Design as a relevant and related domain (Dayton, 2014). Rather counter-productively, this enlargement often becomes mired in politics as STEM advocates resist what they see as the humanities' play for funding and influence. The issue however, is not so much whether or not creativity and design are indispensable to STEM progress and innovation - that is a given - but to what extent exposure to the arts is necessary for fostering such sensibilities. Certainly, there exists an ever-present danger of diluting STEM rigour and knowledge through over-emphasizing design but such a risk is mitigated through focusing on creative *processes* and in particular, on one central to both, *composition*.

Composing Code and Text

Striking parallels have previously been observed between composing algorithms and essays (Cummings, 2006; Fernandez, 2007) with arguably the most significant pointed out by Flower and Hayes - repeated oscillations between macro and micro viewpoints (1981). The computing macro-view corresponds to an algorithms' overall conceptualization prior to its decomposition into constituents; its micro-view implementing, testing and debugging these serving parts. A text's macro-view, on the other hand, stems from its overarching narrative, a connective thread drawing together constituent words, sentences and paragraphs into, hopefully for the author, a persuasive flow; its micro-view corresponds to the drafting and crafting of these smaller literary units in the service of this larger narrative.

Modern pedagogy points to the back and forth, the toggling, the toing and froing between these two viewpoints as most accurately characterizing the composing process for both coders and writers. The dual meaning of "compose" highlights interplays between both activities in both modes; its creative, artistic sense quintessentially evokes music or poetry but also the crafting of textual *compositions* while its (dis)aggregating sense captures the (*de)composition* so synonymous with top algorithmic design. Next, both senses are characterized in both forms.

To write effectively writers need something to say and someone to persuade. To carry out this *function* however, they need a *form* to impose structure, to give the persuasion some ballast. Part of this structure is provided by conventions specifically tuned to match the message - book genres, scholarly formatting, report layouts - but ultimately authors contribute a specific structure via headings, paragraphs, hypotheses, supporting evidence and drawn connections. This last aspect is particularly relevant given the need for good writing to consistently guide a reader's focus towards the piece's narrative while accommodating a competing tension to maintain the text's readability.

An author's *style* gives a piece its originality and is itself a complex, artistic endeavour while also being elusive to precisely categorize. Some identifiable elements of style include: an authorial voice, imagery evocation, apt noun/verb/adjective/adverb combinations, word choice, succinctness and a sentence's cadence and rhythm. A writer's development relies on adding and refining such devices however their most effective deployment comes when they dovetail with an overarching narrative.

Wing describes a "separation of concerns" (J. M. Wing, 2006, p. 33) as characterizing computational thinking while alluding to its role in distinguishing between micro and macro viewpoints, an initial practice that the most accomplished writers are able to parlay into an ensuing "joining of concerns". Designing an overall narrative commences most effectively unencumbered with stylistic concerns while conversely, bringing forth a sentence's natural rhythm can initially do without over-arching narrative impingements. Masterful expressions of both however, result from a recursive *joining* of both concerns (Flower & Hayes, 1981). A narrative benefits from readers responding to an argument pleasingly outlined, empathically-framed and compellingly articulated. On the other hand, good style benefits from an overarching narrative pointing to the "right" word or nuanced emphasis. The two also dynamically influence; the very act of stylistic improvements gives rise to deliberate changes in overall meaning and vice-versa in a virtuous cycle converging towards just *what* the author wants to say and just *how* to say it.

To code effectively, coders need a computation worth invoking. The code's *function* is the function itself while a major difference with writing is that coding's *form* comes in two flavours, the human-friendly interface used to invoke the function and the code itself. As with writing, this latter form needs a structure which is initially provided by the constructs of the chosen programming language but also by abstract *design patterns* most appropriate to the function's objective. Despite these supports, coders likewise ultimately implement their own structure in defining the sub-modules that emerge in the overarching function's *decomposition*. It is in the implementation of these modules that a coder's style begins to emerge.

A coder's style is what gives a piece of code its correctness, robustness, and readability. In contrast to writing style, aesthetic qualities give way to precision, consistency and clarity. These qualities reflect the coder's primary concern in delineating underling data structures, their unambiguous transformations all the while trying to ensure an unalloyed clarity in the program's *control flow*. This concern is so important since it allows ready *debugging* on the program's journey to correctly running.

In effect, the coder's first reader is a *compiler* who is a cold, austere entity unimpressed with adornments outside unforgiving logic. Following this initial constraint however, aesthetic demands enter the picture by way of ensuring the code's *maintainability* and *extendibility* - in short, it needs to start accommodating human readers. At this juncture, coding style assumes more literary-like connotations with questions such as - can redundancies/repetitions be removed? is there consistency and aptness in the word choice associated with function names? do functions contain humanly-graspable computational chunks? is the scope of local variables/concepts consistently displayed? are (prefix, infix and postfix) operators naturally ordered? These too speak to a coder's developing literacy and just as with writing, these local decisions about style ultimately connect with the aimed-for global functionality.

The initial value of Wing's "separation of concerns" is vital for coding as global planning is divorced from local implementations but, just as in writing, elite coders display a highly-honed facility for oscillating between holistic and immediate viewpoints. So, for example, an overall architecture can be informed by the availability of congruous sub-modules and while the process of debugging may start with localising faulty sub-functions, it often finishes with understanding the control flow as determined by the global architecture. Further, the influence is similarly bi-directional; the implementation of sub-functions frequently motivates adjustments in global architecture that can, in turn, engender remarkable simplification at the local level.

Both writing and coding exhibit similar improvement processes with *refactoring* a fundamental part of the latter. Refactoring is a technique that aims to exploit the curiously common phenomenon whereby two code-blocks can exhibit vastly different levels of readability despite implementing exactly the same algorithm. While keeping the code's functionality constant, the code's "readability" can be progressively improved to reap benefits beyond aesthetics. When done well, it can foster collaboration, programmer development, programs that run more efficiently and reliably while also helping motivate and smooth the addition of new functionality. It is also an art-form, distinguishing true artisans from hackers.

By far and away the most important technique in code refactoring is modularization whereby a chunk of code is encapsulated and replaced with a single function. Naturally that code must appear somewhere in the program to maintain functionality but it is wrapped-up, labeled, and strategically positioned elsewhere. The improvement in readability derives from now being able to conceptualize *what* the function does without concerns about *how* it does it. In so doing, a considerable cognitive overhead is removed allowing a coder to conceptualize an algorithm at the highest level.

The process of modularization is fundamental not simply as a means for organizing code but also because it forms a key part of computational thinking - the ability to conceive an algorithm, a system, a mathematical solution, almost any complex phenomena as a combination of interlocked, constituent parts. The process proffers multiple advantages which although couched here in a coding context are clearly applicable to any complex activity, as befitting a core literacy.

One of the most productive, refactoring activities is to imbue code with an almost linguistic-like readability. “Code” - the name itself indicates a space between its appearance and underlying meaning - has traditionally needed clarifying accoutrements (pseudo-code, comments, documentation) but modern languages are increasingly allowing more linguistic-like input forms (macros, operator forms, name-space management). What this means is that code-bases can be more quickly absorbed and therefore more readily maintained and extended.

The great advantage of a programming language taking on the complexion of a natural language is the resulting, enlarged space of individuality-stamped programs. Such individuality, as opposed to monolithic codebases generated by thousands, promotes coders as artisans whose ongoing improvement is motivated from learning from legendary practitioners or culturally-determined classics. Further, the additional richness of resulting programs inevitably recasts the relationship between form and function in engendering *new* algorithms.

Turning towards writing’s improvement process, we initially observe that polishing or refining a piece of writing can draw upon three significant practices used in code refactoring, the first being a more precise delineation of what is being preserved between refinements. In coding what is preserved during refactoring is a program’s *functionality* whereas in writing the equivalent invariant throughout the refinement is a piece’s *meaning*. Already this represents is a slight divergence from coding since almost by definition re-wordings involve at least subtle shifts in meaning but nonetheless, there usually remains a faithfulness towards an overarching thread or *narrative*. Often such a narrative is said to contain a logical structure itself not unlike a program’s logic defining its functionality. This structure includes reasoning chains which, if made explicit (or evaluated dynamically with real-time sentiment or coherency analysis (McNamara, Graesser, McCarthy, & Cai, 2012)), can act as guiding lodestar in satisfying the refiner that style is being improved without compromising previously established substance.

Modularization is a core component of *computational thinking* in both composing types but it is pursued relentlessly throughout coding in a way in which, if repeated with writing can yield many clarifying benefits. In this refining stage there are four types of modularization typically used as a means to shift material whose current placement may be detracting from a narrative’s clarity: 1) in-text parentheses, 2) footnotes 3) appendices and 4) references. It is through liberal and systematic use of these devices that a piece of writing can be refined, filtered, *reduced* to reveal its narrative essence. Further, unifying how these are included and managed, in following the ways in which coding modules are organized (e.g. code folding), can enhance composing flexibility.

Another striking difference between the respective processes of improving writing and coding is the frequency and duration over which they take place. In writing, stand-alone compositions veer towards singly-authored, frozen-in-time artefacts. Contrast this with large codebases produced by hundreds of contributors that are often published daily following nightly *builds*. This gap suggests how writing can be made more adaptable to contemporary circumstances while also promoting writers’ own development, education and perhaps even untapped virtuosity.

Literacy possesses a virtuosic hue in the sense of taking years to develop and yet being expressible within a singular “performance”; a feature that has rarely explored pedagogical implications. Consider the inefficient way students acquire essay-writing expertise: along with a final grade, a submission may receive feedback advising an improvement in word choice, the omission of redundant or repetitive terms together with establishing a more coherent and definitive narrative. Rarely however, does this end up occurring in the critiqued piece itself; instead students are left to implement (often a subset of) these recommendations in subsequent essays, where they may manifest differently in different contexts that themselves carry new literacy imperatives. An *ongoing* process however, whereby students have the opportunity to craft a piece over an extended period, would facilitate better use of feedback, incorporate new knowledge while also conveying explicit connections between literacy and localized manifestations of virtuosity.

The first rationale behind drawing connections between natural language and coding is the belief that learners with an awareness of both can ultimately become better writers and coders. Literacies are by definition lifelong processes, (in contrast to say course leaning outcomes), so ongoing opportunities present for long-term scaffolding. Further, the ongoing and rapid digitization of learning data in combination with the emerging field of learning analytics affords opportunities for verifying and shaping such longitudinal interactions.

The final rationale stems from a deeper natural language and coding nexus that is harnessing Natural Language Processing (NLP) to both *define* and *understand* algorithms in ways set to transform learning spaces. While text (completions) have revolutionized search and more recently AI-like tools such as Apple's *Siri*, Google's *Assistant* and Microsoft's *Cortana* are applying language for every-day assistance, the corresponding algorithms, while impressively summoned, all remain relatively constrained and task-oriented. Learning analytical feedback, on the other hand, is potentially on another level of complexity and importance as its algorithms define educational, life-long pathways. Consequently, the ability to understand and direct such feedback, or equivalently, understand and create algorithms in natural ways through visualization (Beheshitha, Hatala, Gašević, & Joksimović, 2016) and language (Muslim, Chatti, Mahapatra, & Schroeder, 2016) represents a new educational frontier.

Conclusion

This paper has introduced *LACR*, a grouping of four literacies aimed at reflecting a modern consilience while focussing on two, *language proficiency* and *computational-thinking prowess*. It broadened the notion of computational thinking to include recent developments in machine learning and programming languages while demonstrating how connections between the two can be used to improve both literacies. Curricula-wise, while there remains much to be done, the intent was to set the scene for perhaps an even bigger challenge, the use of these language-based means to instil LACR's other, "higher-order" literacies; *art-design dexterity* and *reasoning deftness*.

References

Beheshitha, S. S., Hatala, M., Gašević, D., & Joksimović, S. (2016). The Role of Achievement Goal Orientations When Studying Effect of Learning Analytics Visualizations. *Learning Analytics and Knowledge (LAK'16)*, 54–63. http://doi.org/10.1145/2883851.2883904

Berman, A. (2016). The Last Frontiers of AI: Can Scientists Design Creativity and Self-Awareness? Retrieved from http://singularityhub.com/2016/04/20/the-last-frontiers-of-ai-can-scientists-design-creativity-and-self-awareness/

Cummings, R. E. (2006). Coding with power: Toward a rhetoric of computer coding and composition. *Computers and Composition*, *23*(4), 430–443. http://doi.org/10.1016/j.compcom.2006.08.002

Dayton, E. (2014). *Exploring STEAM: Science, Technology, Engineering, Arts, and Mathematics*.

Fernandez, L. (2007). Code and Composition. *Ubiquity*, *8*(Issue 19), 16. http://doi.org/10.1145/1276156.1276157

Flower, L., & Hayes, J. R. J. R. (1981). A cognitive process theory of writing. *College Composition and Communication*, *32*(4), 365–387. http://doi.org/10.2307/356600

McNamara, D. S. ., Graesser, A. C. . c, McCarthy, P. M. ., & Cai, Z. . (2012). *Automated evaluation of text and discourse with Coh-Metrix*. *Automated Evaluation of Text and Discourse with Coh-Metrix*. http://doi.org/10.1017/CBO9780511894664

Muslim, A., Chatti, M. A., Mahapatra, T., & Schroeder, U. (2016). A rule-based indicator definition tool for personalized learning analytics. In *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge - LAK '16* (pp. 264–273). New York, New York, USA: ACM Press. http://doi.org/10.1145/2883851.2883921

Nielsen, M. (2016). Is AlphaGo Really Such a Big Deal? | Quanta Magazine. Retrieved from https://www.quantamagazine.org/20160329-why-alphago-is-really-such-a-big-deal/

Silver, D., Huang, A., Maddison, C. J., Guez, A., Sifre, L., van den Driessche, G., … Hassabis, D. (2016). Mastering the game of Go with deep neural networks and tree search. *Nature*, *529*(7587), 484–489. http://doi.org/10.1038/nature16961

Snow, C. P. (Charles P. (1993). *The two cultures*. *Nature* (Vol. 400). Cambridge University Press.

Wing, J. (2014). Computational Thinking Benefits Society. Retrieved from http://socialissues.cs.toronto.edu/index.html%3Fp=279.html

Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, *49*(3), 33. http://doi.org/10.1145/1118178.1118215

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Assessing the impact of an "Echo360-Active Learning Platform"- enabled classroom in a large enrolment blended learning undergraduate course in Genetics.

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In response to calls from the higher education science community to increase student engagement in learning, scientific teaching (reflecting the true nature of science by capturing the process of discovery in the classroom) and reflective teaching (or scholarly teaching), a genetics course was redesigned as a blended learning course. The new course model has provided several opportunities to engage students in the 5E learning cycle and to redefine the classroom experience. Despite the growing literature on effective design of blended courses, very little research has been conducted and very little is known about the impact of components of blended courses for large enrolment courses in relation to student learning outcomes. The goal of this investigation was to assess the impact of an Echo360-ALP enabled classroom on learning gains in a large enrolment blended learning course.

Keywords: Blended learning, Student response System, Learning analytics, Echo360-Active Learning Platform, Scientific teaching, pedagogy, learning outcomes, learning gains.

Introduction

The Introductory Genetics course at the University of Ottawa is a second-year large enrolment course offered by the Department of Biology. Though compulsory for students in the Biology, Biochemistry, Biomedical Sciences and Biopharmaceutical undergraduate degree programs, students from different faculties also take the course as an elective. Topics covered in this course include Mendel's laws of inheritance and application of Mendelian analysis to problems in genetics including gene mapping and linkage, molecular genetics, bioinformatics, and population genetics; with laboratory experiments to illustrate genetic principles. Initially taught using traditional teaching approaches (e.g. lectures), technology-enabled pedagogies have facilitated the transition of this course into an active learning zone combining online activities, face-to-face classes, and laboratory sessions to provide students with spaces to study, discuss, and apply within a collaborative environment the conceptual frameworks that serve as the foundation of genetics as a method of scientific discovery.

In 2013, the University of Ottawa Board of Governors approved an initiative for the implementation of large scale blended courses at the University to enrich the student learning experience while providing many benefits for both students and professors (Caulfield, 2011) by combining the best of online and face-to-face (F2F) teaching. The support provided by the blended initiative made possible the implementation of technology-enabled pedagogies in this course. In a broader context, it also gave opportunities to respond to calls from the higher education community to increase student engagement in learning (Bradforth and Miller, 2015), scientific teaching (reflecting the true nature of science by capturing the process of discovery in the classroom) and reflective teaching (or scholarly teaching) (Handelsman et al., 2004). The new course structure, designed to engage students in the 5E learning cycle (Piaget, 1950) – Engage, Explore, Explain, Extend, and Evaluate – aims to lead students in learning content outside of class time through assigned readings and online homework that include interactive exercises, quizzes, and metacognitive reflective activities. Class time, on the other hand, is used to study, discuss, and apply the conceptual frameworks of the discipline in a collaborative setting to scaffold learning of core disciplinary ideas such as applying the process of science, using models, reasoning analytically, developing arguments, creating narratives, and working cooperatively to actively construct knowledge. Inasmuch, taking advantage of pedagogical approaches associated with blended learning known to enhance the student learning experiences (Caulfield, 2011).

Using blended delivery, the new course model (figure 1) has provided several opportunities to redefine the classroom experience. The online environment offers students the convenience and flexibility to study and review materials at their own pace and time, enabling the instructor to use pedagogical strategies and activities for synchronous peer-to-peer and student-faculty conversations. Consequently, this allows students to receive immediate feedback and mentorship and to hone their critical and analytical thinking skills in support of independent learning (i.e online). Inasmuch, these opportunities also offer the instructor chances to gauge learning through routine formative and summative assessments. Indeed, classroom activities are now dominated by student-centred activities that rely on Just-in-Time teaching and learning approaches, problem-based learning, and clicker-case studies (e.g. interrupted cases) (Herreid 2006) to engage students, individually and in groups, in applying their learning and scientific knowledge to evaluate and solve issues contained within a story (Herreid 2006; Lundeber et al., 2011).

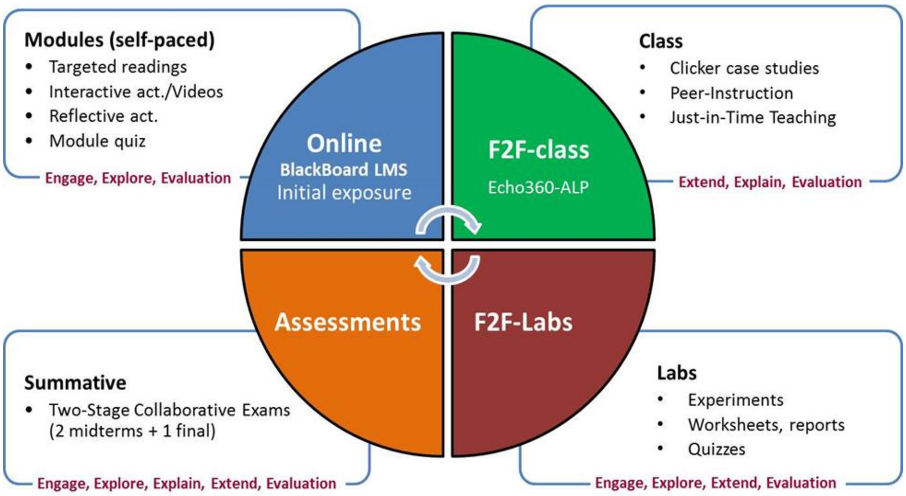

Figure 1. Structure of the BIO2133 Genetics Blended Course

The redesign of the course aims to combine online, F2F and lab activities that take advantage of the 5E learning cycle to engage students in independent, reflective, and collaborative learning activities.

Anderson (2003) defines 6 modes of interaction in distance education between student, teacher and content; from the students' perspective, these include student-student, student-teacher and student-content, while from the teacher's perspective, teacher-teacher, teacher-content and content-content interactions are considered. The Interaction Equivalency Theorem (Anderson, 2003) posits that while a high level of a single type of interaction between two components (student-teacher, student-content or teacher-content) can provide "deep and meaningful learning, high levels of more than one of these three modes will likely provide a more satisfying education experience". Though Anderson`s work has been largely dedicated to online teaching and learning, it is not unreasonable to extend his views to blended courses given their pedagogical and structural similarities.

The Echo360-Active Learning Platform (acronym ALP, a cloud-based student-response-system (SRS)) was chosen to engage a high number of students by harnessing large scale student ownership of laptops and mobile devices and to facilitate a community of learning fostering student-content, student-student, & student-professor interactions. Echo360-ALP features can facilitate the interaction between students and their professor; reciprocally, polls and quizzes allow professors to assess their student's grasp over content and intervene accordingly. Ability to write time-stamped notes alongside class videos (lecture captures) and playback recordings allows for a deeper student-content interaction. Students also have the ability to flag points of confusion and ask their professor questions through the platform without the fear of exposing themselves publicly. Finally, access to data on learning analytics and on viewing/reviewing of content by students allows teachers to identify student needs and customize content to improve classroom effectiveness.

Despite the growing literature on effective design of blended courses, very little research has been conducted and very little is known about effective design of blended courses for large enrolment courses in relation to student learning outcomes. Given that the Echo360-ALP provides tools with which to implement effective technology-enabled pedagogical approaches and to access learning analytics, the Echo360-ALP is well positioned to play a central role in providing deep and meaningful educational experiences in courses designed for blended learning in accordance with Anderson`s Interaction Equivalency Theorem (Anderson et al., 2003a). Knowing the nature and manner in which students engage with the Echo360-ALP system will enable instructors to develop informed strategies to improve the effectiveness of the course. The present study aims to assess Echo360-ALP's role in strengthening Anderson's 6 modes of interactions, and to investigate if student outcomes can be related to student engagement with the system.

Methodology

The study was carried out during the 2016 winter semester (January to April) in three separate sections (different times and days) of the course taught by the same professor, in an Echo360-ALP enabled auditorium (lecture capture software and camera) with a smart podium and WI-FI capabilities. Echo360-ALP learner metrics were collected each time students accessed the various features of the platform by logging-in to their personal accounts using a laptop computer or a mobile device connected to the internet prior, during, and after class. From this platform, students have the ability to navigate and annotate class notes to slides (in addition to accessing a PDF version of the slide deck) and flag content that confuses them to the professor. Moreover, students were also free to post questions/comments on a backchannel with the professor, teaching assistants, and other students able to respond to them. Every class, students submitted answers to "clicker-style" questions using their device and earned participation marks for submitting answers, regardless if they were correct or not. Following class, lecture captures were also available for viewing. Student usage of the various features of the Echo360-ALP was recorded by the system's "learner analytics". Eight variables (learner metrics) were collected from the learner analytics to conduct the analysis. These were Activity Participation: % answers submitted to the total of activity questions asked; Activity Score: % of correct answers to the total of activity attempts; Attendance: % of classes attended (and logged in to platform); Note Taking: total amount of words written in platform during the term; Presentation Views: total amount of times a presentation (slide decks) were viewed during the session; Presentation Views - % total viewed: average of the % of slides viewed; Video Views: total amount of times a lecture capture (video) was viewed; Video Views - %total viewed: average of % of length viewed of the lecture captures. Note, the "posting a question" feature was used by less than 5% of the students and thus not used in this analysis. Echo360-ALP learner metric data was collected from approximately 597 students.

Understanding of genetics concepts was assessed using a validated genetic assessment test (Smith et al., 2008), which comprises a set of 25 multiple choice questions designed to measure conceptual understanding of content aligned to course learning outcomes. The test was administered at the beginning of the course and prior to instruction (pre-assessment) to get a baseline level of student understanding and again at the end of the course (post-assessment). Learning gains were measured using the following equation: LG= [(Postscore – Prescore)/(100%-Prescore)]. A total of 434 students completed both the pre- and post-assessments.

Correlations and linear regressions were used to assess the impact of Echo360-ALP learner metrics on student learning gains. Correlation was first used to assess the link between each metric and student performance on exams and learning gains, respectively, as well as between each metric, individually. Stepwise backward multiple linear regression with AIC criterion for deletion was used to test interactions between Echo360-ALP learner metrics and learning gains. Finally, logistic regression was used to further break down the analysis and evaluate how the effect of metric usage varies for different levels student learning. Students were divided into quartile groups: 0-25%, 26-50%, 51-75%, 76-100% for this analysis. All statistical analyses were performed using version 3.3.0 of the R software (R Core Team, 2016).

Results/Discussion

The Echo360-ALP was introduced to the students during the first class and 99% of the students were signed on to the platform by the second class. Prior to class meetings, slides prepared in PowerPoint were uploaded in the platform. On a per class basis, 5-7 "clicker-style" questions were asked to engage students in peer-instruction activities. Students submitted answers to a mix of multiple-choice questions, short answer questions, ordering list questions, image hot-spot quizzes, or numerical questions, using their laptop computers or mobile devices logged in to the course Echo360-ALP account.

All features of the Echo360-ALP were used during and/or following class. Echo360-ALP learner metrics show that students attended class on average 89% (with a median 89%) of the time and, when present in class, submitted answers to activity questions 99% of the time. On questions seeking a correct answer, students were successful approximately 50% (median 52%) of the time. In terms of note taking, students wrote on average 2245 words (median 1350). 91% of students took notes in the platform during at least one lecture. Overall, students averaged approximately 200 words per class meeting. Students viewed the slide deck in the platform on average 125 times (median 114) during the term. 100% of the students viewed a slide deck at least once during this time. Furthermore, an average of 90% of students viewed the slide decks associated with each class meeting. Students viewed on average 60% (median 62%) of the length of the slide decks associated with each class time. Following class meetings, number of lecture captures viewed by students varied between 0 and 24 times for an average of 13.8. Students viewed on average 34% (median 30%) of the length of each lecture capture. Each student viewed at least 5% of one lecture during the term.

Based on classroom observations and student comments, students greatly appreciated the implementation and use of this tool during class meetings. Factors that contributed to this appreciation include low cost (no cost to the student; cost covered by the institution), low-stakes participation (students earn participation marks, no grade associated with correctness of answers), anonymity of revealed answers, and the ability to communicate with the professor (and other students) in private during class without exposing themselves publicly. Students felt that the instructor was listening to them during lectures and that the professor was able to provide prompt feedback (e.g. address confusions and/or common questions/comments on the "ask your prof" feature, or share thoughts on student answers to "clicker questions") in a more synchronous fashion. Students felt that the platform helped make classes more game-like. The opportunity to combine peer-instruction approaches with the various ways to ask questions made class fun, interactive, collaborative, and intellectually challenging, and made class time go by more quickly. Others indicated that the classroom approaches helped transform class time into a "study-zone". Some students even expressed a wish for longer class sessions! A large proportion of the students appreciated the ability to take and keep notes within the platform, and then access them wherever they went. Finally, students also liked being engaged with their own devices as they could consult the Internet at the ready during classroom activities

While the Echo360-ALP supported the implementation of strategies that reinforce the 7 principles of good teaching (Gamson and Gamson, 1987), notably activities encouraging student to student interactions, interactions between the students and the professor, and student interaction with the content (among others), the aim of this project was to investigate if student outcomes can be related to student engagement with the system. Because exam questions and difficulty may differ from year to year along with group abilities, and despite all the good intentions to formulate thoughtful and useful questions to assess student learning, final exam scores may not necessarily serve as good indicators of class success. An alternative way to assess classroom performance is through the use of concept inventories. Concept inventories are tools designed to help educators evaluate students' understanding of a specific set of concepts and identify misconceptions. Unlike typical MCQ tests, both questions and response choices are the subject of extensive research designed to determine both what a range of people think a particular question is asking and what the most common answers are. In its final form, the concept questions present both correct answers as well as distractors, which are incorrect answers based on actual commonly held misconceptions. Questions used in this test were aligned with the learning objectives of the course.

Among the students who completed both the pre- and post- assessment, normalized learning gains were normally distributed with a class average of 50%. Correlations and linear regressions were then used to assess whether student gains on the concept assessment test could be associated with student engagement within the Echo360-ALP system. Correlation was first used to assess the link between each learner metric, and between learner metrics and normalized gains on the concept assessment test. Correlation tests revealed very little links or no links between the Echo360-ALP learner metrics and normalized gains on the assessment. Stepwise backward linear regression was then performed to test for higher order interactions between learner metrics that may lead to differences in assessment gains. The generated predictor model accounted for 60% of the variance in normalized gains (p-value = 0.09), where very few interactions were deleted from the full model. Overall, these observations suggest significant and complex interactions between the Echo360-ALP learner metrics and associated gains on the concept assessment.

Using this model, the impact of the Echo360-ALP features on student outcomes was assessed by calculating the effect size of each of these features on the predicted assessment gains. The results demonstrate that while high attendance, the % of presentations viewed, # of video views, and the activity score positively impacted gains on the assessment, note taking within the platform and the length of video views may be negatively associated with these gains. Thus, attending class, participating in activities, and engaging in independent study appear to positively contribute to student gains on the concept assessment test.

The effect of feature usage on the probability of falling within a gains (on the assessment test) quartile was assessed by logistic regression. The results show that while the higher level activity participation and activity score increased the chances of students to fall within the 1st, 2nd and 3rd gains quartile, low participation and activity scores increased chances of students obtaining lower gains score, therefore falling in the 4th learning gains quartile. Finally, while attendance, note taking, presentation views (# viewed and length viewed) and video views (# viewed and length viewed) appear to have had very little to no impact on the probability of falling within the 1st and 2nd gains quartile, they seemingly had effects on those students falling in the 3rd and 4th gains quartiles. For example, higher note taking, and longer length of presentations and videos viewed increased the probability of obtaining lower learning gains. Predictively, the manner in which these students are using these features for studying purposes is impacting their conceptual understanding of the subject matter.

Conclusion

Historically the course has been regarded by students and instructors as one of the most difficult 1st and 2nd year undergraduate science courses and has typically had high failure rates. As in other higher education institutions, instructors attribute this reputation to a number of factors: little or no opportunities for the development in numeracy and thinking skill in the curricula; ineffective study habits (e.g. rote vs higher cognitive levels); larger focus on content coverage than student-centred outcomes; lack of familiarity with assessment strategies (e.g. assessment of conceptual understanding); and few opportunities to interact with genetics as a research model. The inclusion of the Echo360Active Learning Platform into the class component of the course has provided opportunities to redefine the classroom learning experience to one that is aligned with a student-centred classroom consistent with the institution's teaching and learning philosophy for blended learning courses, scientific teaching, and scholarly teaching. Does student engagement in the classroom in a blended learning course translate into successful learning? The Echo360-ALP facilitates active learning and formative assessment opportunities to improve student performance by offering a diversity of approaches to setup instruction and reflections on prior knowledge (to provoke thinking, stimulate discussions and induce cognitive conflicts); to develop knowledge (tackle misconceptions, exercise skills, and conceptual understanding, judging etc.); communicate (asking and answering questions); and assess learning (exit polls, probe limits of understanding, demonstrate success, and review). The platform also offers educators endless ways to engage student intellectual and affective domains and metacognition, while offering students the means to express themselves (even in a large group setting). The results of this study suggest that the level of students' engagement with the Echo360-ALP system can have impacts on their performance in the course. The degree to which students use features of the Echo360-ALP in and out of the classroom and the manner in which these contribute successfully (or unsuccessfully) to their conceptual understanding remains unknown and will be the focus of future studies. Engagement with the Echo360-ALP features and strategic use of each of these features in concert with one another could predictively play a significant role in learning outcomes. In these regards, it is therefore of essence for instructors to scaffold student use of the Echo360-ALP to ensure effective studying practices in and out of the classroom. To further help in these endeavours, the goal of future studies will be to dissect how the tool is used by the students and to formulate best practises for usage by students and instructors.

References

Anderson, T. (2003). Getting the mix right again: An updated and theoretical rationale for interaction. *The International Review of Research in Open and Distance Learning*, 4(2). Retrieved from http://www.irrodl.org/index.php/irrodl/article/viewArticle/149/230.

Bradforth, S. and Miller, E.R. (2015). Improve undergraduate science education. *Nature* 523, 282-284. Retrieved from http://www.nature.com/news/university-learning-improve-undergraduate-science-education-1.17954.

Caulfield, J. (2011). *How to design and teach a hybrid course – Achieving Student-Centered Learning Through Blended Courseroom, Online, and Experiential Activities*. Stylus Publishing, Virginia.

Chickering, A.W. and Gamson, Z.F. (1987). Seven Principles for Good Teaching in Undergraduate Education. *American Association for Higher Education & Accreditation Bulletin* 39, 3-7. Retrieved from http://www.aahea.org/articles/sevenprinciples1987.htm.

Handelsman, J., Ebert-May, D., Beichner, R., Bruns, P., Chang, A., DeHaan, R., Gentile, J., Lauffer, S., Stewart, J., Tilghman, S.M., and Wood, W.B. (2004). Scientific Teaching. *Science* 304, 521-522. Retrieved from http://www.jstor.org/stable/3836701?origin=JSTOR-pdf&seq=1#page_scan_tab_contents.

Herreid, C.F. (2006). "Clicker" Cases: Introducing case study teaching into large classrooms. *Journal of College Science Teaching*, 36(2), 43-47. Retrieved from http://sciencecases.lib.buffalo.edu/cs/pdfs/Clicker%20Cases-XXXVI-2.pdf.

Lundeberg, M.A., Kang, H.K., Wolter, B., delMas, R., Armstrong, N., Borsari, B., Boury, N., Brickman, P., Hannam, K., Heinz, C., Horvath, T., Knabb, M., Platt, T., Rice, N., Rogers, B., Sharp, J., Ribbens, E., Maier, K.S., Deschryver, M., Hagley, R., Goulet, T., Herreid, C.F. (2011). Context matters: Increasing understanding with interactive clicker case studies. *Education Technology Research Development* 59, 645-671. Retrieved from http://link.springer.com/article/10.1007/s11423-010-9182-1.

Piaget, J. (1950). *The psychology of intelligence*. New York, Harcourt Base.

Smith, M.K., Wood, W.B., Knight, J.K. (2008). The Genetics Concept Assessment: A New Concept Inventory for Gauging Student Understanding of Genetics. *Life Sciences Education* 7, 422-430. Retrieved from http://www.lifescied.org/content/7/4/422.full.pdf+html

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Challenges implementing social constructivist learning approaches: The case of Pictation

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Most medical professionals need to make meaning of clinical images collaboratively with colleagues. To develop this ability in our Health Sciences students, we designed a social constructivist learning activity where students jointly annotate clinical images via an in-house web application, Pictation. We conducted a case study with 85 third-year students using Pictation alongside lectures and tutorials. The learning activity was evaluated via a survey questionnaire, interviews, and observations. Three challenges in implementing a social constructivist learning activity were identified: students' inadequate prior knowledge; embarrassment in exposing inadequate understanding to peers; and need for certainty. These challenges pose particular dilemmas for teachers wanting to implement social constructivist learning because such learning approaches inherently imply that students: have incomplete prior knowledge; are willing to expose incomplete understanding to peers; and are comfortable with uncertainty. Our findings and recommendations can serve to guide teachers and academic developers in implementing social constructivist learning in realistic contexts.

Keywords: social constructivism; technology integration; medical education

Introduction

Medical practitioners (particularly pathologists, radiologists, ophthalmologists, dermatologists, and surgeons) are routinely asked to recognise and interpret abnormal physiological structure and function in images, such as patient photographs, x-rays, or micrographs. In practice, images are often interpreted collaboratively and by consensus opinion. Medical education should hence prepare students for collaborative demands by developing their ability to make meaning of clinical images with peers.

Social constructivist learning approaches can help students develop collaborative meaning-making by foregrounding social interaction. Vygotskian social constructivist theory holds that learning results from "internalisation" of social practices (Vygotsky, 1978, p. 56). Through social interaction (e.g., problem-solving as a group), learners transform knowledge from the social to individual planes, negotiating various meanings of a particular phenomenon to arrive at a shared understanding.

Strictly speaking, social constructivism provides a descriptive account of a particular learning process. However, drawing on descriptive learning theories, educational technologists can make inferences and prescriptions about how learning experiences should be designed (Reigeluth, 1989). In this sense, we "implement" social constructivist learning approaches in this case study.

Social constructivist principles have been shown to be effective for the teaching of pathology: for example, Canfield (2002) and Weurlander, Masiello, Söderberg, and Wernerson (2009) report on successful interventions where students collaboratively discussed and diagnosed cases.

We designed a similar social constructivist learning activity in a university pathology course, where students collectively annotated images and diagnosed cases via a web application called Pictation. Pictation was specifically designed for the sharing and annotating of digital images. Importantly, Pictation was designed to respect social constructivist principles: tutors can group students to work on particular images, making it possible to structure collaboration; students can reply to each other's annotations, enabling dialogue. A video clip on Pictation's full features (e.g., zooming and panning images; drawing shapes) is available at https://unitube.otago.ac.nz/view?m=Lib77198fqk.

Tutorial redesign

Pictation was implemented within a third-year university course, Principles of Pathology. This course's main objective was to develop students' understanding of normal and abnormal structure and function of the human body over a 12-week semester. Each week, students attended three lectures and participated in one tutorial on a particular topic (e.g., acute inflammation, chronic inflammation).

Pictation was used to enhance tutorials, rather than lectures, as tutorials gave students opportunities for discussion in small groups (approximately 15-20 students per tutorial). Students were expected to read lecture material and consider given case questions before tutorials. Drawing on textual information and photographs, case questions typically asked students to: describe pathological features depicted in the images; and suggest diagnoses. A typical tutorial question is shown below:

> PAS staining of kidney samples stain the basement membrane purple-pink. A normal kidney is shown in Image A, while a diabetic kidney is shown in Image B. Describe what you see in your case image (Image C) by annotating the image. What is your diagnosis?

Previously, tutorials typically ran as follows: working through case questions, tutors would ask individual students for answers and provide evaluative feedback on their responses. If a student could not answer a question, tutors would ask someone else, or provide the answer themselves. This Initiation-Response-Evaluation (IRE) communication pattern (e.g., "Can you see the neutrophils?"- "Is this one of them?"- "Yes") is typical in many classrooms (Cazden & Beck, 2003). In redesigning these tutorials, we aimed to shift class interaction from more didactic IRE to more dialogic discussions.

Case images previously were either black-and-white photographs in the students' individual tutorial workbooks, or laminated colour photographs handed out during tutorials. These images were problematic for three reasons: first, colour is often needed to discern pathological features; second, students could not keep the laminated colour images for future revision (some were observed using their mobile phones to photograph these colour images); and third, most importantly, it was difficult for students to discuss around these photographs, particularly when pinpointing and sharing areas of interest with their peers and tutor.

In 2015, we redesigned these tutorials with Pictation as follows: a few days before the tutorial, one to three pathology cases were posted on Pictation for students to solve. Pictures were assigned to groups (approximately 5-6 students per group), and students could log on as individual members of the group, in their own time, and: (1) annotate images with pathological observations; (2) comment on each other's annotations; and (3) ask questions where they were unsure of particular pathological features/diagnoses. Students were expected to solve cases as a group, using lecture material and each other's annotations as scaffolds. Students were encouraged to 'have a go' answering case questions even if unsure of their answers. Tutors could review student annotations before tutorials, glean common trends and misconceptions, and address these during tutorials.

We expected student misconceptions because we designed Pictation cases to be beyond individual problem-solving and achievable only via collective problem-solving. In other words, we designed cases to be within our students' Zone of Proximal Development (ZPD), defined as:

> the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (Vygotsky, 1978, p. 86)

We positioned Pictation as a space where students could articulate their developing and incomplete understandings, focussing on the process of collaborative meaning-making, rather than the 'correct' answer. Case questions were deliberately designed to be open-ended in order to exploit the plurality of meanings students make (Jonassen, 1991).

Social constructivist learning approaches have been widely reported as being relevant and valuable in higher education (Harland, 2012). However, few studies specifically document real-world challenges faced when implementing social constructivist learning activities. This is surprising given that constructivism, as a theoretical explanation of how learning happens, offers little to teachers in the way of practical advice or teaching strategies (Davis & Sumara, 2002; Karagiorgi & Symeou, 2005).

A few studies reporting problems implementing such learning approaches come from the field of International Education, where the implementation of learner-centred education (including social constructivist learning) in different countries is "riddled with stories of failure" (Schweisfurth, 2011, p. 425). For example, Zhu, Valcke, and Schellens (2010) reported that Chinese teachers (accustomed to more hierarchical cultures) expressed low support for social constructivist learning approaches, compared with Flemish teachers.

Other such studies come from the field of Educational Technology: Lee, Huh, and Reigeluth (2015) reported instances of intragroup conflicts when implementing collaborative learning approaches; Loke et al. (2012) described challenges in 'reining in' free exploration into fixed class times; and Valtonen, Havu-Nuutinen, Dillon, Kontkanen, Vesisenaho, and Pöntinen (2013) highlighted issues with getting students to value collaborative learning processes.

In this paper, we build on this literature, identifying potential challenges in implementing social constructivist learning, and proposing solutions that may guide teachers and academic developers to implement social constructivist learning approaches in realistic contexts.

Method

We conducted a case study with 85 third year dental students enrolled in the course Principles of Pathology at the University of Otago. The students were divided into five tutorial groups led by five different tutors. The authors played two roles in this research project: authors one and two were researchers observing the tutorials; author three was the course coordinator and also facilitated one of the tutorial groups.

We redesigned tutorials by integrating Pictation over a 12-week semester (February-May 2015). We evaluated the Pictation activity in three ways: (1) student use of Pictation; (2) a survey questionnaire; and (3) two focus group interviews. Ethical approval was obtained from the university's human ethics committee.

To evaluate student use of Pictation, we collected data from the system database and logs, and observed student interaction in face-to-face tutorials. We observed low participation by students, both in terms of total number of annotations on images, and the rarity of student-student interaction in the online comments: students typically labelled discreet areas of images independently, and we observed few or no replies/questions between students (see Figure 1). Also, the quality of individual comments was relatively shallow: responses were usually single-word diagnoses with no explanatory details showing how students arrived at their conclusions.

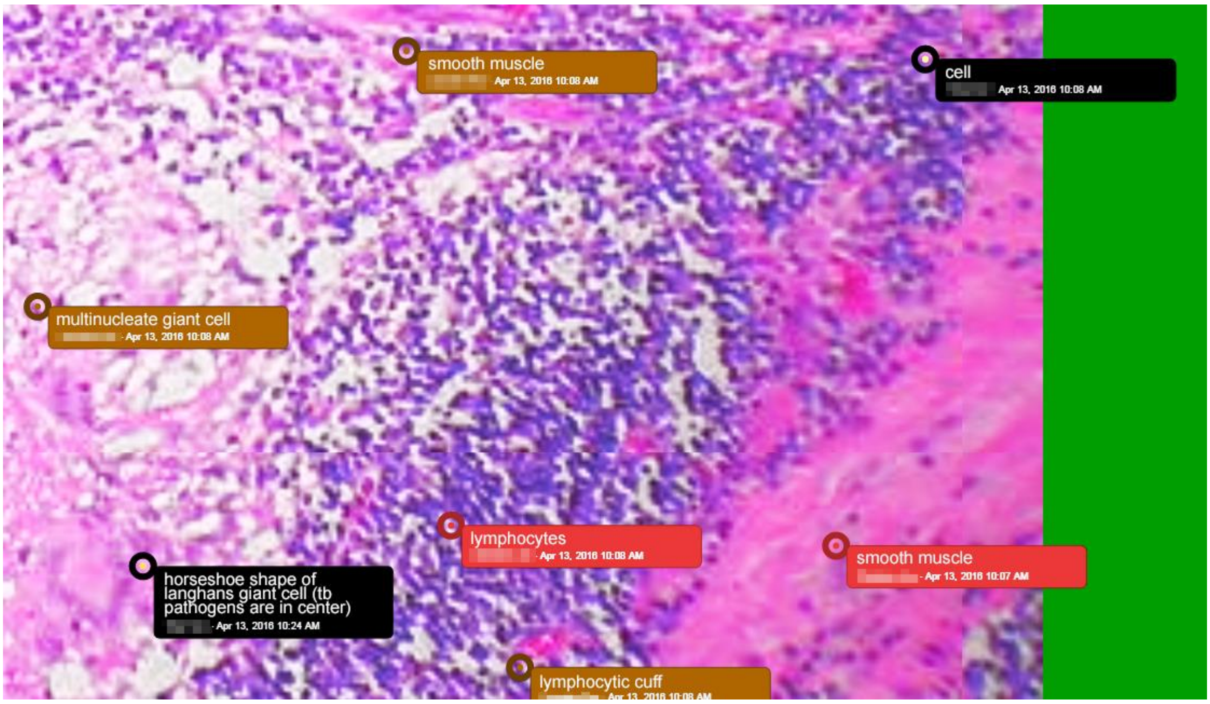

Figure 1: Typical example of student-annotated Pictation image. Annotations were usually made by only a few students in each group independently.

We gathered student perceptions of the Pictation learning activity through a questionnaire comprising eight Likert-scale and two open-ended questions. The questions interrogated:

- general aspects of the pathology course (e.g., To what extent did attending lectures improve your understanding of the principles of pathology? To what extent did attending tutorials improve your understanding of the principles of pathology?); and
- specific features of learning with Pictation, adapted from Gilbert and Driscoll's (2002) instructional conditions for social constructivist learning environments (e.g., To what extent did working in a group on Pictation improve your understanding of the principles of pathology? To what extent did working on questions in your own time improve your understanding of the principles of pathology?).

Our evaluation of the Pictation learning activity revealed mixed success: only 37% of respondents (n=26) found annotating images using Pictation, and only 21% of respondents (n=15) found working in a group on Pictation helped them understand the principles of pathology. Given the mixed results, we decided to further interrogate the challenges students faced in participating in the Pictation learning activity. In this paper, we identify challenges encountered and lessons learnt from an educational technology initiative that did not meet initial expectations.

In the questionnaire, students were asked to rate the usefulness of the Pictation annotation activity and explain their responses; students frequently wrote about their challenges in the open-text responses. To understand students' challenges, we analysed these open-text responses according to Thomas' (2006) general inductive approach, suitable for analysing qualitative course evaluation data. Authors one and two read all the open-text responses and, individually, created and assigned categories to every response. Then the two authors met to negotiate their categories (e.g., "Good for self-study" and "Good for revision" were combined into "Good for revision"), and finally arrived at the distribution of categories shown in Figure 2.

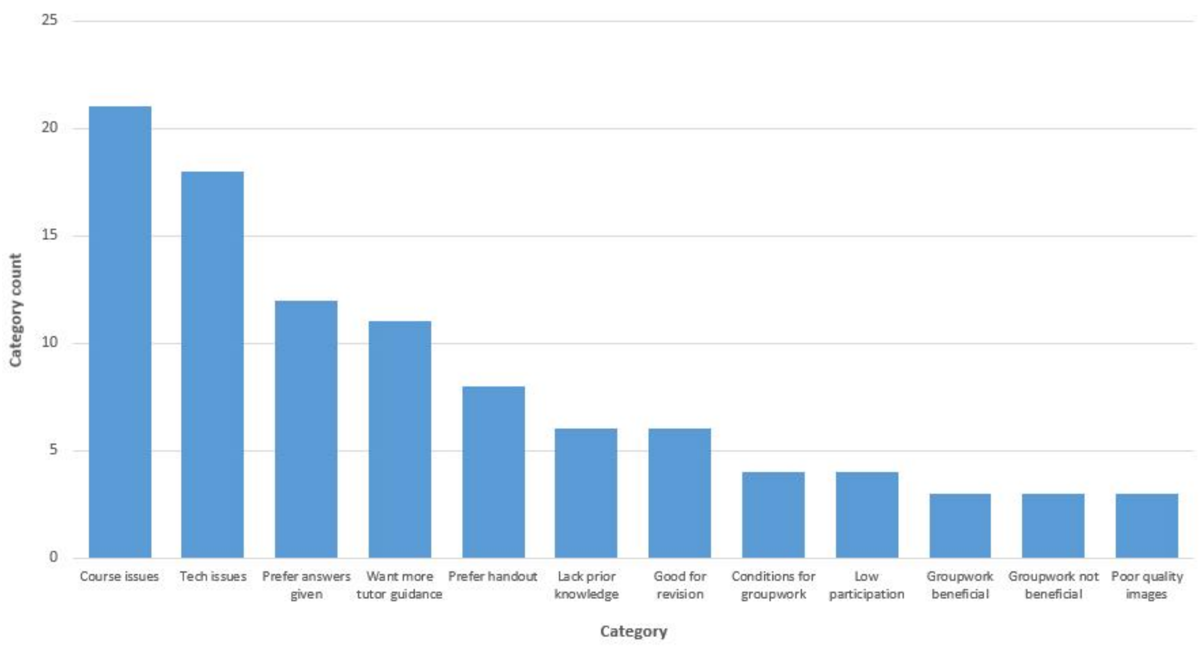

Figure 2: Distribution of categories from open-text responses.

While students frequently wrote about challenges in their open-text responses, they also wrote about things unrelated to challenges (e.g., Pictation was good for revision). Referring only to categories related to students' challenges, we designed questions for two focus group interviews. Since the aim of the focus groups was to deepen our understanding of student challenges in learning in social constructivist ways, we excluded from the interview questions issues not directly related to the Pictation learning activity: for example, logistical course issues or technical issues that had already been resolved.

We conducted two hour-long focus group interviews (FG1 and FG2) with students to follow up responses to the questionnaire. These group interviews were conducted with two of the tutorial groups noted to have the most overall use of Pictation. The interviews gave us a better understanding of students' challenges, and the relative importance of these challenges: for example, while only hinted at in the questionnaire, students' discomfort with exposing their inadequate understanding to peers emerged as an important challenge in the focus groups.

Findings and discussion

Analysis of the questionnaire and interviews highlighted three primary challenges of implementing social constructivist learning in the Pathology tutorials:

- inadequate prior knowledge;
- embarrassment in exposing one's inadequate understanding to peers; and
- need for certainty.

We will now describe and discuss these challenges sequentially.

Inadequate prior knowledge

We initially planned for students to collectively solve case questions before the tutorial. We assumed that students would be able to engage in the pre-tutorial activity because they were third-year students for whom the topic was not totally new: Kirschner, Sweller, and Clark (2006) found that novice learners in constructivist environments often lacked necessary prior knowledge to integrate new information, but that non-novice learners would benefit from such minimally guided activities.

The aim of the pre-tutorial activity was to give students a group space to explore and articulate their developing understandings of pathological features before being given correct answers in class. However, in the questionnaire, only 29% of students found the ability to annotate images prior to tutorials helpful in understanding the principles of pathology. In the open-text comments from the questionnaire, students identified their lack of prior knowledge as a limiting factor for engaging with the Pictation activity:

> I struggled to comprehend what I was supposed to see, although it makes more sense once we've gone through it [during the tutorial].
>
> We didn't understand the pictures very much, but I think that's more on our behalf.
>
> It was helpful going through the images during the tutorial, but not trying to do them at home because I had little idea of what I was looking at until I got to the tutorial.

We further explored their lack of prior knowledge in the focus group interviews. Several students supported the view that lack of prior knowledge hindered their participation in the pre-tutorial Pictation activity: "[some] things that we are labelling are so far out and no one knew what was going on" (Student 5, FG1); "labelling the pictures before we had gone over them in the tutorials was difficult" (Student 4, FG1). Seemingly, the Pictation case questions were beyond our students' ZPD.

However, some students said they could participate in the pre-tutorial Pictation activity, provided they first engaged in some form of self-directed learning:

> I annotated the ones that I could understand quite well (...) [and for the questions I was unsure of] I found myself doing more research when I answered Pictation questions (...) I researched the textbook and stuff. (Student 13, FG2)

Similarly, Student 12 (FG2) reported that she "Googled" in order to attempt the pre-tutorial activity, adding that the learning activity "forces you to do the background study". That some students engaged in self-directed "background study" was one serendipitous outcome of the project. However, most students did not engage in self-directed learning, and hence lacked the necessary prior knowledge to participate in the learning activity (even after attending relevant lectures).

This challenge poses a particular dilemma for teachers wanting to implement social constructivist learning because such approaches inherently imply that students have incomplete prior knowledge. Well-designed social constructivist activities should be within students' ZPD: beyond individual problem-solving, but achievable via collective problem-solving. However, current research offers little guidance to teachers regarding how much prior knowledge would be incomplete but adequate (Wass & Golding, 2014). To make our activity more achievable, we could have designed easier case questions or positioned the Pictation activity post-tutorial (suggested by some students). However, this would likely result in a learning activity achievable by individual problem-solving, and not requiring collaborative meaning-making (as intended).

To design learning activities that better align with students' ZPD, we recommend that teachers:

- design case questions of varying difficulty (e.g., an easy Q1 and a difficult Q2) and adjust difficulty as students progress to situate activity within students' ZPD;
- group students of differing abilities together and encourage them to help each other; and
- suggest ways for students to participate even when they are unsure (e.g., Student 12 mentioned that she would add question marks to annotations when she was unsure of her answers).

However, even if we address students' inadequate prior knowledge (e.g., designing activities that encourage student participation even with gaps in their understanding), we may still face a social challenge associated with exposing one's incomplete understanding to peers. This emerged as our second challenge from the survey responses and focus group interviews, and is discussed below.

Embarrassment in exposing one's inadequate understanding to peers

Students were generally uncomfortable exposing their inadequate understanding to peers, and hence were reluctant to engage with the group annotation activities. We had not anticipated this challenge when designing the Pictation activities; we assumed our students would be comfortable with collaborative learning as collaboration and teamwork are explicitly promoted as graduate attributes in Health Science courses (Rudland & Mires, 2005). Our assumption was reinforced because this group of students had studied together for the past three years.

However, from our questionnaire, only 21% of students found working in a group on Pictation helped them better understand the principles of pathology. Comments from the questionnaire and focus groups revealed many students felt uncomfortable annotating images incorrectly in front of peers:

> Was often worried about labelling diagrams in case I was wrong and everyone could see.
>
> I wouldn't mind if it was just myself and the tutor. I wouldn't mind putting what I thought was wrong, and no one else could see it.
>
> You basically publicly embarrass yourself.

Some students remarked that they were comfortable exposing incomplete understanding in front of some peers, but not others: "I'm comfortable with this group, not with other groups... because I know that [this group] won't judge me for giving the wrong answer" (Student 13, FG2). In general, encouraging students to articulate inadequate understanding publicly is a known challenge in higher education (Fritschner, 2000), particularly in more competitive courses: for example, the competitive first year Health Science course in New Zealand (from which our students graduated) leaves some students feeling "pitted against each other from the start" (Jameson & Smith, 2011, p. 60). Such students may hence be unwilling to expose any 'weaknesses' to peers.

As stressed above, social constructivist learning activities inherently require student participation with incomplete understanding, and assume students are willing to expose their incomplete understandings to peers. This assumption should be questioned and addressed when implementing social constructivist activities.

Some students suggested that anonymising annotations might make them more willing to expose inadequate understanding. However, this is not recommended because ownership of the emerging body of knowledge is a crucial characteristic of social constructivist learning (Scardamalia & Bereiter, 2006).

To design learning activities where students are more comfortable exposing inadequate understanding, we recommend that teachers:

- create safe learning environments. Palloff and Pratt (2007) provide useful strategies for creating a safe environment for online learning: for example, the establishment of ground rules that respect a diversity of views, so students feel safe in expressing themselves without fear of punishment; and
- position these learning environments as spaces where students can deliberately explore and articulate their incomplete understandings.

As before, even if we successfully make students comfortable in exposing inadequate understanding to peers, we may still face a challenge if students are solely concerned with getting 'correct' answers. This emerged as the third principal challenge and is discussed below.

Need for certainty

We initially planned for students to solve case questions on Pictation by themselves, foregrounding the multiple meanings students make and their collective negotiation to reach a shared understanding. However, from the questionnaire, students expressed that they preferred to be given the correct answer, the lack of which hindered their participation in the Pictation activity:

> There was uncertainty of being correct.
>
> Never know if what is on Pictation is right.
>
> Please give us some examples of fully-labelled, correct answers. Otherwise, it is the blind leading the blind.

Students expanded on this need for certainty in the focus group interviews:

> many people liked annotating the pictures during the tutorial [when the tutor is giving the answers], so they actually know it's right (Student 1, FG1)
>
> that will be the correct answer because it's what I got from [tutor] (Student 14, FG2).

In the same vein, many students expressed that Pictation was a good tool for revision, provided that correctly-labelled images were given: 61% responded in the questionnaire that reviewing Pictation images post-tutorial was beneficial to their understanding. Interestingly, one student did highlight a benefit of articulating incorrect responses: "at least you know what you don't know, instead of [not knowing] what you don't know" (Student 15, FG2). Few other students shared this view.

Again, this challenge is particularly problematic for teachers wanting to implement social constructivist learning because these approaches generally require students to be comfortable with the uncertainty of "consensus between individuals" (Adams, 2006, p. 246) and not need to be told the "final answer" (Student 12, FG2).

To design social constructivist learning activities where students are more comfortable with uncertainty, we recommend that teachers:

- design open-ended case questions that genuinely allow multiple meanings to be made; and
- reassure students that correct answers will be given after (a) student participation in pre-tutorial activities and (b) the class has discussed possible answers during tutorials.

Some students made this last recommendation in their free text comments: "It would be great if answer is provided after the tutorial"; "Have correct labelling available afterward". Nonetheless, one student warned that if students knew correct answers were forthcoming, few would likely attempt the pre-tutorial activity (Student 13, FG2).

Conclusion

We designed a social constructivist learning activity to help students learn to make meaning of clinical images collaboratively. We identified three challenges in implementing social constructivist learning related to: inadequate prior knowledge; embarrassment in exposing one's inadequate understanding to peers; and need for certainty. These challenges are related to inherent characteristics of social constructivist learning: we speculate that we are grappling with specific interminable tensions between theory and practice.

We propose seven recommendations to address the above challenges:

- design social constructivist activities of varying difficulty and adjust the difficulty as students progress to situate activities within students' ZPD;
- group students of differing abilities together and encourage them to help each other;
- suggest ways for student participation even when they are unsure;
- create safe learning environments;
- position activities as spaces for deliberately exploring and articulating incomplete understandings;
- design open-ended activities that genuinely allow multiple valid meanings to be made; and
- reassure students that correct answers will be given after (a) participation in the activity and (b) possible answers are discussed collectively.

Our future work will involve implementing these recommendations into the 2016 Principles of Pathology curriculum, as well as integrating Pictation into other courses, such as Medicine and Radiology.

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References

Adams, P. (2006). Exploring social constructivism. *Education 3-13*, *34*(3), 243–257. http://doi.org/10.1080/03004270600898893

Canfield, P. J. (2002). An interactive, student-centered approach to teaching large-group sessions in veterinary clinical pathology. *Journal of Veterinary Medical Education*, *29*(2), 105–110.

Cazden, C. B., & Beck, S. W. (2003). Classroom discourse. In A. C. Graesser, M. A. Gernsbacher, & S. R. Goldman (Eds.), *Handbook of discourse processes* (pp. 165–198). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Davis, B., & Sumara, D. (2002). Constructivist discourses and the field of education. *Educational Theory*, *52*(4), 409–428. http://doi.org/10.1111/j.1741-5446.2002.00409.x

Fritschner, L. M. (2000). Inside the undergraduate college classroom. *The Journal of Higher Education*, *71*(3), 342. http://doi.org/10.2307/2649294

Gilbert, N. J., & Driscoll, M. P. (2002). Collaborative knowledge building. *Educational Technology Research and Development*, *50*(1), 59–79. http://doi.org/10.1007/BF02504961

Harland, T. (2012). *University teaching*. New York, NY: Routledge.

Jameson, M., & Smith, J. (2011). Voices of students in competition. *The New Zealand Medical Journal*, *124*(1338), 55–67.

Jonassen, D. H. (1991). Objectivism versus constructivism. *Educational Technology Research and Development*, *39*(3), 5–14.

Karagiorgi, Y., & Symeou, L. (2005). Translating constructivism into instructional design. *Journal of Educational Technology and Society*, *8*(1), 17–27.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work. *Educational Psychologist*, *41*(2), 75–86. http://doi.org/10.1207/s15326985ep4102_1

Lee, D., Huh, Y., & Reigeluth, C. M. (2015). Collaboration, intragroup conflict, and social skills in project-based learning. *Instructional Science*, *43*(5), 561–590. http://doi.org/10.1007/s11251-015-9348-7

Loke, S.-K., Al-Sallami, H. S., Wright, D. F. B., McDonald, J., Jadhav, S., & Duffull, S. B. (2012). Challenges in integrating a complex systems computer simulation in class. *Australasian Journal of Educational Technology*, *28*(4), 671–683.

Palloff, R. M., & Pratt, K. (2007). *Building online learning communities* (2nd ed). San Francisco, CA: Jossey-Bass.

Reigeluth, C. M. (1989). Educational technology at the crossroads. *Educational Technology Research and Development*, *37*(1), 67–80.

Rudland, J. R., & Mires, G. J. (2005). Characteristics of doctors and nurses as perceived by students entering medical school. *Medical Education*, *39*(5), 448–455. http://doi.org/10.1111/j.1365-2929.2005.02108.x

Scardamalia, M., & Bereiter, C. (2006). Knowledge building. In K. Sawyer (Ed.), *Cambridge Handbook of the Learning Sciences* (pp. 97–118). New York: Cambridge University Press.

Schweisfurth, M. (2011). Learner-centred education in developing country contexts. *International Journal of Educational Development*, *31*(5), 425–432. http://doi.org/10.1016/j.ijedudev.2011.03.005

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation*, *27*(2), 237–246. http://doi.org/10.1177/1098214005283748

Valtonen, T., Havu-Nuutinen, S., Dillon, P., Kontkanen, S., Vesisenaho, M., & Pöntinen, S. (2013). Challenges with social software for collaboration. *International Journal of Media, Technology and Lifelong Learning*, *9*(1), 18–31.

Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Wass, R., & Golding, C. (2014). Sharpening a tool for teaching. *Teaching in Higher Education*, *19*(6), 671–684. http://doi.org/10.1080/13562517.2014.901958

Weurlander, M., Masiello, I., Söderberg, M., & Wernerson, A. (2009). Meaningful learning. *Medical Teacher*, *31*(6), e248–e253. http://doi.org/10.1080/01421590802637933

Zhu, C., Valcke, M., & Schellens, T. (2010). A cross-cultural study of teacher perspectives on teacher roles and adoption of online collaborative learning in higher education. *European Journal of Teacher Education*, *33*(2), 147–165. http://doi.org/10.1080/02619761003631849

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Using Gamification and Mixed Reality Visualization to Improve Conceptual Understanding in ICT System Analysis and Design

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This paper presents a research design and intervention that investigates how the use of mixed reality visualization and gamification can be applied to an ICT systems analysis and design course. The research focuses on a learning approach of an ICT modelling and design framework based on visual augmentation of traditional course content and class delivery. Assessment of the learning impact in regards to learners, system components and their interaction in system scenarios will be performed. Allowing learners to explore and discover information in the form of a gamified *scavenger hunt* that supports scaffolding learning chunks, aims to assist them towards a conceptual understanding of the solution. Educators can incorporate selected representations of key learning artefacts and resources in an augmented capacity using a variety of media such as 2d images, videos, graphics, simulations, and 3d models applied into the design process and promote active learning in the classroom.

Keywords: mixed reality, gamification, visualization, modelling and design, systems analysis

Introduction

In this fast changing digital economy, there has been an increase in the dependency on Information Systems (IS) and technology requirements across organizations (Adams et al., 2016) .With the increasing compliance between business strategies and Information Communication and Technology (ICT) design, system modelling is becoming a very relevant skill to learn (Furian et al., 2014). However, learners face increasing difficulties in conceptualizing (Moreno and Mayer, 2007) and understanding abstract concepts particularly in System Analysis and Design (SAD) (Wu et al., 2013).

Learners are challenged to conceptualize without a real world reference model, or specific visualizations of the system under investigation. This can lead to learning disconnection and therefore disengagement (Barjis et al., 2012; Fayoumi and Loucopoulos, 2016). Gamification is one potential solution to improve students' motivation and engagement in the chunking and scaffolding of information necessary to build complex systems models and to involve them into an active learning process (Dominguez et al., 2013; Hamari, Koivisto and Sarsa, 2014; Kim, 2015; Starks, 2014).

Simulations and game-based learning approaches are gaining popularity when analyzing and designing complex systems (Barjis et al., 2012). According to Prensky, Aldrich and Gibson (2007), there is an integration between innovation and technology, leading to the increasing use of visualizations (Martin et al., 2011), mixed reality (Adams et al., 2016) and game-like learning environments (Barjis et al., 2012) in higher education. These environments can be ubiquitous across desktop, web or mobile applications (Dominguez et al., 2015).

In conjunction, gamification has started to change the way training, assessment and motivation is done in business, marketing, management and sustainability initiatives (Dicheva et al., 2015), but its increasing usage and application in education and engineering is still a terrain to explore. Robson et al. (2015) acknowledges that gamification can change participants' behaviors as reinforcement and emotions are key drivers of human behaviors, which links well with education motivation and learning through visualization.

The use of visualization through multi-dimensional graphics and simulation could provide an opportunity to present key learning content for students using multiple representations (Martin et al., 2011; Wang et al., 2013; Wei et al., 2015). Augmented visualization and gamification may help to create new teaching dimensions that can increase students' motivation, attention, confidence and satisfaction and stimulate a deeper understanding of complex problems and content learning (Fayoumi and Loucopoulos, 2016; Wei et al., 2015; Wu et al., 2013).
In particular, a visual representation, images or simulations could overlay solutions, complement content and facilitate understanding when a written narrative fails to communicate a concept or a given problem (Sankey, Birch and Gardiner, 2011; Starks, 2014). Therefore, the use of mixed reality and gamification in SAD curricula has the potential to link conceptual and practical activities.

According to Siau and Loo (2006), Unified Modeling Language (UML) is the standard modeling language for object-oriented modeling, learning UML becomes essential for the majority of novice designers, as well as some proficient analysts. An essential question that arises from this research is how augmented visualization and gaming can be used as a bridge to advance students from the use of traditional UML language to comprehensively address the dynamics of a system design and improve students' conceptual understanding of modelling.

Background

According to Satzinger, Jacson and Burd (2015, p. 5) *System Analysis and Design is an iterative process where analysts build models to represent the real world using Unified Modelling Language*. Traditional delivery methods of systems modelling using UML rely on paper and pencil or abstract design tools such as MS Visio, Smartdraw or Conceptdraw diagram software (Brandt, 2013). This approach to modelling can be difficult for novice learners to understand because the concepts need to be understood first as no feedback is provided when using traditional modelling tools (Schenk, Vitalari and Davis, 1998).

Research shows that learners do not process the entire conceptual modelling of information. Instead, they focus on specific areas and components of the model and connect their understanding by integrating pieces and portions of the model (Gemino and Wand, 2005). As a result, learners are becoming disengaged, as they find it hard to understand the connection between the concepts and model components without a visual learning aid (Estapa and Nadolny, 2015; Wei et al., 2015). Therefore, scaffolding (Starks, 2014) theoretical systems models, particularly around the complexities of SAD can assist learners understand concepts. This enables them to gain conceptual understanding of design rational and how components and connections develop (Fayoumi & Loucopoulos, 2016; Sedrakyan, Snoeck & Poelmans, 2014).

The use of visualization and game-like learning environments increase social contact and collaboration and include motivational elements such as curiosity, challenge and healthy competition between students (Dicheva et al., 2015; Dominguez et al., 2013; Robson et al., 2015). Adding a gamified layer to a core activity rather than a full activity game allows learners to connect key concepts and their representations and therefore to increase user experience and engagement (Hamari, Koivisto and Sarsa, 2014).

In addition, learning environments may include more than one instructional approach. For example, a mixed reality environment can be designed in a game situation, adapting location-based learning (Wu et al., 2013). Through mobile devices learners can access important information as they arrive at pertinent locations; for example, students could discover a campus or school or information in the form of a *scavenger hunt* (Kim, 2015). Geolocation used in dispersed population could be advantageous as students could capture data or contribute to the creation of information and make them available to others (Sharples, 2013).

The use of novel educational technologies and approaches such as visualization and gamification opens up opportunities for researchers to investigate and design enhanced, interactive and more dynamic curriculum for learners. AR improves SAD courses in several ways, for example students' motivation increases when they can enjoy the process of learning and therefore course comprehension is improved. By incorporating immersion, navigation and interaction using AR, confidence, relevance and attention can be improved. Additionally, by integrating multiple sources of information while learning, AR can reduce the cognitive workload of learners (Neumann and Majoros, 1998) and allow them to focus on a particular component of the system. The cycle of building and modelling using AR can be an educational experience in itself compared to a traditional approach because it allows students to receive feedback enabling them to connect the real and the virtual scenario. The challenge in a SAD course is for learners to integrate concepts to be used by mixing technology and learning styles (Wei et al., 2015).

According to Mayer (2005) multimodal learning environments deliver instructional materials in many sensory styles. Accordingly, students that participate in a multimodal learning approach outclass learners who learn using traditional learning methods. These sets of tools are considered supportive for teaching delivery. In some situations student's learning success are determined by their ability to visualize and manipulate multidimensional materials using technology skills to thrive in the digital economies (Sankey, Birch and Gardiner, 2011).

Therefore, this research proposes an intervention for enhancing learners' understanding of SAD through augmenting traditional course content and delivery. The use of visualization, mixed reality, and gaming activities will be used to enhance learner understanding, involvement and motivation. The context for this study is a traditional face-to-face delivered undergraduate ICT SAD course at an Australian University using multiple classes. Mixed reality intervention and gamification is expected to improve Systems comprehension, conceptual understanding and engagement of students undertaking the course when compared to traditional classroom approaches of static UML. The research questions are as follows: RQ1: Does gamification and simulations allow students to visually learn about components of the system and their interaction? RQ2: Can students learning of modelling and design be improved by incorporating gamification and mixed reality learning environments into teaching practices? RQ3: Does the use of gamification in teaching enhance students' conceptual understanding compared to a traditional UML approach?

Research Design and Methods

An action research methodology will be used to capture data to answer the research questions. The research questions seek to assist in the development of a framework and to identify the attributes of future interventions. The natural cyclical setting of action research involves four dynamic steps: planning, action, observation and reflection that allow researchers to critically reflect on their actions and provide a structure for practice and improvements (Kemmis and Mc Taggart, 2005). The reflective nature of action research and its attention to practical outcomes is suitable when innovation and evaluation in teaching and learning is applied (Hodgson, Benson and Brack, 2013).

Experiment Design

Participants for this research will be 50 students enrolled in an undergraduate ICT System Analysis and Design course at an Australian University. Action research will be conducted using a multilayered visualization and will be implemented into three standard tutorial classes. All students will have access to the visualization intervention as per ethics requirements to collect data from students. The research design will incorporate tools, technology and methodologies to promote learning communication, creativity and motivation.

The approach for the experiment is to divide students into two groups A and B; taking one group out of the classroom and having this group discover learning chunks by using location based activities that feature some elements of game playing to create a systems model. Students will need to interact with their campus or community of learning, find information in a scavenger mode, and complete certain steps to connect their findings. Students will be using a mobile or tablet with a custom mixed reality application developed in Unity 3D with the Vuforia AR plug-in. As students move throughout the campus, fiduciary markers will be encountered to access chunks of game-related information that are found using the geolocation method.

The other group of students will be using the traditional approach using paper and pencil and MS Visio tool to complete UML exercises. For this purpose, students will work on different levels of the exercises and all students under experimental conditions will have access to the intervention and technology by rotating students. Student learning outcomes in the experimental conditions will be compared with the traditional approach using SPSS. The goal is to provide research data on those completing the exercise in the traditional way with those completing the intervention after implementation. Qualitative data will be analysed using NVivo to identify significant themes presented in students' survey feedback.

The requirements of the system that are examined will define the parts of the system that have to be analysed and modelled. In this case the stakeholders (researchers and tutors) will outline criteria and propose pragmatic limitations of the model. Instructions given related to the visualization intervention and model constructions will assist students to comprehend conceptual understanding of the model rationale. In particular, components of the key aspects of the problem will be modelled. The framework used for the intervention, adapted from Dominguez et al., (2015) and develop further by the authors is termed *5CT building framework*. This framework aims to assist students to find and develop blocks of information and connect them as part of the building model blueprint (see figure 1).

Fig 1. 5CT modelling framework

The first brick of the frame will be called *components* these are the parts of the system in discussion that are to be found. The second brick will be called *cases*, where a brief case description has to be completed by students. The third brick will be called *connection* where specific tasks have to be defined and matched to the *cases*. The fourth brick will be called *compilation* where the students connect relevant parts of each of the 4C steps to finally *construct* the model solution, completing the 5CT building framework to obtain a trophy as part of the gamified learning progression. Intermediate and advanced levels will be introduced to reinforce concepts for students and to help them to develop models of different levels of difficulty.

Research methods

Pre- and post- testing will be performed with students group A and B on different tutorial exercises. Data regarding students' learning outcomes in different conditions will be compared using a quantitative approach. The goal is to provide research data on those completing the exercises with the traditional UML approach to teaching modelling and those completing the exercises after implementation of the gaming/mixed reality intervention. Student learning outcomes in the experimental conditions will be compared with the traditional approach by using SPSS to help analyze quantitative data.

The students will be surveyed and the zones of improvements will be identified based on their actions. Additionally, by interviewing participants, the aim is to explore students' conceptual understanding, how learners break down the problems and integrate components to design an ICT model. Qualitative assessment exploring student motivation, communication, engagement, and their satisfaction on performing activities will be performed. The utilization of a 5-point Likert scale can quantitatively assess students *feeling* about using the new visualization tools, by comparing their perception before and after the intervention. Finally, focus groups will be used to reflect on conducting the research and allow the researchers to formulate action and planning by incorporating students' feedback. In addition, the reflections gathered will lead the investigation to the next planning stage.

Conclusions

This proposal has presented an intervention using mixed visualization and gamification to assist understanding the complexities of teaching and learning System Analysis and Design in an ICT subject in an Australian University. This study proposes a framework to support students' conceptual understanding using gaming and visualization alongside the instructions given while building their models. This investigation has proposed that the use of gamification and visualization can enhance a traditional teaching approach to modelling in the classroom; by using these techniques practitioners may promote active engagement by providing challenges to continue playing the game. These approaches will lead to an improved learning process and student outcomes compared to a traditional approach. Students will be able to work together and to share their findings, experiences and observations of the gameplay learning process.

The research design uses an action research framework and a combination of research methods: qualitative interviews, focus groups, surveys and quantitative questionnaires. These approaches will assist in gathering data and information for comparison and analysis as well as providing evidence on whether the intervention and implementation have made a difference in regards to conceptual understanding. Through the results of this work we can expect by integrating visualization and model construction the conceptual understanding of ICT modelling and design will be improved. Researchers and academics can use visualization and gamification techniques to create new learning opportunities for different learning styles and to incorporate techniques such as game challenges, hints and puzzles. For future research the use of visualization tools and gamification in ICT subjects has the potential to increase student motivation, enjoyment and engagement in learning in addition to improving comprehension of the system being engineered.

References

Adams Becker, S., Cummins, M., Davis, A., & Yuhnke, B. (2016). NMC Technology Outlook for Australian Tertiary Education: A Horizon Project Regional Report. Austin, Texas: New Media Consortium.

Barjis, J., Gupta, A., Sharda, R., Bouzdine-Chameeva, T., Lee, P.D & Verbraeck, A. (2012). Innovative teaching using simulation and virtual environments, *Interdisciplinary Journal of Information, Knowledge and Management*, 7(1), 237-255.

Brandt, C. (2013). *Review: Smartdraw 2013 Helps You Go With The Flow*. Retrieved from: http://www.pcworld.com/article/2025308/review-smartdraw-2013-helps-you-go-with-the-flow.html

Dicheva, D., Dichev, C., Agree, G., & Angelova, G (2015). Gamifying in Education: A systematic mapping study, *Educational Technology and Society*, 18(3), 75-88.

Dominguez, A.D., Saenz-de-Navarrete, J., de-Marcos, L., Fernandez-Sanz, L., Pages, C., & Martinez-Herraiz, J.J. (2013). Gamifying learning experiences: Practical implications and outcomes, *Journal of Computer and Education*, 63, 380-392.

Estapa , A., & Nadolny, L (2015). The Effect of an Augmented Reality Enhanced Mathematics lesson on Student Achievement and Motivation, *Journal of STEM education*, 16 (3), 40-48.

Fayoumi, A., & Loucopoulos P. (2016). Conceptual modelling for the design of intelligent and emergent information systems, *Journal of Expert Systems with Applications*, 59, 174-194.

Furian, N., O'Sullivan, M., Walker, C., Vossner, S., & Neubacher, D. (2015). A conceptual modelling framework for discrete event simulation using hierarchical control structures, *Journal of Simulation Modelling Practice and Theory*, 56(1), 82-96.

Gemino, A., & Wand, Y. (2005). 'Complexity and Clarity in conceptual modelling: Comparison of mandatory and optional properties', *Data and Knowledge Engineering*, 55, 301-326.

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work? A literature review of empirical studies on gamification, *47th Hawaii International Conference on System Science*, 3025-3034.

Hodgson, Y., Benson, R., & Brack, C. (2013). Using action research to improve student engagement in a peer-assisted learning programme, *Educational Action Research*, 21(3), 359-375.

Kim, B. (2015), *Understanding Gamification' Library Technology Reports*, 51(2), pp. 20-28.

Kemmis, S., & Mc Taggart, R., (2005). *Participatory action research: Handbook of qualitative research*, 271-330.

Martin, S., Diaz, G., Sancristobal, E., Gil, R., Castro, M., & Peire, J. (2011). 'New technology trends in education: Seven years of forecast and convergence', *Journal of Computer and Education*, 57, 1893-1906.

Mayer, R.E. (2005). *Cognitive theory of multimedia learning*. The Cambridge handbook of multimedia learning, 31-48.

Moreno, R., & Mayer, R.E. (2007). Interactive Multimodal Learning Environments, *Journal of Educational Psychology*, 19, 309-326.

Prensky, M., Gibson, D., & Aldrich, C (2007). *Games and simulation in online learning: Research and development frameworks*. Hershey USA: Information Science Publishing.

Robson, K., Plangger, K., Kietzmann, J.H., McCarthy, I., & Pitt, L. (2015). Is it all a game? Understanding the principles of gamification, *Business Horizons*, 58, 411-420.

Sankey, M.D., Birch, D., & Gardiner M.W. (2011). The impact of multiple representations of content using multimedia learning outcomes across learning styles and modal preferences, *Journal of Education and Development*, 7(3),18-35.

Satzinger, J.W., Jackson, R.B., & Burd, S.D. (2015). *Systems analysis and design in a changing world.* (7th ed.). Boston MA: Cengage learning.

Sedrakyan, G., Snoeck, M., & Poelmans, S. (2014). Assessing the effectiveness of feedback enabled simulation in teaching conceptual modelling, *Journal of Computers and Education*, 78, 367-382.

Schenk, K.D., Vitalari, N.P., & Davis, S. (1998). *Differences between novice and expert systems analyst: what do we know and what do we do?, Journal of Management Information Systems*, 15(1), 9-50.

Sharples, M (2013). Mobile Learning: Research, Practice and Challenges, *Institute of Educational Technology*, 3 (5), 5-11.

Siau, K., & Loo, P. (2006). Identifying difficulties in learning UML, *Information System Management*, Vol. 23, 3, 43-51.

Starks, K. (2014). Cognitive behavioral game design: a unified model for designing serious games, *Frontiers in psychology*, 5(28), 1-10.

Wang, Y., Vincenti, G., Braman, J., & Dudley, A. (2013). The ARICE Framework: Augmented Reality in Computing Education, *International Journal of Emerging Technologies in Learning*, 8(6), 27-34.

Wei, X., Weng, D., Liu, Y., & Wang, Y. (2015). Teaching based on augmented reality for technical creative design course, *Journal of Computer and Education*, 81, 221-234.

Wu, H.K., Lee, S.W., Chang, H.Y., & Liang, J.C. (2013). Current status, opportunities and challenges of augmented reality in education, *Journal of Computer and Education*, 62, 41-49.

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Mobile learning in the Asia-Pacific region: Exploring challenges hindering the sustainable design of mobile learning initiatives

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Higher education institutions and government departments in the Asia-Pacific region have invested significantly in technological innovation to enhance educational delivery and redress inequality in access to formal education. As a result of the fast-paced growth of mobile adoption and mobile internet access in these regions, universities are able to leverage the affordances of mobile devices to offer greater flexibility to students. Despite the emphasis on enhancing technological capacity, there remains significant challenges to the effective adoption of strategies to integrate mobile technologies in learning and teaching. This article briefly explores 12 projects undertaken at different universities across nine countries. The projects were selected from 28 chapters submitted to an edited book on supporting the implementation of sustainable mobile learning initiatives in the Asia-Pacific region. The motivation and aims of each of the projects are compared and the primary challenges are explored at four levels of institutional stakeholders.

Keywords: Keywords: mobile learning, m-learning, sustainable innovation, Asia-Pacific region

Introduction

Educators and higher education institutions worldwide are under immense pressure to offer students personalised learning opportunities that enable tailoring of learning environments to meet the needs of individual learners. This is particularly true in developing countries where millions of people have been excluded from formal education. Around 45 per cent of the world's population of youth live in the Asia-Pacific region, which is one of the fastest developing regions in the world. Regional youth unemployment rates are, however, around 10 per cent, which is on average three times more than for adults (UN, 2010). Large numbers of young people in Asia-Pacific countries struggle with access to education and other resources, and transition between education and employment is one of the main obstacles facing youth in the region. The Asia-Pacific region also experiences a low level of enrolment in tertiary education, just 25 per cent in Central Asia, 26 per cent in East Asia and the Pacific and 13 per cent in South and West Asia (UNESCAP, 2010). Barriers to participation in education include large disparities between rural and urban areas, socio-economic inequality and exclusion of youth with disabilities (UN, 2010), as well as poor geographical and physical infrastructure (Dholakia & Dholakia, 2004). Female youth and youth from poor families, rural or remote areas, and ethnic and language minorities are the groups most likely to be excluded from tertiary and even secondary education. Long journeys from residential areas to schools are also cited as a significant barrier (UN, 2010).

The fast ownership growth rate and increasing sophistication of mobile technologies in the Asia-Pacific region, offer higher education institutions added opportunities to leverage the flexibility of mobile devices to support the educational redress of regional and socio-economic gaps in education provision. Currently the Asia Pacific region dominates the world's mobile industry with a third of the population using mobile devices to access the internet. This is expected to grow to half the population by 2020 (GSMA, 2015). In some metropolitan regions, mobile device ownership reaches over 100 per cent (Jeroschewski et al., 2013). Smartphones have more affordances to be leveraged for mobile learning, though levels of smartphone ownership as compared to feature phones remains relatively low across most of the Asia-Pacific (excluding Australia and New Zealand) (Farley& Song, 2015). Data collected by Pew Research indicates that in Malaysia, 89 per cent own a mobile and 31 per cent own a smartphone; in Indonesia, 78 per cent own a mobile and 11 per cent own a smartphone; and in the Philippines, 71 per cent own a mobile and 17 per cent own a smartphone. Predictably, smartphone ownership tends to be higher in countries with higher per capita income (Pew Research Global Attitudes Project, 2014). Mobile devices, in the form of smartphones, tablet computers, and in some cases even laptops, are widely available and have the potential to provide greater flexibility and personalization of learning to students, regardless of location. Mobile devices have a number of advantages for learning and teaching in developing countries that include the ease of use of these technologies, widespread availability and greater familiarity than computer-based online learning systems (Motlik, 2008).

According to a report developed by Adkins (2013), there is currently a massive demand for mobile learning content in Asia-Pacific countries. At the same time, providers of mobile learning have value added services and are investing heavily in the development and provision of mobile devices, such as tablets and smartphones, preloaded with educational content such as apps, dictionaries and assessments. As a result, higher education institutions are competing heavily with these providers, particularly in rural populations where potential students are forgoing formal education for less expensive and more easily available options. Current initiatives to implement mobile learning at universities in Asia-Pacific countries are, however, frequently undertaken on a small scale or ad-hoc basis, with few initiatives moving beyond merely providing content to encouraging creativity and self-directed learning (So, 2012). Additional support for institutional leaders in these organisations is required to support the development of mobile learning initiatives that can be sustainably integrated into current strategies, policies and procedures as well as meet the learning and teaching needs of educators and students. This paper presents preliminary findings from a research study aimed at addressing this gap.

Methodology

The authors are presently compiling an edited book consisting of 28 chapters to be published by Springer in 2016 titled: “Mobile Learning in Higher Education in the Asia Pacific Region: Harnessing Trends and Challenging Orthodoxies” (Murphy, Farley, Dyson & Jones, in press). The book consists of discussion papers and case studies submitted by educators from 18 countries within the Asia-Pacific region including; Australia (including regional and remote areas), Cambodia, Laos PDR, China, Hong Kong, India, Indonesia, Japan, Republic of Korea, Malaysia, New Zealand, Pakistan, Pacific Islands, Papua New Guinea, Russia, Samoa, Singapore and Vietnam. Each of the case studies focused on the implementation of a mobile learning initiative either at a pilot level (one or more courses) or at an institutional level as a cross-university strategy. At the conclusion of each chapter case study, authors discussed the challenges and implications of their studies at one or more of four institutional levels (Murphy & Farley, 2012):

Organizational: The institutional policies and practices that currently support or hinder the implementation of mobile learning initiatives.

Technical: The current infrastructure assets and challenges as well as standards and protocols that will impact on the success of mobile learning initiatives.

Pedagogical (teaching): Strengths and inefficiencies of current mobile learning practices and pedagogies as well as the barriers and critical success factors that impact on educators adopting mobile learning initiatives.

Pedagogical (learning): Expectations of mobile learning and insight into current formal or informal mobile learning practices of students to identify gaps in current services and student learning needs.

During the two-year period it took to compile the book, the authors of the chapters worked closely with the editors through an iterative process consisting of peer review workshops, detailed feedback from the editors and external reviewers to ensure that the chapters aligned with the aims of the book and clearly identified the limitations at each of the organisational levels discussed. Interviews were also carried out with 16 authors using a semi-structured interview guide to gain detailed insight into the pedagogical foundations and unique issues experienced during the implementation of each project. The aim of this exercise is to inform the development of a Mobile Learning Evaluation Framework (Murphy & Farley, 2012) for supporting the sustainable implementation of mobile learning initiatives within the Asia-Pacific region. The findings from those interviews will be discussed in detail elsewhere. The purpose of this article is to present preliminary insights from 12 case studies representing nine countries within three major regions of the Asia-Pacific; East and North-East Asia (Japan and the Republic of Korea), South-East Asia (Laos PDR and Cambodia, Indonesia, Malaysia, Singapore) and Oceania and the Pacific Islands (Samoa and Fiji). The three regions that had the highest number of submitted case studies were selected for inclusion in this stage of the research. All case studies that involved mobile learning in higher education institutions in the three selected regions were retained for the preliminary analysis. Key learnings at each of the organisational levels and the potential implications of for higher education institutions considering the implementation of mobile learning at various levels are discussed.

Asia-Pacific Mobile Learning Case Studies

The case studies presented in Table 1 demonstrate a very preliminary overview of the mobile learning landscape in the Asia-Pacific and do not constitute an exhaustive account of all mobile learning initiatives occurring in these countries. The variation in scale of implementation, however, demonstrates that a number of universities are investing significant time and resources in developing solutions to support and enhance mobile learning platforms for their students. At least three universities have developed institution wide mobile learning portals to provide students with access to mobile learning content in various forms including courses and administrative activities. Two case studies presented mobile apps that were developed to support learning and teaching in specific disciplines (chemistry and language learning). Four studies focused on the use of features inherent to mobile devices to support learning such as multimedia capabilities (audio, photo and video), mobile instant messaging, and access to social media. Only two case studies involved exploratory research to identify current spontaneous use of mobile devices for supporting learning and explore readiness for further mobile learning initiatives.

Table 1: Summary Comparison of Mobile Learning Cases

Country	**Level of implementation**	**Focus of initiative**	**Project aims**
East and North-East Asia			
Japan (Uosaki, Ogata, Mouri & Choyekh, in press)	Various learning environments within Japan (Community & university)	Mobile App: Use of Mobile Learning Log (SCROLL) for language learning (vocabulary)	• App developed by the authors. • The app enables learners to record daily learning experiences with locations, text, photos and videos using smartphones and share those experiences with other learners. • On-going project with new functions continuously added to the system. • The app aims at linking learning in formal and informal environments to enhance opportunities for students to engage in informal learning. • Chapter evaluates effectiveness of app for language (vocabulary learning) in Japanese universities
Republic of Korea (Pooley, in press)	Pilot project – student perspectives	Mobile Instant Messaging (MIM) for language learning & intercultural communication	• International students involved in student exchange programs to Korea experience challenges learning the Korean language. • MIM chat rooms were trailed as tools to ease social and cultural challenges between Korean and international speakers and enabled additional informal language development opportunities. • Students advised to use local MIM platform KakaoTalk which contains all the features of traditional SMS, including additional ways to incorporate textual and visual media, and does not require network data use.
South-East Asia			
Laos PDR Cambodia (Starasts, Xiong & Ly, in press)	Exploratory study of current use by lecturers and students at two universities: National University of Laos (NUOL) & Royal University of Agriculture (RUA), Cambodia	Mobile device features for supporting learning	• Few students have access to computers or mobile devices, mobile device ownership is more common. • Those who have access to mobile devices use them to communicate with lecturers through email or phone calls, social media and storage of learning content. • Access of learning content using mobile phones rather than computers is also common. • Lecturers and students lack access to sufficient technologies, resources and training for both e-learning and m-learning.

Indonesia (Padmo, Belawati, Idrus & Ardiasih, in press)	Institution wide implementation at Universitas Terbuka (UT), Indonesia	Mobile-interface website	• Implementation of mobile-interface website to enable students to access administrative study support, all courses and all learning content using mobile devices. • Development began in 2013 and has undergone a number of phases including preparation of infrastructure (applications and frameworks), content development (multimedia and OER), and program delivery (including tutors, technical assistance and support systems).
Malaysia (Gabarre, Gabarre & Din, in press)	Pilot project – student perspectives	Social media (Facebook) on mobile phones for foreign language learning	• Pilot study to provide alternative environment to the university's LMS which limits student's abilities to discuss freely and post multimedia content. • An open Facebook page was trailed as an alternative environment for running the full foreign language (French) course including uploading of student assessments.
Malaysia (Talib, Norishah, Shariman & Othman, in press)	Presentation of app & expert evaluation	Mobile app: application of Organic Chemistry Reaction Application (OCRA) for gamification of chemistry learning	• Practical demonstration of the functionalities of a mobile app to support learning of complex constructs in undergraduate chemistry modules. • Demonstration of an app designed to enhance the value of learning in the mobile education context and future work will involve the development of a generic pedagogical model underpinning the design of any mobile application for educational purposes
Malaysia (Darmi & Albion (in press)	Pilot project – student perspectives	Mobile device features (audio recording) for supporting language learning	• Pilot study to assess the potential for mobile devices to be used to support English language learning. • Students were encouraged to use the audio recording facilities of mobile devices to practice English-language learning tasks prior to assessments. • Findings were compared to a control group and demonstrated an increase in learner performance at the end of semester.
Malaysia (Ariffin, in press)	Pilot project – student perspectives	Mobile device features for student driven content generation for the study of local culture	• Students undertaking a local culture studies program used photos, audio and video to generate creative content for assessment. • The pilot resulted in development of new multimedia skills, encouraged collaborative and student-driven authentic learning, empowerment of students and improved learning outcomes.
Singapore (Tan & Soo, in press)	Pilot project – technical instructions on app creation	Mobile app: development of 2 apps to support chemistry learning	• Demonstration of app development process to support content expert educators with technical insights to create their own apps. • Frequency of app use appeared to be highly correlated with improved learning outcomes.

Oceania and Pacific Islands			
Samoa (Ozawa & Ualesi, in press)	Exploratory study of current use of mobile technologies for learning at the National University of Samoa	Mobile device features for supporting learning	• Pacific islands are highly distributed and connected through microwave connections, to be replaced by submarine optical fibre cables. • Current internet bandwidth poor resulting in difficulties delivering online learning. • Findings concluded that most students have internet access on their mobile devices, students are already using mobile technologies to access learning materials and are interested in using mobile devices for further learning purposes, but are unsure how.
Fiji (Sharma, Kumar, Rao & Finiasi, in press)	Institution-wide implementation at the University of the South Pacific (USP)	Mobile learning programme consisting of 4 integrated approaches; (a) short message service, (b) edutainment, (c) mobile course modules, (d) tablet-based learning	• USP is a multi-campus university consisting of 14 campuses in 12 member countries which due to geographic spread is challenging for delivery of traditional print or online learning. • The mobile learning program was developed (1) to access information and knowledge, (2) to establish a vibrant online community of Pacific learners, (3) to empower students to create and share knowledge, essentially transforming them from mobile learning users to mobile learning producers, and (4) to design or deploy mobile learning tools to provide and support learning.
Fiji (Kumar & Mohite, in press)	Institution-wide pilot project at Fiji National University	Evaluation of mobile app (MLearn) developed to provide students with access to lecture notes, tutorials and course information	• MLearn was developed to provide distance and flexible learning students with a mobile learning facility. • Evaluation was conducted in response to expressed student dissatisfaction. • Findings indicated usability problems and recommendations were developed to improve the app.

Learning, Teaching, Technical and Organisational Implications

While each of the case studies has a focus on one or two of the levels of the framework they all discussed implications across the four levels and there are many commonalities between the case studies across the countries of the Asia-Pacific region, regardless of the level of development. Several of the implications also apply across one or more levels; for example, the need for training and support applies across all levels as the development of digital literacy skills are important for both staff and students; development of new pedagogical approaches is important for staff, technical knowledge is needed by staff and students and institutions need to provide the necessary support and training. There were no clear differences between regions with regard to the types of concerns or developments that are occurring. The most notable of the learnings and implications are (summarised graphically in Figure 1):

Learning: The use of mobile technologies for language learning was one of the main themes with Darmi and Albion (in press) discussing how use of mobile phones can alleviate language anxiety levels amongst Malaysian undergraduates learning English and Pooley discussing how they can be an enabler of intercultural communication among speakers of two dissimilar languages. Adoption of mobile learning can encourage the amount of learning that occurs out of the formal classroom (Uosaki et al., in press), and those students who regularly use specially developed apps are more likely to achieve higher grades than those who only use these rarely (Tan & Soo). There some problems when generic apps are used as these are often authored in English which may not be the first language (or even spoken at all) by a large number of students and they will not contain appropriate cultural content. However, there are some institutions that have strict policies prohibiting use of mobile devices in class, which limits the uptake of this type of learning to outside class (Ozawa & Ualesi, in press). In this case study from Samoa, the use of mobile devices is still quite rare. Another advantage of mobile learning is the use for student-generated content, utilising the multi-media capabilities of mobile devices, which can lead to deeper understanding of content (Arrifin, in press).

Teaching: Several authors (Gabare et al, in press; Starasts et al., in press; Talib et al., in press) noted the need for teachers to consider a change of pedagogy to student-centred, collaborative, constructivist approaches. Support and training for these pedagogies as well as digital skills are also discussed as important areas of consideration (Ozawa et al., in press; Sharma et al., in press; Starasts et al., in press). Many educators across the globe, not just in the Asia-Pacific region favour didactic, instructor-led approaches to learning. To effectively embrace mobile learning, some instructor authority needs to be ceded as students take charge of their own learning (Brown & Mbati, 2015).

Technical: Development of apps was a major consideration for several of the institutions (Kumar & Mohite, Sharma et al., in press; Uosaki et al., in press) particularly in the Chemistry discipline (Talib et al., in press; Tan & Soo., in press) while usability, including the small screen size and limited input capability, and lack of Wi-Fi/network access are discussed in three case studies (Kumar & Mohite., in press; Ozawa et al., in press; Sharma et al., in press). Apps frequently have social functions that can allow sharing of content and discussion between users. Augmented reality apps can allow for exploration of historical sites with just-in-time information. Apps can also allow for creation of content, leveraging the features of the smartphone such as camera and sound recording features (Johnson et al., 2012). The literature indicates that discipline-specific mobile apps will become more popular. For example, there are large numbers of apps for foreign language students including dictionaries and flash cards. For almost every discipline, there are a number of apps available for both Android and iOS devices (Oz, 2013).

Organisational: The main issues of concern from an organisational perspective were the adoption of relevant policy and guidelines (Owaza et al., in press; Starasts et al., in press) and provision of relevant infrastructure, resources, support and training. (Padmo et al., in press; Sharma et al., in press). Interdisciplinary collaborations as well as between researchers were also considered important (Kumar & Mohite, in press; Tan & Soo, in press). UNESCO policy guidelines were written in order to expand and enrich educational opportunities for learners in diverse settings, particularly for those in countries with little in the way of policy guidance (UNESCO, 2013). Their aim was to provide guidance to institutions around the integration of mobile learning into education policy and were written to support and enable teaching and learning through the safe, affordable and sustainable use of mobile technologies (Parsons, 2014). Though these guidelines are available, there is little evidence of their widespread adoption across the Asia-Pacific region.

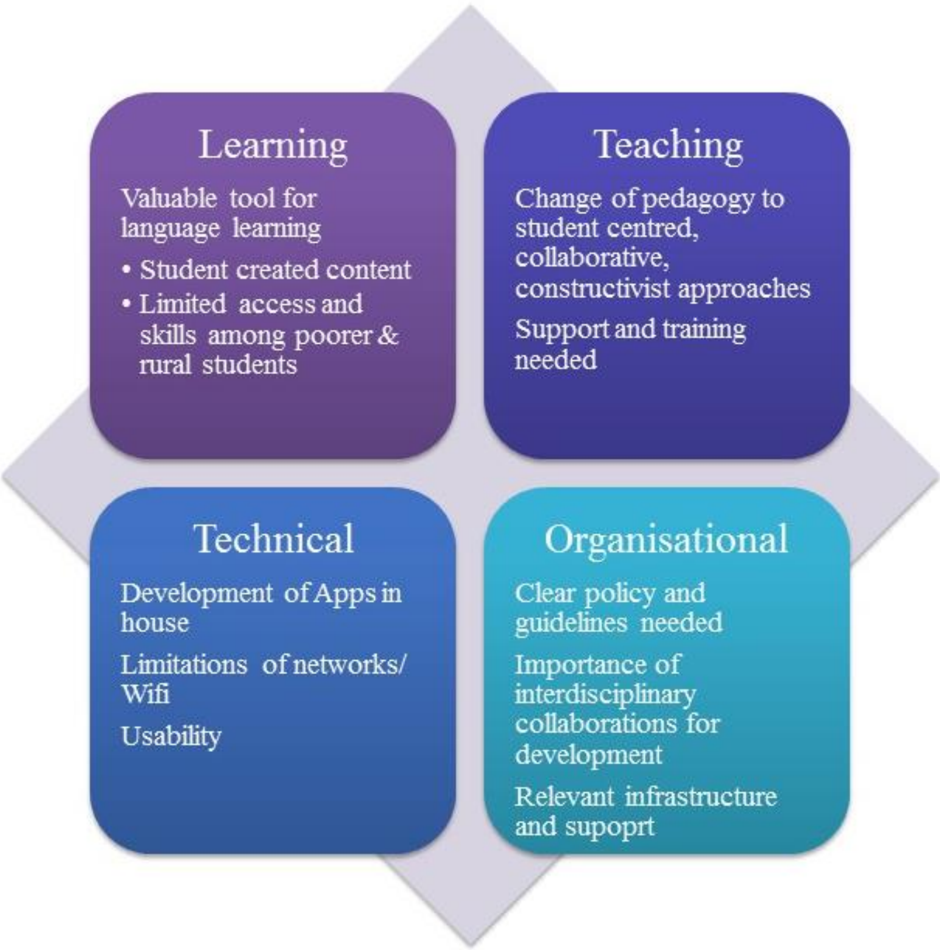

Figure 1. Implications of mobile learning adoption

Conclusion

On May 16 2011, the United Nations declared that access to the internet was a human right. That statement has implications for governments in terms of the provision of infrastructure, hardware, social access and so on (La Rue, 2011). Even so, broadband internet penetration remains poor in most of the Asia Pacific region. Due to the poor access to broadband internet, and in some cases, even electricity, there has been a marked lack of success with e-learning in many parts of the Asia Pacific. More recent data suggests that prices for mobile phones and internet access have dropped substantially, opening the door for mobile learning initiatives in these areas (So, 2012). Even though mobile devices and subscriptions may still provide a significant cost for many people, mobile technologies are more affordable than both broadband internet and desktop or laptop computers. In addition, mobile learning provides study options to learners who are geographically remote from physical campuses and allowing them to fit study around their work or carer commitments (Chun & Tsui, 2010). Even so, critical success factors for the incorporation of mobile learning in education include: a high market penetration of mobile phones; adequate technological infrastructure (wireless network and mobile applications): and specific professional development on mobile learning for teachers (So, 2012). Educators need to address the blending of formal and informal learning. The case studies highlighted in this paper are beginning to do just that.

Though a number of challenges have been identified in the case studies examined, it would be a mistake to assume that these are restricted to the countries of the Asia Pacific. Western culture dominates most regions of the world, pushing aside local cultural nuances, and privileging the English language over all others. Even within Australia where English is the official language, Aboriginal and Torres Strait Islander leaners are disadvantaged as English may be their second, third or even fourth language. Similarly, though many instructors in the Asia-Pacific region favour didactic, teacher-led pedagogies (Johnson, et al., 2012), this is common in many other regions and countries. These dominant pedagogies are not conducive to the adoption of mobile learning whereby learning is often student-centred and self-directed.

The widespread adoption of mobile learning in the Asia-Pacific, in common with mobile learning in other regions of the world, will depend on leveraging how students are already using their mobile devices in everyday life. Social networking is increasingly being used by educators to promote interactivity in classrooms and to enhance collaborative opportunities. Interestingly, people in the Asia-Pacific are some of the world's most frequent users of popular social networking sites such as Facebook and Twitter. In 2010, Indonesia, the Philippines, and Singapore were among the top ten Twitter users in the world. Similarly, the Philippines and Indonesia are among the top ten markets of unique Facebook users, ranking third and fourth respectively. With these numbers, it allows the features of social networking such as discussion boards, the ability to broadcast announcements to select groups, share photos and videos, and so on to be leveraged for mobile learning. Anecdotal evidence would suggest that groups of students frequently form Facebook groups to offer mutual support and discussion opportunities in specific courses and programs. The use of web 2.0 tools to collaborate is becoming increasingly popular in this region (Tsai & Hwang, 2013).

When designing mobile learning initiatives in an area as culturally diverse as the Asia-Pacific region, the rules and roles of the social relationships in the mobile learning space must be made explicit. Also, when designing mobile learning initiatives across cultural boundaries, special care must be taken to accommodate the cultural differences between designer and learner (Teal et al., 2014). Regional factors must be considered when designing for the learning behaviours of students. Each country has its own unique economic, political and cultural context which may impact on how students can learn (Tsai & Hwang, 2013). Instead of just using mobile devices for generic learning activities, as far as possible cultural learning and recognition must be incorporated into activities. For example, use mobile learning for cultural or social studies programs (Tsai & Hwang, 2013).

As significant as the barriers and challenges are, this paper highlights some of the successful initiatives undertaken by educators in the diverse contexts of the Asia-Pacific. As infrastructure to support these and other similar initiatives is built and the cost of technologies and access continues to decrease, there is likely to be a burgeoning of mobile learning initiatives and their widespread and sustained adoption across institutions.

Case Study References

The case studies discussed are extracted from:

Murphy, A., Farley, H. S., Dyson, L. E. & Jones, H. (in press). *Mobile Learning in Higher Education in the Asia Pacific Region: Harnessing Trends and Challenging Orthodoxies.* Springer: Singapore.

Referenced case studies are as follows:

Ariffin, S. A. Mobile Learning Student-Generated Activities from Students' Perspectives: Malaysian Context.

Darmi, R., & Albion, P. (in press). Enhancing oral communication skills using mobile phones among undergraduate English language learners in Malaysia.

Gabarre, S., Gabarre, C., & Din, R. (in Press). Facebook on mobile phones: A match made in the cloud?

Johnson, L., Adams Becker, S., Ludgate, H., Cummins, M. and Estrada, V. 2012. Technology Outlook for Singaporean K-12 Education 2012-2017: An NMC Horizon Project Regional Analysis. Austin, TX.

Kumar, B. A. & Mohite, P. (in press). Usability Study of Mobile Learning Application in Higher Education Context: An Example from Fiji National University.

Ozawa, S., & Ualesi, E. T. (in press), A Pilot Study of Mobile Learning in Higher Education in Samoa.

Padmo, D., Belawati, T., Idrus, O., & Ardiasih, L. S. (in press). The State of Practice of Mobile Learning in Universitas Terbuka Indonesia.

Pooley, A. (in press). Mobile instant messaging (MIM) for intercultural communication: A qualitative study of international students in the Republic of Korea.

Sharma, B., Kumar, R., Rao, V., & Finiasi, R. (in press). A Mobile Learning Journey in Pacific Education.

Starasts, A., Xiong, M., & Ly, T. (in press). Investigating Mobile Learning in Higher Education in Laos PDR and Cambodia.

Tan, E. S. Q., Y Soo, Y. J. (in press). Creating Apps: A Non-IT Educator's Journey Within a Higher Education Landscape.

Talib, O., Norishah, T. P., Shariman, T., & Othman, A. (in press). Authentic Mobile Application for Enhancing the Value of Mobile Learning in Organic Chemistry and Its Pedagogical Implications.

Uosaki, N., Ogata, H., Mouri, K., & Choyekh, M. (in press). Implementing Sustainable Mobile Learning Initiatives for Ubiquitous Learning Log System called SCROLL

References

Adkins, S. S. (2013). *The Asia Market for Mobile Learning Products and Services: 2012-2017 Forecast and Analysis.* Ambient Insight. Retrieved from http://www.ambientinsight.com/Resources/Documents/AmbientInsight-2012-2017-Asia-Mobile-Learning-Market-Abstract.pdf

Brown, T. H., & Mbati, L. S. (2015). Mobile learning: Moving past the myths and embracing the opportunities. *The International Review of Research in Open and Distributed Learning, 16*(2), 115-135.

Chun, D. and Tsui, E. 2010. *A reflection of the state of mobile learning in Asia and a conceptual framework*. Paper presented at the IADIS International Conference Mobile Learning 2010, Porto, Portugal.

Dholakia, R. R., & Dholakia, N. (2004). Mobility and markets: emerging outlines of m-commerce. *Journal of Business research*, *57*(12), 1391-1396.

Farley, H., & Song, H. (2015). Mobile Learning in Southeast Asia: Opportunities and Challenges. In J. A. Zhang (Ed.), *Handbook of Mobile Teaching and Learning: Design, development, adoption, partnership, evaluation and expectation* (1 ed., pp. 403-419). Berlin, Germany: Springer-Verlag.

Jeroschewski, A., Levisse, A., Salazar, L., Tesoriero, R. and Ying, S. 2013. Connecting Southeast Asia through Broadband. In *Enhancing ASEAN's connectivity*,B. Das,ed. Singapore: Institute of Southeast Asia Studies: 72-90.

La Rue, F. 2011. Report of the Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression, Frank La Rue (pp. 22). Geneva: United Nations General Assembly.

Motlik, S. (2008). *Mobile learning in developing nations*. (Technical Evaluation Report, International Review of Research in Open and Distributed Learning Volume 9, No 2). Retrieved December, 7, 2015 from http://www.irrodl.org/index.php/irrodl/article/viewArticle/564/1039.

Murphy, A. & Farley, H. (2012). Development of a framework for evaluating the impact and sustainability of mobile learning initiatives in higher education. In Australasian Society for Computers in Learning in Tertiary Education (ASCILITE). *Proceedings ASCILITE 2012: 29th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education: Future Challenges, Sustainable Futures.* Wellington: Massey University.

Oz, H. (2013). Prospective English Teachers' Ownership and Usage of Mobile Devices as M-learning Tools. *Procedia - Social and Behavioral Sciences, 141*: 1031-1041. doi: 10.1016/j.sbspro.2014.05.173

Parsons, D. (2014). Pathways to a Better World: Assessing Mobile Learning Policy against UNESCO Guidelines in a New Zealand Case Study. In M. Kalz, Y. Bayyurt, & M. Specht (Eds.), *Mobile as a Mainstream – Towards Future Challenges in Mobile Learning: 13th World Conference on Mobile and*

Contextual Learning, mLearn 2014, Istanbul, Turkey, November 3-5, 2014, Proceedings (pp. 182-196). Cham: Springer International Publishing.
Pew Research Global Attitudes Project. (2014). Emerging Nations Embrace Internet, Mobile Technology: Cell Phones Nearly Ubiquitous in Many Countries. Washington, DC: Pew Research Center.
So, H. J. (2012). *Turning on mobile learning in Asia: Illustrative initiatives and policy implications.* [United Nations Educational, Scientific and Cultural Organisation working paper series on mobile learning], *1*, 1-32.
Teal, E., Wang, M., Callaghan, V. and Ng, J. W. P. (2014). An Exposition of Current Mobile Learning Design Guidelines and Frameworks. *International Journal on E-Learning*, 13(1): 79-99.
Tsai, C.-C. & Hwang, G.-J. (2013). Issues and Challenges of Educational Technology Research in Asia. *The Asia-Pacific Education Researcher*, 22(2): 215-216. doi: 10.1007/s40299-012-0038-9
UNESCO. (2013). *Policy guidelines for mobile learning*. Retrieved from: http://unesdoc.unesco.org/images/0021/002196/219641e.pdf
United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). (2010). *Regional Overview: Youth in Asia and the Pacific.* Retrieved from http://www.un.org/esa/socdev/documents/youth/fact-sheets/youth-regional-escap.pdf
United Nations (UN). (2010). *Regional Overview: The State of Youth in Asia and the Pacific.* Retrieved from http://social.un.org/youthyear/docs/ESCAPFinal5.pdf

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Academic Development through Intensive Learning Design

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Participating in learning design sessions is a transformative learning experience for academic staff. This poster traces the emergent relationship between an academic and a learning designer during an intensive 4-hour learning design session, visually representing the interplay and intensity of six key domains across the session: approach, emotion, relationship, design-as-process, design-as-product, and capability-building. The poster demonstrates the relationship between the domains and their dispersal throughout a session, to illustrate how the challenge to and transformation of attitudes towards technology-enhanced learning (TEL), helping to overcome common resistance to change, providing a richer, more productive understanding of how academic development can be foregrounded through learning design.

Keywords: Academic development; learning design; technology-enhanced learning

Background

As universities continue to direct academics to deliver more technology-enhanced learning experiences, the role of the learning designer increasingly involves informal academic development. This includes influencing positive changes to attitudes and mindsets in the face of general reluctance and resistance to change (Deaker, Stein, & Spiller 2016), especially regarding technology integration (Howard 2013; Westberry et al. 2015). Learning design as a separate and specialized domain of educational research has matured considerably over the past decade; research has begun to define and interrogate design methods and methodologies, conceptual frameworks, pedagogical patterns, and sequences of activities, as well as examine tools and resources to support the design process (Bennett et al 2011; Dalziel 2013; Dobozy 2013). A substantial body of research on teachers' beliefs has emerged over the last few decades, including attitudes towards educational technology (Bain & McNaught 2006); however, studies of learning design as an academic development activity, its impact on teachers' pedagogical beliefs, skills, and practices, are less common. Academic development itself has recently shifted away from formal and structured activities towards experiential (Kolb 1984) and situated (Lavé & Wenger 1993) learning approaches, identifying and utilizing learning opportunities for academics in everyday work (Boud and Brew, 2013). As facilitated learning design becomes part of academics' standard professional practice, it shows potential to mature from educational notation into a transformative learning experience (Mezirow 1991).

Process

Our research process is experiential rather than empirical, and emerges from the practice of five learning designers. The team delivers rapid, intensive, personalized, contextualized 4-hour sessions, working with a number of partners in the higher education sector. Based on this experience, the team attempts to describe the relationship between an academic and a learning designer. Data collection occurred through collaborative critical self-reflection and interrogation, wherein key patterns and themes emerged from descriptions of practice. Alternative patterns of behaviour were observed, analyzed and synthesized, and finally visually represented across a sequence or continuum which typically structures the sessions.

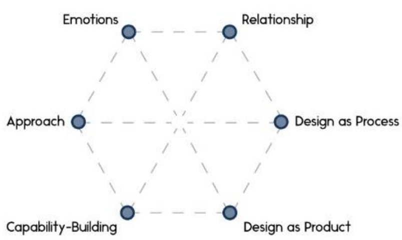

Figure 4. Matrix of the six domains

Domains

The emergent relationship between an academic and a learning designer is shown. The six domains (fig. 1) are mapped across the key phases of a 4-hour session—onboarding, positioning, negotiation, awareness, and transformation —to visually represent their interplay and intensity across the continuum (fig. 2).

- **Approach:** Designing for TEL is still often unfamiliar and daunting for academics, and there remains a culture of substitution and augmentation rather than modification or redefinition. Designers must personalize and contextualize their approach to suit academics' prior knowledge, experience, and mindset. This starts with a dialogue, customized to the design setting and teaching context. Designers' personal and professional experience, and knowledge base, helps to build credibility.
- **Emotion:** Emotions play a vital role in the transformation of thinking required for effective design. Designers build the relationship through both verbal dialogue *and* a complex world of non-verbal clues. How does the academic react to a new idea? Are they excited, indifferent, or dismissive? How best to convince someone that a particular approach is more suited to TEL? Tension, arising from these negotiations, incites academics to move beyond their comfort zone and consider new perspectives.

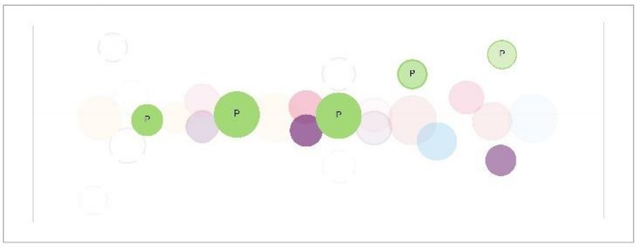

FIGURE 5. POSTER EXCERPT, "INSIGHT: DESIGN

- **Relationship:** Productive human relationships are an essential component of learning design. Designers actively engage the academic to transform thinking. Meaning is continually renegotiated through the processes of participation and reification (Wenger 1998); building a strong relationship, by engaging in this inter-disciplinary knowledge exchange, provides a mechanism for the negotiation of meaning.
- **Design-as-Process:** Process is the active co-construction of new knowledge. Designers and academics collaborate as an inter-disciplinary team, re-conceptualizing their initial thinking, and leading to a design blueprint (the product). This is achieved through a combination of constructive dialogue, expert facilitation, and the application of design thinking approaches.
- **Design-as-Product:** A shared common goal provides a sense of empowerment. Designers and academics work to achieve a collaborative output in a form of a cohesive, constructively aligned activity, unit, course, or even degree. This can include the structure or sequence of learning, activities, resources, and tools for effective learning in the online environment. The product is a transformative stage in itself.
- **Capability-Building:** Academic capability building occurs throughout all the phases and in all domains of a session. Capability building occurs primarily through the transformation of attitudes. This is not a linear process, but rather a complex interplay between academic and designer. Transformation occurs gradually, with learning design (as a practice, process, and product) foregrounding academic development—from raising awareness and building knowledge, to acquiring skills and improving practice, to altering academic mindsets and identities as teachers.

Significance

Further research is required to more fully describe the experience of learning design sessions from academics' perspectives and mindsets. However, it is already clear that participating in facilitated learning design sessions can be a fundamentally transformative learning experience for academic staff. Better understanding learning design as more than educational notation, but also an experiential and situated form of academic development, can assist designers and universities to better understand academics' mindsets, overcome resistance to change regarding TEL, and facilitate more effective design and learning outcomes all around.

References

Bain, J. D., & McNaught, C. (2006) How academics use technology in teaching and learning: Understanding the relationship between beliefs and practice. *Journal of Computer-Assisted Learning*, 22: 99-113.

Bennett, S., Thomas, L., Agostinho, S., Lockyer, L., Jones, J., & Harper, B. (2011) Understanding the design context for Australian university teachers: implications for the future of learning design. *Learning, Media and Technology*, 36(2): 151-167.

Boud, D. & Brew, A. (2013) Reconceptualising academic work as professional practice: Implications for academic development. *International Journal for Academic Development*, 18(3): 208-221.

Dalziel, J. (2013) Implementing Learning Design: A Decade of Lessons Learned. *Electric Dreams: 30th ascilite Conference Proceedings*. Ed. H. Carter, M. Gosper & J. Hedberg. Sydney: Macquarie University. 210-220.

Deaker, L., Stein, S. J., & Spiller, D. (2016) You can't teach me: Exploring academic resistance to teaching development. *International Journal for Academic Development*. 1-13.

Dobozy, E. (2013) Learning design research: Advancing pedagogies in the digital age. *Educational Media International*, 50(1): 63-76.

Howard, S. K. (2013) Risk-aversion: understanding teachers' resistance to technology integration. *Technology, Pedagogy and Education*, 22(3): 357-372.

Kolb, D. A. (1984) *Experiential learning: Experience as a source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.

Lavé, J., & Wenger, E. (1993) *Situated learning: Legitimate peripheral participation.* Cambridge: Cambridge University Press.

Mezirow, J. (1991) *Transformative Dimensions of Adult Learning*. San Francisco: Jossey-Bass.

Wenger, E. (1998) *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press.

Westberry, N., McNaughton, S., Billot, J., & Gaeta, H. (2015) Resituation or resistance? Higher education teachers' adaptations to technological change. *Technology, Pedagogy and Education*, 24(1): 101-116.

Please cite as: Nguyen, T., Abblitt, S., Hickie, C., Pesina, J. & Sutherland, J. (2016). Academic Development through Intensive Learning Design. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 470-472).

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Reflections of a new educational designer

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Educational design is an area of growing significance in tertiary education, though the career pathway to educational design is varied. Few specific qualifications are available, and so educational designers tend to take up their roles with little experience or in-depth knowledge. The purpose of the study is to investigate one new educational designer's development from new to role to experienced practitioner, in order to identify what new educational designers might expect as they develop. Across the early stage of her educational design role, Nicky Meuleman, educational designer at Open Polytechnic of New Zealand, captured significant encounters and recorded ongoing reflection. This paper summarises and discusses the key themes from those reflections, providing insight into one educational designer's journey from beginner to proficient practitioner.

Keywords: Educational design, development, reflection, practitioner.

Educational design at the Open Polytechnic of New Zealand

Higher education is providing more and more opportunities for educational designers (The Chronicle of Higher Education, 2016) however training opportunities are very fragmented. Though educational design is clearly an area of professional expertise, no established career pathway is in place. Up to 20% of educational designers have no specific training for the role (MacLean & Scott, 2007); in Australasia, some 50% have up to an unspecified bachelor's degree as their highest qualification (ibid.). Many educational designers are drawn to their craft without really knowing what to expect, and with little direct experience.

It is not uncommon for new educational designers to not have any qualification specific to the craft; teachers and those with teaching experience are typically attractive choices for employers. Given the trend toward more potentially capable yet inexperienced appointments into educational designer roles, and a desire to help orientate such educational designers, the authors agreed to collaborate on a project to explore what a new educational designer might expect and how they might best develop toward proficiency.

This poster session will trace Nicky's development drawing on her account of experiences on the job, and regular reflection points. The poster will provide highlights of her reflections and provide advice for those beginning careers as educational designers.

Method

The methodology of this study is that of case study and grounded theory, with a population of one. Nicky is the subject and sole source of data. The project relies on a semi-structured series of journal entries.

Following an initial written piece describing her context as an educational designer, Nicky undertook to prepare a series of experience accounts (reflections based on experiences she considered meaningful to her role and development) and fortnightly summaries of her development. Fortnightly summaries used the headings "What I did well", "What I learned", "What I need to be able to do better", and "What I need to know more about". All reflections were up to 500 words in length. In all, Nicky prepared thirty-seven reflections.

Findings and recommendations

Over time, the reflections broadly developed as follows:

1. Initial excitement and bewilderment, helpfulness and eagerness; a new job, in an exciting area!
2. Frustration at a lack of knowledge alongside developing confidence and independence in the role.
3. Increased awareness of the collegial and institutional context, with an increasing awareness of the political and organisational culture.
4. Rationalisation as to how much she could contribute (following a time of real pressure); setting personal boundaries for work hours, while still mindful of responsibilities.
5. Recognition as a technical expert and contributor to new initiatives; the result of prior knowledge, and a willingness to get involved constructively.
6. Satisfaction as to the results of her work and development as an ED; seeing the results of her work, and maintaining a student focus alongside an increasing awareness of the constraints of the role.
7. Disillusionment and questioning about the role as a career; experiencing the repetitiveness of much of the work, understanding the constraints of institutional tools and project focus, the call of other options.

Subsequent correspondence reveals that other opportunities within the role opened up following the end of the reflections period.

The poster will highlight the following advice for those new to the educational designer role:

1. **Relax, because the context will come.** That you were appointed shows you have potential. Expect to be bewildered and feel out of your depth from time to time. Eventually you build knowledge of the task, and the inter-relationships and workings of the organization you've joined will gradually make sense.
2. **Trust – and challenge – your instincts**. Often your gut sense about design is a good guide, but be open to your instincts being further shaped and improved by others. You will often need to apply your own judgement, because not everything will be clear. Learn when to take your own initiative, and when to ask for guidance.
3. **Expect to change**. Even your standards will change over time; these will not necessarily get worse, but they will be tempered by productivity, available technical solutions, institutional style, and the good practice you encounter in the work of others. You will eventually understand that productivity is not the antithesis of good design, too.
4. **Be realistic about your workplace**. Temper your expectations. Not everything will be perfectly outlined or systematized. As much as you can, adopt an appreciative and constructive approach to such situations. Expect a political environment, and be deliberate about your response to it. Adopt a flexible approach to situations; even with good management deadlines will change, stakeholders will change, and the courses assigned to you will change from time to time.
5. **Learn the rhythm of the role**. There will be peak times when you will likely get frazzled, frustrated, and fed-up; there will also be times when you can celebrate achievements. From time to time things will slow down, too, giving you an opportunity to further develop.
6. **Foster good relationships with all**. Educational designers always work in a team context. Rely on and support your colleagues, and other project members.
7. **Be deliberate about self-development**. Learn, learn, learn. Master the tools of the trade, both technical and pedagogical. These enhance both your practice and potential. Expose yourself to new experiences as much as possible. These will provide ample means of learning, while boosting your confidence and independence. Develop an instinctive mastery of soft skills.
8. **Consider keeping a reflective diary** as a valid and useful form of professional development:
   a. What did I do well this last fortnight? What am I proud of?
   b. What did I learn this last fortnight? What was new to me?
   c. What do I need to know more about? How can I further extend myself?

References

MacLean, P., & Scott, B. (2007). Learning design: requirements, practice and prospects. *Campus-Wide Information Systems*, *24*(3), 187–198. http://doi.org/10.1108/10650740710762220

The Chronicle of Higher Education. (2016). *Instructional designers in higher ed*. Washington, US: The Chronicle of Higher Education. Retrieved from https://www.huronconsultinggroup.com/Insights/Report/Education/~/media/EAAA06E1D6CB4ED8950821BC8F8DC8B2.ashx

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Show me the Feedback: A Multi-Institutional Project Exploring Technology-Enabled Feedback Approaches for First Year

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The Y1Feedback project is a partnership between four Irish Higher Education institutions, which aims to enhance feedback dialogue in first year undergraduate programmes through the use of digital technologies, to better support student transition. The project has conducted a review of feedback practice across partner institutions and a synthesis of feedback literature. Informed by this work, the project has identified a set of features of effective feedback for first year together with a set of technology-enabled feedback approaches. Currently, there are 20 case studies in progress to pilot these approaches. This paper reports the findings from the review of feedback practices and outlines features of effective feedback and approaches that educators can implement to better support first year transition.

Keywords: feedback, first year, transition, technology-enabled feedback

Introduction

It is well established that the provision of timely and useful feedback has significant potential to support and improve student learning (Hattie & Timperley, 2007; Merry, et al., 2013; Sadler, 2010). Moreover, in the context of supporting transition, effective feedback can play a pivotal role in fostering student motivation, confidence, and success in the first year, as well as in improving retention rates (Kift, 2015; Nicol, 2009; Tinto, 2005). In recent years, feedback has increasingly become the focus of research and Higher Education (HE) policy, partly due to national surveys in the United Kingdom (UK), Australia, Asia and Ireland, which have consistently identified low levels of student satisfaction about feedback practices (Carless, 2006; HEFCE, 2015; Radloff & Coates, 2010). In Ireland, while the need to support student transition into Irish HE has been foregrounded by the Higher Education Authority (HEA, 2015), there would appear to be a disconnect between the potential of feedback in supporting transition, and feedback practice in Irish HE institutions. Mirroring international findings, successive student surveys in Ireland have revealed concerns surrounding feedback practices, particularly in relation to first year. For example, the Irish Survey of Student Engagement (ISSE), found that nationally, 23.3% of first year undergraduate students never and 44.9% only sometimes received timely written or oral feedback from teachers on their academic performance (ISSE, 2014). These findings emerge in the context of political and contextual challenges, most notably, the massification of Irish HE against the backdrop of austerity, which has largely been accommodated through larger teaching workloads and growing class sizes.

Project Overview

Supporting Transition: Enhancing Feedback in First Year Using Digital Technologies (Y1Feedback) is a two-year project (January 2015-January 2017) funded by the Irish National Forum for the Enhancement of Teaching and Learning in Higher Education. The project is led by Maynooth University in partnership with Athlone Institute of Technology, Dublin City University and Dundalk Institute of Technology. The project seeks to directly respond to concerns around student transition and feedback in first year by enhancing feedback dialogue in first year undergraduate programmes through the use of digital technologies. In particular, the project seeks to identify and develop case studies of technology-enabled feedback approaches that might be particularly useful in supporting students in their first year of study. The project consists of three main phases of activity: a review of current feedback practices within partner institutions, a synthesis of the literature in relation to feedback in HE, and case study development of feedback approaches.

Phase 1: Feedback in First Year - A Landscape Snapshot

This review of current feedback practice was undertaken to increase our awareness of feedback practices in first year within participating institutions. It was conducted from April to June 2015 and utilised a mixed methods approach consisting of a staff online questionnaire and student focus groups across all four institutions. Semi-structured focus groups were conducted, one in each of the four participating institutions with 36 first year class representatives participating from across a wide range of disciplines. In total, 213 (30% of target population) staff participated in the online questionnaire, which sought to explore staff perceptions of feedback and feedback practices in first year. Due to the qualitative nature of the study and the self-selecting nature of participants, it is acknowledged that it may not be possible to generalise the findings to a wider population. High level findings are as follows:

- **Students' experience of feedback in first year is inconsistent.** While there were positive feedback examples, there seemed to be considerable variation in the student experience, from references to delayed feedback, to the absence of feedback entirely. Moreover, students often perceived feedback practices to be lecturer dependent. In contrast, the majority of staff reported providing feedback within two weeks or less.
- **Feedback approaches are lecturer dependent.** Considerable diversity of feedback approaches was evident among staff, often related to individual preferences. Written and oral methods (e.g., grades and comments returned on papers, one-to-one discussions or collective reviews), particularly those provided in-class, were commonplace. Limited use of rubrics was evident; where rubrics were employed, students did note advantages, especially in signposting what was required in the assessment task.
- **Grade as feedback.** Grades are recognised as a form of feedback by students and staff. However, the staff perception that students are exclusively interested in the awarded grade would seem to be incorrect. Rather, students view grades alone as insufficient, with a strong preference for more comments to clarify exactly where they are going wrong, and how they can/could improve.
- **Low use of peer feedback.** Few staff or students described any use or experience of formal peer involvement in feedback. Students viewed peer feedback apprehensively, with the perceived academic standing of the peer determining the value of the feedback. In addition, there appeared to be low levels of awareness of the potential benefits of peer feedback among staff.
- **Limited use of technology.** E-submission was utilised more widely than e-marking or e-feedback. Examples of technology-enabled feedback approaches were limited to a small number of explicit examples such as online feedback comments, audio feedback, and screencasts.
- **Challenges**. Staff highlighted several challenges in relation to the provision of timely, individual and quality feedback in first year including: lack of time, large classes, heavy workloads, and lack of student engagement with feedback.
- **Student recommendations.** Student recommendations for improvements to feedback practices centered around three main themes: greater consistency in feedback practices across first year modules, more feedback to support ongoing academic improvement, and more timely feedback.
- **Shared value of feedback conversations.** Students and staff valued the opportunity to engage in a dialogue about the academic work. Interestingly, both staff and student recommended a combination of written and oral feedback from lecturers as the ideal feedback approach.

Phase 2: Effective Feedback in First Year: Features & Approaches

The project conducted a synthesis of the literature in relation to feedback in HE, feedback and first year transition, and feedback and technology (Y1Feedback, 2016b). The project found that contemporary perspectives on feedback in HE highlight that feedback should: take place in formal and informal learning settings beyond assessment, feedforward to future work, and be a dialogic process that ultimately supports learners to become self-regulating. Furthermore, in the context of the first year, fostering competence, motivation, and a sense of belonging was identified as key to student success and retention. It is also essential to scaffold the development of students' assessment and feedback literacies as they adjust to the challenges of learning at in HE. Moreover, technology-enabled feedback provision can play an important role in supporting the development of students' digital literacies. From the synthesis of the literature, the project has identified eight features of effective feedback in the first year:

- promotes feedback both within and beyond assessed work;
- supports the embedding of student assessment and feedback literacies;
- fosters student competence, motivation, and belonging;
- provides opportunities for dialogic feedback among teachers and peers;
- feeds forward to future work;
- supports the development of digital literacies;
- employs consistent and co-ordinated approaches to feedback across programmes of study; and
- fosters sustainable feedback practices that encourage self-regulated learning.

In conjunction with the identified features, a number of formal and informal feedback approaches were identified:

- **Peer feedback.** Peer feedback gives students the opportunity to construct and receive feedback, which can support and improve learning (Falchikov, 2004; Nicol, Thomson & Breslin, 2014). It also engages students with issues in relation to quality and standards, thus scaffolding the transition towards self-regulation (Nicol et al., 2014).
- **Marking guides, rubrics and exemplars.** Marking guides, rubrics and exemplars can help students to understand the expectations and standards associated with a particular assessment, and with their subject discipline (Carless, 2015; Panadero & Jonsson, 2013). They can also support transparency, consistency, and efficiency in provision of feedback (Carless, 2015; Reddy & Andrade, 2010).
- **In class dialogue and feedback.** Many first-year students can feel uncomfortable contributing to a large class. However, it is suggested that approaches such as 'boot grit' feedback (Hounsell, 2015) are less intimidating ways to encourage discussion and feedback both within, and beyond, the classroom, and thus may be particularly useful in the context of the first year. Other approaches include the use of audience response systems and social software tools such as Padlet or Twitter.
- **Separating grades and feedback.** While grades and feedback are typically simultaneously issued to students, several authors have argued that grades can act as a distraction from feedback (Gibbs, 2015; Sutton & Gill, 2010). Recent studies have shown that separating grades and feedback can encourage student engagement with feedback, and has been demonstrated to increase the perceived value of feedback by students (Hepplestone et al., 2010; Jackson & Marks, 2015).
- **Feedforward strategies.** Ensuring that links between assessment tasks are explicit is essential to supporting feedforward between assessment tasks (Price et al., 2010). A number of strategies for promoting feedforward can be employed, including flipping feedback, multi-stage assignments, and linked assignments. These approaches enable the locus of feedback to shift from end of task, to in-task meaning feedback becomes "prospective rather than retrospective" (Hounsell, 2015: 2). This can be an effective way to promote engagement with feedback, as well as generating an opportunity for students to utilise it (Carless, 2015; O'Donovan et al., 2015).
- **Generic feedback.** Generic, whole-class feedback on draft work in progress can be an effective way to provide timely feedback, particularly in the context of large classes. It is argued that this approach can be more effective than individualised feedback that comes too late for students to engage with or apply (Gibbs, 2015; O'Donovan et al., 2015).
- **Anticipatory feedback.** End of semester exams continue to play a major role in the assessment of student learning in Irish HE and the grade that students receive may be the only form of feedback they receive on their work. Anticipatory approaches to feedback on exams in the form of class and peer discussion around past papers can enable students to identify gaps between their current and required level of performance.
- **Programmatic approaches.** Programme-wide approaches to feedback could complement programme assessment strategies by promoting feedforward between assessment tasks across a programme (Boud & Molloy, 2013; Carless, 2015; O'Donovan et al., 2015). Both Gibbs (2015) and Jessop et al. (2014) point to the need for programme teams to work together to develop a shared culture in relation to issues such as consistency and timing of feedback. While the literature suggests a number of ways in which programmatic approaches to feedback might be actualised, there is scant evidence of their application.

Phase 3: Case Studies of Technology-Enabled Feedback Approaches

Phase three focuses on how technology support implementation of identified feedback approaches. Suggested potential affordances of technology for feedback include: support for the provision of a greater volume of timely feedback; improved student understanding of, and engagement with, feedback; greater variety in feedback formats and approaches; support for dialogic feedback opportunities; and greater flexibility and accessibility in relation to feedback access and use. (Y1Feedback, 2016a). Technologies that may support the feedback approaches above include online written feedback tools, audio-visual feedback, peer feedback technologies, e-portfolios, automated feedback tools, audience response systems, and learning analytics.

Currently, 20 case studies are in progress across the four partner institutions, which are due for completion in January 2017. The case studies are being developed in partnership with 32 academic staff across 16 different disciplines with class sizes ranging from 10 to 750 students. A selection of the case studies is listed below:

- Real-Time Feedback in Engineering Using a Graphical App-Based Audience Response System
- Embedding Dialogic and Sustainable Approaches to Feedback in a First Year Critical Skills Module
- Use of E-portfolios to Map Student Competences and Enable Timely Dialogic Feedback for Work-based Learning in a Social Care Setting
- Using Screencasting for Rich Summative Feedback on Handwritten Lab Reports in Science and Engineering
- Using PeerWise for Student Feedback in an Online Distance Module
- Providing Feedback through Learning Analytics in First Year
- Using Rubrics to Promote Engagement with Formative Feedback in Applied Social Care
- Using Screencasts to Promote Engagement with Formative Feedback as part of a Multi-Staged Assessment in a Sports, Exercise and Enterprise Module

Reflections on Phase 3

While the project is ongoing, there are a number of reflections on case study implementation to date:

1. **Approaches not Technology.** The project began with the assumption that our main focus would be on identifying appropriate technologies and developing staff capability in these. In reality, the project has found that to enhance feedback dialogue in first year, the primary focus needs to be on raising awareness on contemporary perspectives of feedback and feedback approaches, and in developing staff capability in this area.
2. **Investment in Time vs. Learning Benefits.** The project has found that implementing dialogic feedback approaches, while pedagogically beneficial, can be considered more time-consuming by staff, and outside of pilot project, potentially unsustainable.
3. **No Grade = Lower Engagement.** Engagement by students in ongoing and informal feedback activities has been significantly lower than in graded activities or assignments, in some cases less than 40% student engagement. A key challenge is how can we better engage students in on-going non-graded feedback activities.
4. **EdTech Maturity?** In implementing technology-enabled feedback approaches, we have found that the maturity, flexibility and sustainability of the best-available technology can be an issue, particularly in the case of peer feedback technologies for large groups.
5. **Beyond Champions.** A key challenge and question for future work is 'How do we progress beyond working with innovation champions on modules towards programme team collaboration and buy-in?'

Future Work

This paper provided a set of features of effective feedback for first year together with approaches to support the implementation of these features. The need for programmatic approaches to feedback was highlighted as particularly important towards embedding feedback approaches that can support effective feedback strategies in first year. While the evidence of programmatic feedback approaches is scarce, it is sufficient to encourage further research, which could focus on the development and evaluation of approaches, processes and tools to support programme teams in developing programmatic approaches to assessment and feedback.

References

Boud, D., & Molloy, E. (Eds.). (2013). *Feedback in higher and professional education: Understanding it and doing it well*. Oxon: Routledge.

Carless, D. (2006). Differing perceptions in the feedback process. *Studies in Higher Education, 31*(2), 219-233.

Carless, D. (2015). *Excellence in university assessment: Learning from award-winning practice*. Oxon: Routledge.

Falchikov, N. (2004). *Improving assessment through student involvement: Practical solutions for aiding learning in higher and further education* Routledge.

Gibbs, G. (2015). *53 powerful ideas all teachers should know about* SEDA.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81-112.

HEA. (2015). *Supporting A better transition from second level to higher education: Implementation and next steps*. Dublin: Higher Education Authority (HEA).

HEFCE. (2015). *National student survey* No. 2015)

Hepplestone, S., Parkin, H., Irwin, B., Holden, G., Thorpe, L., & Burn, C. (2010). *Using technology to help students engage with their feedback. A best practice guide for academic staff.*Sheffield Hallam University.

Hounsell, D. (2015). *Commenting constructively:Feedback to Make a Difference. wise assessment briefing no. 11*. Retrieved 12/2, 2015, from http://www.cetl.hku.hk/wise-assessment-forum/wp-content/uploads/2015/08/wise-assessment-briefing11.pdf

ISSE. (2014). *The irish survey of student engagement (ISSE) 2014*. Dublin: Higher Education Authority (HEA).

Jackson, M., & Marks, L. (2015). Improving the effectiveness of feedback by use of assessed reflections and withholding of grades. *Assessment & Evaluation in Higher Education*, , 1-16.

Jessop, T., El Hakim, Y., & Gibbs, G. (2014). The whole is greater than the sum of its parts: A large-scale study of students' learning in response to different programme assessment patterns. *Assessment & Evaluation in Higher Education, 39*(1), 73-88.

Kift, S. (2015). A decade of transition pedagogy: A quantum leap in conceptualising the first year experience. *HERDSA Review of Higher Education, 2*, 51-86.

Merry, S., Price, M., Carless, D., & Taras, M. (2013). *Reconceptualising feedback in higher education: Developing dialogue with students* Routledge.

Nicol, D. (2009). Assessment for learner self-regulation: Enhancing achievement in the first year using learning technologies. *Assessment & Evaluation in Higher Education, 34*(3), 335-352.

Nicol, D., Thomson, A., & Breslin, C. (2014). Rethinking feedback practices in higher education: A peer review perspective. *Assessment & Evaluation in Higher Education, 39*(1), 102-122.

O'Donovan, B., Rust, C., & Price, M. (2015). A scholarly approach to solving the feedback dilemma in practice. *Assessment & Evaluation in Higher Education*, (ahead-of-print), 1-12.

Panadero, E., & Jonsson, A. (2013). The use of scoring rubrics for formative assessment purposes revisited: A review. *Educational Research Review, 9*, 129-144.

Price, M., Handley, K., Millar, J., & O'Donovan, B. (2010). Feedback: All that effort, but what is the effect? *Assessment & Evaluation in Higher Education, 35*(3), 277-289.

Radloff, A., & Coates, H. (2010). *Doing more for learning: Enhancing engagement and outcomes: Australasian survey of student engagement: Australasian student engagement report.* Camberwell: Australian Council for Educational Research (ACER).

Reddy, Y. M., & Andrade, H. (2010). A review of rubric use in higher education. *Assessment & Evaluation in Higher Education, 35*(4), 435-448.

Sadler, D. R. (2010). Beyond feedback: Developing student capability in complex appraisal. *Assessment & Evaluation in Higher Education, 35*(5), 535-550.

Sutton, P., & Gill, W. (2010). Engaging feedback: Meaning, identity and power. *Practitioner Research in Higher Education, 4*(1), 3-13.

Tinto, V. (2005). Taking student success seriously: Rethinking the first year of college. *Paper Presented at the Ninth Annual Intersession Academic Affairs Forum, California State University, Fullerton*, pp. 01.

Y1Feedback. (2016a). *Feedback in first year: A Landscape Snapshot across four Irish Higher Education Institutions.* Retrieved 08/5, 2016, from http://y1feedback.ie/wp-content/uploads/2016/04/ALandscapeSnapshot2016.pdf

Y1Feedback. (2016b). *Technology-enabled Feedback in the first year: A Synthesis of the Literature.* Retrieved 08/5, 2016, from http://y1feedback.ie/wp-content/uploads/2016/04/SynthesisoftheLiterature2016.pdf

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Using student voice in the design of game-based learning

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Game technologies can provide exciting ways to engage and educate students and provide an active learning experience with a goal-directed agency. This research investigates how student voice is integral to the development and trialing of educational computer games in order to effectively target, and add meaning and relevance to learning outcomes. Games can offer a transformational change in pedagogical approaches by being intrinsically motivating, providing immediate feedback and scaffolding skill and knowledge acquisition. The research focused on understanding learner needs by involving students in project based development and examines the rationale behind making a pedagogical shift from unidirectional content delivery to collaboratively designing experience. The study adopted a Design Based Research methodology, within an Activity Theoretical framework.

Keywords: Activity theory; Game-based learning; virtual worlds; student voice

Introduction

The research explored the design, development and trial of computer games used for learning and teaching, and investigated the significance and impact of game parameters on learning outcomes in the Vocational Education and Training (VET) context. The games-based learning environments involved interactions amongst students, VET teachers and game developers. Three games were designed and developed for the research addressing different VET disciplines and curriculum, and trialled with different cohorts in order to listen to the voices and experiences of a diversity of students (Beavis, Muspratt, & Thompson, 2015).

These games included: *Play It Safe* which addressed three Units of Competency at Certificate and Diploma level from MEM05: Metal and Engineering Training Package; *LabSafe* which addressed one Unit of Competency at Certificate and Diploma level from PML04 - Laboratory Operations Training Package; and *The White Card Game* which addressed one Unit of Competency at Certificate level from CPC08 - Construction, Plumbing and Services Training Package. The iterative development of the three games allowed for the student voice to play an integral part in improvements in the pedagogical alignment and design.

Research design and methodology

The research design has been structured around clearly defined phases. The research progressed in iterative cycles with each successive phase of data collection and analysis informing modifications to the games. The iterative development of the three games allowed for student voice to be an integral aspect for the improvement in the pedagogical alignment and design by providing insight into students' learning experiences (Campbell, Beasley, Eland, & Rumpus, 2007)

The major concern that guided the research design of this project were the significant resources and time required for designing, developing and refining computer games to be used for education. The aim was to explore an approach to analyse tensions and facilitate productive interactions among developers, teachers and students that are involved in the design, application and use of games-based learning. The approach adopted an Activity Theoretical framework in order to analyse needs, tasks and outcomes in the games-based learning environment. In particular, how to best target skill development and knowledge acquisition by involving students in the iterative cycles of development of these highly interactive learning environments. This approach involved: analysing the interactions between components in the games-based learning activity system while they evolved; identifying contradictions and exploring the mediation that progressed the activity outcome; and examining game components within the games-based learning context. This analysis was facilitated through data collection from students that focused on (Seale, 2009):

- asking questions about their experience;
- observing and understanding the student learning perspective;
- reflecting on implications of design choices; and
- catering to the diverse needs of the student cohort.

The components of the activity system that were examined included narrative, gameplay and fun. The data analysis revealed significant increases in knowledge transfer, skill development and engagement with the curriculum in comparison to conventional pedagogical approaches. Data included observations, surveys, interviews collected during the design, development and trialing of three 3D first-person shooter learning games.

Each VET game developed was designed as a discrete activity system. Data was collected from each system and comparative analysis of the components undertaken. The data was analysed in the context of Activity Theory and Design Based Research. By gaining insight into the impact that the components have in different activity systems we can understand the interaction of the components and hence how they influence the learning outcomes, or developmental transformations of the system. The activity-focused data collection and subsequent analysis paid attention to:

- Learner's activities – how the game structure facilitated or constrained successful learning outcomes;
- The game environment – the design of the game including narrative elements and gameplay;
- The dynamics of interaction – interaction with learning content; and
- Developmental transformation of the complete system.

Activity Theory describes how the effectiveness of learning systems depends on the interplay of subjects and objects (Figure 1) (Engestrom, 1987). The focus of activity system analysis involves a subject, the object of the activity, the instruments that are used in the activity and the actions and operations that affect the outcome (Jonassen & Rohrer-Murphy, 1999).

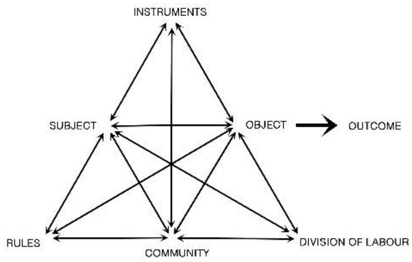

Figure 1. Engestrom's Activity System Model

In the games-based learning context of this research, the learner has been designated 'the subject' engaged in the learning activity, the 'object' of production is the trial of the game and the 'outcome' is the knowledge gained from the activity. The activity can be analysed by examining the tools/devices that mediate it, and the tools can only be understood by the context in which they are used. This context includes cultural factors such as rules, the community and the division of labour. When applied to a games-based learning environment, rules can be interpreted as the 'control' of learning that is dependent on students, teachers and their interaction with technology. Community encompasses styles and strategies of learning and interaction with the technology. Division of labour can refer to communication in that learners adopt new forms of communication when they become available (Sharples, Taylor, & Vavoula, 2010).

The iterative development of the games trialled in this research was in response to the learning context, with each modification a result of feedback from students, VET teachers and developers, which was subsequently assessed, discussed and implemented into production. Although the learner's experience in playing the game could be perceived as achieving individual goals through a series of game tasks, the activity is a system of social relations. This learning is taking place through a complex collaboration of institutional, team-based and artificial agent driven activity – a 'system of collaborative human practice' (Engestrom, 1987). The Activity System is continually transforming through the interaction of components in a dynamic system and represents the processes of learning (Kaptelinin & Cole, 2002).

Results and discussion

The results of this research indicate that student voice is critical for improving curriculum design in games-based learning environments. Observations and interviews with students undertaking trials of the games during iterative development cycles, and surveys and interviews of students after playing the final version of the games are presented along with the analysis of how student voice has impacted on learning outcomes.

Gameplay and learner agency

In the surveys, 83% of the respondents agreed or strongly agreed that they learnt about the topic playing the game. Student comments from interviews indicated that the gameplay experience was relevant and contextualised to the practical work-based situations they were training for:

> So much easier to learn the basics when you play the game because it gets you involved in what is happening around you, which makes you pick up things much faster.
>
> The game was like the real workplace.
>
> Hazards were in the right places just like a worksite, and dealing with them too.
>
> As far as from an apprentice point of view it works really well, considering when I was a first year apprentice you don't really give a damn, until you do some nasty stuff to yourself.

The student learning narrative

The game world enables players to make choices that advance the game narrative. This was supported by 84% of students agreeing or strongly agreeing that they became more involved in the game as the game progressed. The game allows students to have a voice in deciding their own destiny, and hence learning, in the game environment. The player as ‘person with intentionality’(Barab, Gresalfi, & Ingram-Goble, 2010) makes choices in the game context which reveals consequences for players' decisions. Game-world dilemmas aligned with the learning content are resolved by player action. Student comments indicate that learning happens through resolving issues presented in the game narrative:

> Make sure you don't do things too quickly, skip process you end up getting hurt.
>
> You got consequences if you stuff up.
>
> Useful to do everything in sequence, like switching off gas and electricity in the fire emergency before leaving. These I cannot find in real life. When I have to do experiments, disposing of waste, when I finish experiments I have to dispose of waste properly, not just get the result of the experiment.
>
> You can’t complete it unless you complete the tasks, you gotta walk through the workplace and find things – tools, shadow boards makes you look at things, so you know what to look for.

The narrative in the game is particularly relevant to a VET context where players are training to achieve vocational outcomes. Game players draw on culturally available narrative components to contextualise their actions (Louchart & Aylett, 2004). In the games trials, VET learners were able to draw on or refer to the vocational context, and in doing so were able to create and explore new possible scenarios relevant to their future vocation.

Teachers listening to the student voice

Although the results have shown that games-based learning can be effective for student learning, there are other considerations in adopting new technologies in education. This includes the capacity of teachers to engage with the technologies and effectively integrate them into the learning environment. The attention of students in the action and goal-directed pursuit of game goals, which focused on the learning content, meant that students were actively engaged in learning. Students were observed to verbally interact with their peers excitedly as they progressed through the game. These interactions also involved the teacher in lively discussions about the curriculum content. In discussions with the teachers prior to trialling the games, there were comments that they felt students were innately adept at using digital technologies. There was perceived reluctance to adopt the games in their class due to their own low digital self-efficacy. Using the games in the classroom was a new experience for teachers. Instead of dealing with retention issues and disinterest in the learning content, teachers were now in the position of having to actively engage students in the subject matter, content that the teachers were experts in. Student voice is then not only actively present in the development of skills and knowledge in the targeted curriculum, but enabled scaffolding of learning in the Vygotskian (Vygotsky, 1978) tradition. In addition, Lai and Hwang (2015) have shown that being actively engaged with peers in understanding learning problems, and reflecting and revising their approach based on teacher’s comments situated students in higher order thinking.

Engagement and game feedback

Student voice is represented in the playing of the games. When students are navigating the game world, they are in control of their own progression and directing their own learning. They are determining the pace that they learn at and how they approach game challenges. In situations where aspects of the game design provided an obstacle to progressing the activity, student feedback about the game design was fed into the iterative development process to modify and improve the educational game products. Observations of 82 students interacting with the games indicated high levels of engagement, social interaction and motivation to achieve game goals. Survey responses supported this with 78% responding that they found the game engaging. The actionable context which is responsive to the learners’ game activity (Barab et al., 2010) provides a level of immediacy and supplies responsive consequential feedback. This feedback is empowering to students by allowing them to experience the results of their in-game decisions by learning through their successes, failures and mistakes in the game.

The gameplay is experiential with players having a defined role and being situated in the vocational space where they and their actions affect a specific context. The challenge supplied by the game is important for cognitive achievement. Cognitive outcomes have been shown to improve with increased interactivity as long as cognitive overload through intensive gameplay does not limit learners’ capacity to process new information to enable them to meet the instructional goal. This balance is supported by the survey responses where 65% of students found the game challenging yet at the same time 82% understood what to do. Through performing actions, experiencing consequences and reflecting on the decisions they make, users develop a goal-directed sense of agency as they engage with learning content in games-based delivery. Students' comments represent this perspective and reinforce concepts of learning through gameplay:

> Sometimes confusing, first there's a fire, then you got to put the fire out, then what was I doing, then there's a chemical spill, you can't really focus on one task at one time, I suppose that could be a real workplace, a lot of accidents in one day though!
>
> More interactive than some teacher talking my ears off.
>
> Sometimes it is fun, but with my study, not that much information with my study I get, but when I compare things that are very important if I spend 1 hour playing this game I will learn the things that are very important but I will not get that much information in 1hr of study.

Fun and learning

Students were engaged with the content and interacting with their peers and teacher, and the majority found this an entertaining experience. Of the 82 participants survey responses indicated that 74% of students enjoyed playing the games, 70% had fun and 78% found the games engaging. Coupled with 71% stating that they learnt about the topic playing the game we can infer that having fun and being engaged is linked to successful learning outcomes. This is supported by students' comments:

> It was better than doing the text, it was more interactive, better than just sitting there and looking at a bit of paper, more enjoyable.
>
> ...humour good though, you joke about things, not obviously though, keep it entertaining in that regard, the apprentices learn about it more, sometimes coming across as deadly serious doesn't drum it in as much.
>
> A lot better, good concept, more visual and fun, more interaction, you feel better when you do something.
>
> Sticks with you, you might joke about it but you are always thinking about it.

The connection between fun and learning as expressed from the student perspective is supported by Fu and colleagues (2009) who found that game enjoyment is a key factor in determining player involvement and learning throughout the game. In addition Singhal and Rogers (2002) propose that knowledge acquisition is enhanced when learners are being entertained.

Conclusion

This research demonstrated the importance of student voice for analysing the impact that game parameters have on knowledge acquisition in games-based learning environments and validating a pedagogical shift from content delivery to designing experience. Student voice was also an integral aspect of the iterative development cycles of the educational games in this research by providing a contextualised goal for learner engagement in theoretical subjects, and investigating whether games-based learning adds meaning and context to VET learning outcomes.

This research has shown that involving students in the design and development of interactive curriculum in games-based learning environments can enable interactions among teachers and learners, engage learners by conferring agency, provide a scaffolded sequence to enhance skill development, and align assessments and learning with learning outcomes. Gameplay had a positive impact on student retention where students were observed to remain after class to play the games and engage with the learning content. This was in contrast to comments by one teacher who stated that students would often wander out of the class and not return when conventional pedagogical approaches were used to teach the curriculum addressed by the games.

The games-based activity systems analysed offered stimulation and excitation of the subject in attaining the object of improved knowledge transfer and skill development. Surprisingly, outcomes also included additional understandings regarding the complexity of the social and consequential context of work focused activity. Students were observed to make a shift from being passive receivers of curriculum content to active participants engaged in their learning (Beavis et al., 2015). The actions of participants were adjusted by operations or routine processes in order to orient the subject towards attaining a goal. The Design Based Research iterative development and trial of the games involved transformation of these conscious actions to routine operations, and when operations failed to produce a desired result, reflection through student feedback would result in implementing modified procedures. Student voice activities thereby shift perspectives and position ‘students as the agents of change’ (Toshalis & Nakkula, 2012).

References

Apple, M. W., & Jungck, S. (1990). 'You Don't Have to Be a Teacher to Teach This Unit': Teaching, Technology, and Gender in the Classroom. *American Educational Research Journal, 27*(2), 227-251.

Barab, S. A., Gresalfi, M., & Ingram-Goble, A. (2010). Transformational Play : Using Games to Position Person, Content, and Context. *Educational Researcher, 39*(525).

Beavis, C., Muspratt, S., & Thompson, R. (2015). 'Computer games can get your brain working': student experience and perceptions of digital games in the classroom. *Learning, media and technology, 40*(1), 21-42.

Campbell, F., Beasley, L., Eland, J., & Rumpus, A. (2007). Hearing the student voice: Promoting and encouraging the effective use of the student voice to enhance professional development in learning, teaching and assessment within higher education. Retrieved from http://dera.ioe.ac.uk/13053/2/3911.pdf.

Engestrom, Y. (1987). *Learning by expanding. An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit Oy.

Fu, F. L., Su, R. C., & Yu, S. C. (2009). EGameFlow: A scale to measure learners' enjoyment of e-learning games. *Computers & Education, 52*(1), 101-112.

Lai, C. L., & Hwang, G. J. (2015). An interactive peer-assessment criteria development approach to improving students' art design performance using handheld devices. *Computers & Education*, 85, 149-159

Kaptelinin, V., & Cole, M. (2002). *Individual and Collective Activities in Educational Computer Game Playing.* Paper presented at the 2nd international conference on Computer Support for Collaborative Learning, Toronto, Ontario, Canada.

Kaptelinin, V., & Nardi, B. (2012). *Activity Theory in HCI: Fundamentals and Reflections* (Vol. 5): Morgan and Claypool.

Louchart, L., & Aylett, R. (2004). Narrative theory and Emergent interactive Narrative. *International journal of Continuing Engineering education and Lifelong Learning, 14*(6), 506-518.

Mayer, R. (2009). *Multimedia Learning* (second ed.). Cambridge: Cambridge University Press.

Seale, J. (2009). Doing student voice work in higher education: an exploration of the value of participatory methods. *British Educational Research Journal, 36*(6), 995-1015.

Sharples, M., Taylor, J., & Vavoula, G. (2010). A Theory of Learning for the Mobile Age. In R. Andrews & C. Haythornthwaite (Eds.), *The Handbook of E-learning Research* (pp. 221–247). London: Sage.

Singhal, A., & Rogers, E. M. (2002). A theoretical agenda for entertainment—education. *Communication Theory, 12*(2), 117-135.

Sweller, J., & Merriënboer, J. J. G. v. (2005). Cognitive Load Theory and Complex Learning: Recent Developments and Future Directions. *Educational Psychology Review, 17*(2), 147-177.

Toshalis, E., & Nakkula, M. J. (2012). Motivation, engagement, and student voice. *Education Digest, 78*(1), 29-35.

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge MA Harvard University Press.

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A blended learning model and a design model combine to support academics in pedagogical redesign of the curriculum

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Mostly, blended learning is simply interpreted as the combination of face-to-face and computer-mediated learning (Graham, 2006). Unfortunately, this definition not only hides the complexity and transformative possibilities of blended learning, it can also leave the academic teaching developer without the detail and certainty they need to develop learning designs that address their institution's blended delivery expectations and meet their students' learning needs. Our approach to supporting academic change to blended learning addresses these uncertainties and places emphasis on the pedagogic strategies that guide student learning activity and drive the design of integrated learning experiences across learning environments. We present two models - a four phase blended learning model and a two-layer design model, and demonstrate how the properties of each combine to afford a blended learning design approach. Early indications of its effectiveness are promising and favourable responses to the models' simplicity and use indicate they may support teaching developers across other contexts.

Keywords: blended learning models, design approach, pedagogical focus, curriculum change

Introduction

A growing body of work concerned with institutional change to progress the adoption or implementation of blended learning (e.g., Graham, Woodfield & Harrison, 2013; Garrison & Kanuka, 2004; Taylor & Newton, 2013) is supported by evidence compiled in many empirical studies that blended learning is more effective than fully online or fully face-to-face (f2f) learning (Means, Toyama, Murphy, Bakia & Jones, 2010). In this context the term 'blended learning' is most often simply interpreted as the combination of f2f with computer-mediated learning (Graham, 2006). This simple portrayal of blended learning understates its potential: Blended learning is a transformative educational methodology, capable of delivering pedagogically sound learning experiences across disciplines and levels of education as well as providing flexibility and choice to meet the individual needs of students in contemporary society (Graham, Henrie & Gibbons, 2014; Garrison & Kanuka, 2004).

Multiple blended learning definitions exist (e.g., Torrisi-Steele, 2011; Westbrook, 2008) and the variety and possibilities seem endless (Westbrook, 2008). While many researchers suggest this is a strength, providing opportunity for contextualised interpretation and design, others are more circumspect (Alammary, Sheard & Carbone, 2014). Torrisi-Steele (2011, p. 360) cautions that "the lack of consensus on a definition of blended learning and the techno-centric nature of many existing definitions contributes to the unrealised pedagogical potential of blended learning". In essence, the very power of blended learning is frequently lost through mundane interpretations.

Of further concern and the focus of the work presented in this paper, is the position this leaves teaching developers[15]: They feel the pressure to convert existing traditional subject delivery to a blended format but often have limited experience, tools, and time to do so in a pedagogically sound way (Vaughan, 2007). Those who seek support may find a good variety of approaches available for beginning their blended learning journey (e.g., Carter & Huber, 2013; Salmon, Jones & Armellini, 2008). However, many are troubled by the disparity they see between the needs and expectations of their students and institution, and concerned about changes to their teaching role in the new blended learning format (Stacey & Gerbic, 2008). For those contemplating its use for the first time, there is often a lack of certainty on what it is, what is required and where to start.

[15] 'Teaching developers' are academics who (re)design and implement subjects, and teach these subjects to their tertiary level students.

A further challenge is the continued lack of pedagogical focus in models and definitions of blended learning: Graham et al. (2014, p. 27) state that "the heavy focus in existing models on physical or surface-level characteristics rather than pedagogical or psychological characteristics is impeding progress.", while Torrisi-Steele (2011) reveals that a majority of definitions in her study lacked adequate learning and teaching focus to support good practice in blended learning implementation. Further, while a focus on pedagogy is presented in blended learning design practice (e.g., Garrison & Vaughan, 2008; Herrington, Reeves & Oliver, 2010), it can be readily overlooked if pedagogically inadequate definitions and models are used to guide design - particularly by those lacking experience or time. Yet, an adequate focus on pedagogy is critical during design as "it is the design of the experiences and how the students are engaged that directly affect the quality of the learning experience" (Garrison & Vaughan, 2008, p. 87). Learning designs need to be shaped by the desired educational outcomes; moreover, planning and design should emphasize the strategies to engage, motivate, guide and monitor the learning experience while the important blend of f2f interaction and ICT-mediated materials and processes is relegated to that of the tools used to implement the strategies (Torrisi-Steele, 2011).

In essence, effective blended learning is no different to effective traditional learning in the requirement that students engage and are confident in the way the learning has been structured in the subject. In both the traditional and the blended, the student's learning is paramount and the critical difference lies in the role played by the teacher and student in the learning process. Indeed, blended learning represents a "fundamental reconceptualization of the teaching and learning dynamic" (Garrison and Kanuka, 2004, p. 97) and presents new requirements for the teacher's role (Gerbic, 2006 (in Stacey & Gerbic, 2008)).

Our institution has recently progressed from a period in which constructive alignment (Biggs & Tang, 2007) was embraced and embedded across the curriculum to its current focus on delivery mechanisms. This includes moving, at a minimum, to a replacement blended learning format (Twigg, 2003), with sobering requirements for all subjects such that, online learning must comprise at least 25% of each subject's core learning requirements; in-class time is to be reduced; and videoconference lectures abolished. With this in mind our focus has been to move to a blended learning model in which students have more active control of their learning and can achieve deep learning based on a constructivist approach. This is a definite move into transforming blend territory, compelling the teaching developer to refocus their pedagogical approach and engage in a fundamental redesign of their subject learning model (Graham, 2006).

In efforts to support teaching developers through the reconceptualization required, and assist educational designers who guide them in their redesign, we embarked on a project to advance and support the design of pedagogically determined, student-centred blended learning formats, to benefit them and their students. We adopted a design-based research methodology (Anderson and Shattuck, 2012) and derived the research questions seen below to drive the project. Qualitative and quantitative methods will be used to determine the effectiveness of the investigation; academic data will be called on and further data collection relies on a mix of methods including interviews, focus groups, questionnaires, observations and expert reviews.

1. How can we promote development of student-centred, pedagogically integrated blended learning in a way that enables teaching developers to understand and have confidence in their blended learning design?
2. What support do teaching developers need in developing blended learning designs that
   a. pedagogically integrate the blend of f2f and online learning activity?
   b. prepare, encourage and support students through the online learning phase?
   c. promote an elevated cognitive level of learning interaction in the f2f phase?
3. How well do teaching developers' blended learning implementations address student-centred and pedagogic integration indicators and, further, affect their students' learning experiences, behaviours and outcomes?
4. What factors impact on the effectiveness of the teaching developers' blended learning implementations?

In this paper we present outcomes of the early stages of the project. Although unable to formally address the above questions as yet, detail is presented of two models we developed and combined to create a design approach. We discuss examples of its use in subject design and development and identify three core strengths.

A four-phase blended learning model

Figures 1 & 2 are used to introduce the four phase blended learning model. The physical structure and operation of the blended learning process is evident in the simple surface format seen in Fig. 1. Closer inspection reveals active learning elements within each blended learning component. The blended learning format combines these two perspectives and highlights the learning steps students engage in during their blended learning experience.

Blended learning format

The student blended learning experience is influenced by four components: *active learning online*, *face-to-face interactive learning* and two *active learning transitions*. The first two constitute contrasting modes of learning, while the latter two propel the learning process from one mode to the other and influence how effectively students will embark on and learn in each, whether online or face-to-face.

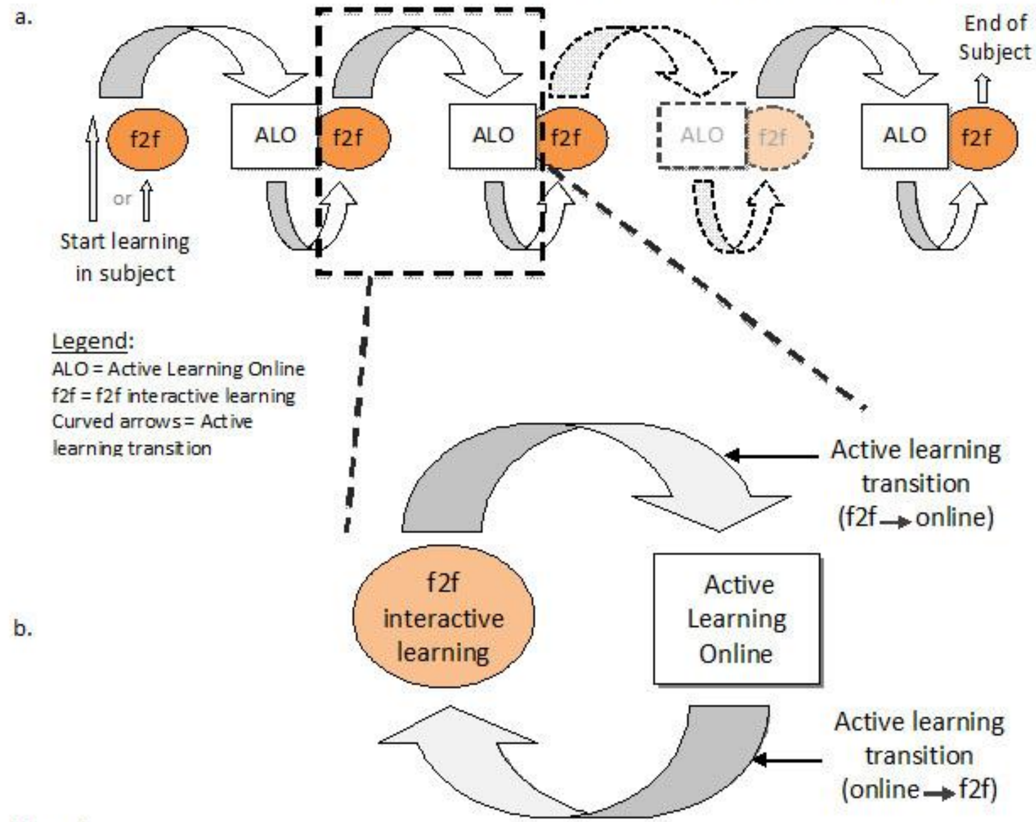


Figure 1.

a. Repeated blended learning cycles form a spiral as the subject and learning progress.

b. A four phase blended learning cycle.

A cycle of blended learning naturally develops as students move from one learning mode to the other (Figure 1b).

The cycle may be repeated several times, with successive cycles building on learning achieved in earlier cycles, forming a spiral as the syllabus & learning progress (Figure 1a).

Often these cycles occur weekly in subjects designed for blended learning beginners, but the learning design and setting for the subject determines their length and frequency. For example, subjects offered in condensed semesters may use several shorter cycles to start with while fewer cycles of varying length might occur in placement or later-year subjects.

Figure 1: Operational structure of the four phase blended learning model (Reprint from Presentation leaflet, *Blended learning format* (p.1), L.Pannan, 2014, La Trobe University)

Blended learning components

ALO

Active learning online comprises at least 25% of the subject learning requirements.

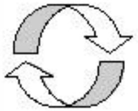
Student work in this component occurs online and out of class, guided by directions found in the subject's online presence. This may, typically, require 2 hours per week of online activity for a first year subject, to be completed individually or collaboratively with peers or in an online or f2f team; and offer opportunity for at least an hour or more of student self-directed online work.

This online component may take place

- on a weekly basis, and cover at least 25% of the subject learning for each week, or
- in a single block, or several blocks of smaller length, in total covering at least 25% of the learning for the whole subject.

In every case,

- students are guided through an active engagement with concepts and content. This involves learning material made available online accompanied by clear instructions on a process to follow (as suited to task and learning level) and the intended focus and learning benefit of their work.
- the learning achieved is later confirmed, or corrected, further enhanced, and celebrated through a subsequent collaborative debrief or reflection, extension and further enquiry. This most frequently takes place in the f2f interactive learning component.



Active learning transitions engage students in learning activity/s to assist their progression into the next learning environment. Two active learning transitions exist, the online-to-f2f and f2f-to-online transitions.

The tasks students perform, and possibly submit, can vary enormously as they are encouraged to review and use concepts, skills and knowledge gained in the previous component. Many are made explicitly 'worthwhile' to the student (such as being for credit, or bonus, or unlocking links to materials) to entice their engagement as failure to do so will likely undermine their success in that next set of learning.

The online-to-f2f learning transition activity usually starts at, or near, the end of the ALO so that students can exercise and demonstrate their current knowledge. For example, students may work in collaborative teams in allocated study areas producing outcomes, or a short draft response, that may be submitted.

The f2f-to-online learning transition activity may follow, or start in the latter third of, the f2f interactive learning component. It needs to motivate students and overcome initial hurdles to ease the struggle many experience when they first start on new ideas and concepts, and independently, online and out of class. For example, students may view an introductory videoed activity; or discuss and solve a problem or the first ALO activity in a collaborative team.

f2f

Face-to-face interactive learning involves at least 1 hour of scholarly interaction between students and academic/s in each blended learning cycle.

Student work in this component mostly occurs in class, perhaps a Q&A lecture or a large/small group discussion workshop, and aims to resolve issues with concepts in the previous ALO.

Activities should be specifically targeted, made possible by a snapshot of student understanding of the ALO work, submitted before class in the form of responses to an online-to-f2f learning transition exercise, such as a quiz, or team task.

During the scholarly interaction

- the transition work submitted by students is acknowledged and, most usually, responded to. The expected learning achieved in the preceding ALO is 'exercised' to ensure students are on track and an adequate level of understanding is reached.
- students may be guided through collaborative extension of their learning in the topic.
- a short student exercise introduces and primes students for the f2f-to-online learning transition activity that links their current learning to that of the next ALO component.

Other f2f interactive learning activity, such as experimental laboratory and field work, aligns and is integrated into this component.
Overall, a total of 10 hours of student work across the subject per week is anticipated.

Figure 2: The four phase model's components (Reprinted from Presentation leaflet (revised), *Blended learning format* (p. 2), L.Pannan, 2014, La Trobe University)

The model deviates from other blended learning models in that four components of student learning activity are identified: *active learning online* (ALO), *face-to-face interactive learning* and two *active learning transition* components. The first two constitute contrasting modes of learning, though both progress earlier learning and introduce new knowledge and concepts as needed. The two transition components offer activities that influence how effectively students assimilate earlier learning and embark on and learn in the next online or f2f component. As learning activity moves from one component to the next, a cycle of blended learning develop that progresses through four learning phases (Fig. 1b). Repeating this four phase cycle allows the learning to progress through the syllabus (Fig. 1a).

The design of each phase in the blended learning cycle is critical, requiring adequate pedagogical planning to ensure that the respective purpose of the phase is supported and may be achieved. For example,

- In the ALO phase, clarity of expectations (e.g. activity duration and learning outcomes), guides and scaffolding for learning activities are particularly important. The aim is to avoid misunderstandings and gaps in explanations as the teacher cannot immediately know about nor readily fix these in the same way as they are often efficiently dealt with in a f2f class (Hoffman, 2006). Students may work collaboratively in study venues on campus, or work on their own, on or off campus.
- The *online-to-f2f learning transition* activity validates the student's efforts in ALO. Its aim is to encourage students to reflect on and apply the concepts and understandings gained in ALO, to well prepare them for the f2f interactive learning. If students submit a completed formative quiz or a f2f collaborative team response to a set question, for example, the teacher can be alerted to issues in their learning progress and develop timely strategies to address them.
- During the f2f interactive learning phase, robust and meaningful scholarly interactions with academic/s and peers should be a distinct possibility. The aim is to raise the cognitive level of learning achieved. Discussion, debating of options or current issues - the activities may vary but their intent is to interactively exercise, strengthen and extend the learning achieved in the preceding ALO. Students will, mostly, arrive well prepared; the teaching developer will need to explore these opportunities to promote deeper learning.
- The *f2f-to-online learning transition* activity encourages reflection and use of previously encountered concepts and knowledge in new situations, preparing students for the next ALO. The activity is short, f2f or online, and probably collaborative. It aims to support them over hurdles they often face when starting study online: allaying uncertainties and resolving issues before they arise - perhaps simply those of a new topic or because fewer or unplanned outcomes arose in the previous scholarly f2f interactions.

Although student-focused learning and engagement strategies influence the design of learning activity in each phase of the model, it is the learning activity in the transition phases that intentionally connects the learning experiences of the f2f and ALO environments. These transition phases encourage students to reflect on and apply concepts and knowledge gained in their preceding ALO or f2f learning experiences so that it is likely they will be curious and well prepared for learning in the next f2f or online environment. This may not only influence the depth of learning achievable in subsequent learning tasks (Biggs, 2009), but it also establishes an effective integration of the f2f and online learning activity to improve the progression and quality of the learning experienced (Garrison & Kanuka, 2004).

Blended learning designs developed through use of the four phase blended learning model are characterized by a student learning experience that alternates between f2f and online learning environments throughout the subject or module. Other design characteristics and flexibilities are available in Fig. 1 & 2. (Note that institutional specific example requirements used in Fig. 2, such as online percentages and study durations, can be changed.)

A two-layer blended learning design model

The two-layer design model draws on theory and practice surrounding more complex design models (Gibbons, 2014; Gibbons & Rogers, 2009), but its simplified form has far fewer design layers. The model provides a conceptual framework for understanding the relationships between elements of blended learning. Its two layers are abstract concepts into which blended learning is divided based on its two key features: "a process that is pedagogically based and a product (course) with a mixture of face-to-face and online components" (Alammary et al., 2014, p. 443). Thus, the *pedagogical layer* and *physical layer* were created to focus on 'learning activity' and the 'operational learning environment', respectively (see Table 1).

The abstract separation of blended learning complexity into two layers facilitates design development by bringing together related structures and functions in each layer: This simplifies comparison, discussion and decision-making with regard to these elements. Although each layer has a distinct purpose, layers are functionally interdependent and decisions made about the elements of one layer will influence the decisions possible for structure and function in other layers (Gibbons, 2014). Development of a design, therefore, needs to be an iterative process. The layer hierarchy established in our model dictates that the physical layer serves the pedagogical layer: Being dominant, the pedagogical drives the design process.

The pedagogical layer is supported, and possibly constrained by, the learning context and mechanics available in the physical layer. It leans heavily on cognitivist and constructivist learning theories (Biggs & Tang, 2007) and research on pedagogical approaches and possibilities in computer integrated learning models (e.g., Conole, 2013; Herrington, Reeves & Oliver, 2010; Littlejohn & Pegler, 2007). When operating in this layer the teaching developer considers strategies to drive student-focused, interactive and activity based learning, and use of constructively aligned learning experiences to promote deep learning (e.g., Biggs & Tang, 2007; Garrison & Vaughan, 2008; Laurillard, 2002). Then, by way of arranged demonstrations of the learning benefits of new and available learning technologies, they can experiment and explore how these may be used to support and enhance learning (e.g., Howland, Jonassen & Marra, 2011; Kenney, 2013). Finally, they select approaches they believe will address the topic and learning needs of their students.

The physical layer provides the context and mechanics for effective blended delivery and can be the primary focus of those first considering use of blended learning and discovering what it can offer. This layer defines all physical elements needed in the operational learning environment and their interrelationships during the blended learning process. In essence, the continuing flow of learning activity through each blended learning cycle is made possible by the scheduling, availability and operation of physical layer elements, such as venues, learning materials and tools. When working in this layer the teaching developer first identifies the learning context, external requirements and constraints. In due course they determine all elements they require in the learning environment and select access to learning resources and delivery support tools for scheduled and any-time learning activity. Notably, locations and schedules are also established for the people needed in the learning environment, including students, teachers, and support personnel.

Table 1: The two layers of the blended learning design model

Layer	Focus	Critical elements the layer is responsible for
Pedagogical	The learning activity: what is done, how and why. It defines the pedagogy and strategies to engage learners, guide & promote deep learning, and monitor engagement & progress.	• Student-focused teaching & learning strategies. • Learning theories: constructivism & constructive alignment, cognitivism. • Learning outcomes and designs. • Blended learning technology strategies
Physical	The operational learning environment: who is where, when. It defines the context, content, structure and mechanics that support operation of the tangible aspects of blended learning, including people and technology products.	• Gross structure, locations, people, components and their interactions. • Requirements & constraints imposed by the environment. • Operational sequences and timing. • Learning tools (f2f & ICT-mediated learning materials & technologies)

While using this two layered design strategy, the teaching developer is encouraged to keep their design concept simple by limiting the set of defined elements and using as few changes in tools and mechanisms as possible to achieve the required functions (Gibbons, 2014). To develop a design concept, we:

6. Plan an integrated flow of learning across the learning environments to achieve the desired outcomes.

Determine, and schedule, the tools that best suit the planned learning tasks and cohort.

Use the plan (from above) to finalize a design for an integrated blend of f2f and ICT-mediated learning that best addresses the topic and learning requirements.

So, for example, following several iterations of investigation and decision making in the two design layers (i.e. iterations of steps 1 and 2), the teaching developers finalize their pedagogical layer decisions and establish learning activities that develop the desired outcomes. Subsequently, their final physical layer decisions ensure that the structure of the learning environment and scheduling and function of all physical elements support their learning plan. The success of the latter step, and subsequent creation of the final design (i.e. step 3), may depend on whether an earlier iteration has accurately negotiated the final set of physical constraints on the design.

The blended learning design approach

Our design approach combines the two models already presented. The four phase blended learning model formulates the pedagogical and physical structure that is aimed for in the design concept, while the two-layer blended learning design model delivers a guided design process for achieving it. Development of the design follows the iterative format dictated by the design model, alternating design effort between the physical and pedagogical layers while following the design process steps until the design concept emerges.

Familiarization with the operating structure of the four phase model (Fig. 1&2) alerts teaching developers to the pedagogical processes that may be required. They consider how students might engage in learning in each phase in every cycle, for each topic and across the curriculum; then they develop their designs through successive cycles of blended learning. While they use elements available in the pedagogical design layer they also retain the integrity of the four phase blended learning cycle's inherent pedagogical structure so that strong integration of learning activity across the f2f and online environments will exist in their design.

Some teaching developers may decide to import learning strategies and tools that are known to better support specific learning activity and outcomes for their cohort and discipline. This can work well, with the pedagogic baseline for the design of integrated blended learning activity and support being provided by the four phase model, while the imported strategies influence the detail of the learning approach.

Implementation

In introducing the four phase blended learning model to the teaching developer we seek not only to establish with them an understanding of the model but also transference to how it works in their context. To this end we provide tools and examples and concentrate their effort on pedagogy. Subjects initially have a variety of formats ranging from the traditional to a flipped classroom delivery (Sankey & Hunt, 2013). Whatever the design and regardless of the student-focused nature teaching developers are striving to achieve, it is inevitable that when they describe the subject they focus on what they as teachers present to their students. This focus is not helped by the administrative approach to subject descriptions being aligned to timetable requirements and academic workload systems, all of which follow the requirements of teachers in f2f environments only.

Working with the teaching developer, we begin by clarifying the context, tools and constraints on the curriculum and thus establish the scope of possibilities for the blended design. Within this scope we refocus on the student experience and encourage them to describe what they want students to do over a topic in each part of the blended learning cycle, and get them to complete the design tool (Figure 3) for one blended learning cycle.

We provide two examples illustrating how use of the model and tools affected the design. The first is a traditionally delivered Engineering subject with a heavily teacher focused delivery across three lectures and a two-hour tutorial/problem class each week. The subject was required on several campuses, and the teaching developer was concerned about the difficulty of successfully reproducing the didactic classes in an efficient and effective way. In discussions, they articulated the idea that they felt the students needed to be more engaged with the subject material, and needed to see the subject as a development of conceptual understanding rather than a series of disjointed topics; and further, that they needed to participate in and wrestle with the problem solving and so develop their understanding and confidence in the material.

Using the design tool, the teaching developer was able to incorporate their ideas in the re-designed delivery. The result is a design where the student is introduced to the initial concepts through a guided use of resources and a short quiz, in the ALO, before engaging in work in a peer group that exercises the concepts through a few carefully selected set problems, and then submit their solutions (Fig. 3). The academic teaching developer can gauge the level of understanding reached by the class from these solutions and this guides the syllabus and activities in the subsequent f2f class. The teacher introduces the next iteration of the blended learning cycle, both conceptually and in practice, towards the end of the f2f class and workshop, respectively. At all times during the blended learning cycle the students are required to be active.

By repeating the design process for a new cycle and linking topics in a progressive spiral, the model allowed the teaching developer to project the bigger picture of the subject being presented as an integrated sequence of learning. The result is a subject delivery design produced by the teaching developer with student learning squarely at its focus, and able to be delivered on multiple campuses. The passive didactic lecture or tutorial that characterized the original design and hindered the required cross campus delivery has been removed. Each cohort has access to the common online activities and resources and experiences the same learning cycle, but their own f2f class each week responds to the particular cohort's needs.

Our second example is a subject that was already taught in a blended and flipped classroom format. By aligning it to our model, the teaching developers were able to visualize the consequences of their design on the student experience and to further develop the subject for multi-campus delivery. The subject is now taught on three campuses and is used as an exemplar to other subjects with regard to multi-campus delivery.

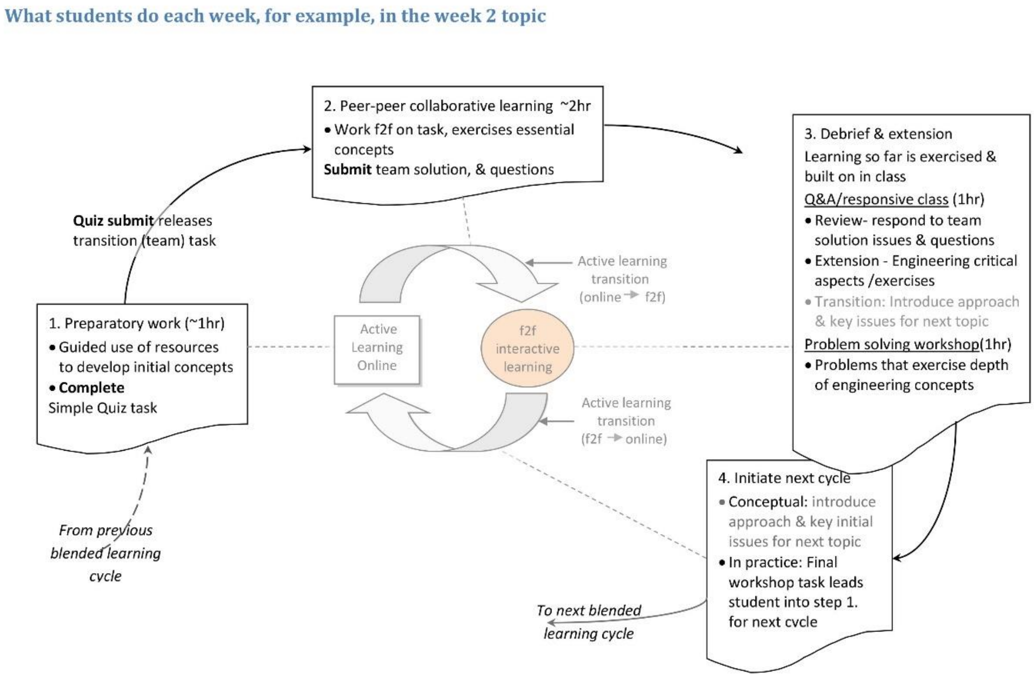


Figure 3: The design tool, with user added content in four scrolls outlining one week's activity

The point is that, whatever the example, the teaching developer is forced to consider the student's learning experience when using this model. Where the teaching developer has difficulty moving past the need for teacher-led lecture delivery, they are forced to describe what it is that the student does, and "sits passively in a two-hour lecture" does not fit comfortably with their idea of engaged learning.

Discussion

Our blended learning design approach exploits the combined properties of a four phase blended learning model and a two-layer design model, both created specifically for this purpose. Although each may also be used independently, when used together the models provide a structured design approach that clarifies the blended learning format and operation as well as the need for pedagogic dominance during design. The design approach and models are in the early stages of deployment and evaluation. So far the signs are promising; teaching developers, irrespective of their experience, appear to quickly grasp the physical structure and blended learning process concepts, and its cyclic nature. The four phase model has received favourable feedback from teaching developers and educational leaders, and also from design and development staff. Drawing on this feedback and our observations so far we identify three core strengths of the design approach and models as follows:

First, the definition of active learning transition components and the resultant integrated cycle of blended learning in the four phase blended learning model. Student learning activity is presented as flowing through the globally accepted f2f and online (or ICT-mediated) learning environments and then from one to the other via the active learning transition phases. The learning and engagement strategies that define the transition phases compel the teaching developer to consider and clarify the pedagogical links between learning activity in the online and f2f environments and develop an integrated learning design across each cycle of blended learning. Thus, these transition phases provide the model with an inherent pedagogical focus that may constitute progress towards addressing the pedagogical inadequacies reported for blended learning models (Graham et al., 2014).

The following feedback comment from one of our institution's experienced educational designers, in 2014, highlights the significance of the model's transition components when working with teaching developers.

> .. I think it is a very useful tool. The explanation of the active learning mode transition is what switches the light bulbs on for people when I show it to them. They finally get to understand blended learning as an integrated process requiring design thought rather than as two separate processes which is commonly how it's understood beforehand. Online learning is usually seen either as a supporting adjunct to face to face (filing cabinet) or as a replacement for face to face (diy university) and therefore is viewed as either irrelevant or unnecessary, or as a threat to the continued existence of teaching staff. This model helps get past those misconceptions and enables more productive conversations, and more adventurous design.

The model has the potential to be a truly useful tool for design of blended learning. It is simple and versatile: The only firmly fixed features of the model are the four phases of learning in the blended learning cycle and the pedagogy that defines them. The essential pedagogical structure of the learning cycle can support an enquiry based learning approach as evidenced in the "inquiry-through-blended-learning" example presented by Garrison & Vaughan (2008, p. 113). Other approaches, such as flipped classroom and problem/case based learning, may also be supported. As yet, the four phase model looks equipped to inspire development of a good variety of learning blend designs, across the range of low to high impact blend categories (Alammary et al., 2014).

Second, the two design layers, and dominance of the pedagogical layer in the two-layer blended learning design model. The two layers provide a clear delineation between the physical operational features and the pedagogical strategies and learning activity; and, they concur with Graham, Henrie and Gibbons' (2014) suggested approach to strengthening blended learning design models. The hierarchical relationship between the layers obliges the teaching developer to focus on the strategies for student learning; this has been observed to motivate exploration of alternative learning strategies and technologies to support specific learning outcome and skill development.

Third, the combined pedagogical emphasis of both models in our design approach. The four phase blended learning model provides strategies to integrate the learning blend across every cycle of blended learning, while the two-layer design model strengthens the pedagogic basis of the final design by prioritizing and iteratively revisiting the pedagogical aspects. With pedagogy as a central theme in both models, the teaching developer is eased into consideration of a variety of engagement, learning and progress monitoring strategies and can move on to design a sequence of integrated learning experiences. This is a step towards addressing the pedagogic deficit observed in blended learning models and abridged design practices (Graham et al, 2014; Hoffman, 2006).

With subjects gradually turning to a blended learning format the response from staff involved has been positive. In the main it is the clarity with which the four phase blended learning model enables them to see what their subject means for the students, that grabs their attention. The requirement to address the blended learning cycle and describe the students' experience reminds them of their responsibility to affect student active learning engagement and supports them in their design of a pedagogically focused blended format.

Conclusion

From a position that appreciates the complexity and uncertainties confronting academic teaching developers we present two blended learning models: One clarifies blended learning as an integrated pedagogical process while the other separates and promotes the pedagogical over the physical during design. The models combine in a design approach that emphasizes pedagogy in blended learning and, by focusing on what the student does and why, shifts attention away from the tools (both f2f and ICT-mediated) and toward the learning intent. We discuss three core strengths of the models and design approach, and how they address current concerns with blended learning. These strengths assist the teaching developer to navigate the complexity of blended learning; in particular, the emphasis on clarity of integration and navigation of essential learning experiences encourages them to create blended learning designs that strive to engage, prepare and support their students through integrated blends of online learning activity and robust scholarly f2f interactions.

Early implementation trials provide signs that the models and design approach can be effective in supporting teaching developers to design or transfer their subject, in accordance with the expectations and physical realities of the institution; in sympathy with the learning needs of their students; and with a clear understanding of their own role in the learning-teaching process. Evaluation effort to validate their effectiveness has started; in addition, studies are required to determine the contexts and constraints on use of both models in designing pedagogically integrated blended learning experiences. Although developed and introduced to meet the demands of our local context, the core strengths and favourable responses to the simplicity and utility of our models and approach suggest they may provide useful support to teaching developers across the tertiary education sector.

References

Anderson, T., & Shattuck, J. (2012). Design-Based Research: A Decade of Progress in Education Research? *Educational Researcher, 41*(1), 16-25. Retrieved from http://edr.sagepub.com/content/41/1/7.full.pdf+html.

Alammary, A., Sheard, J., & Carbone, A. (2014). Blended learning in higher education: Three different design approaches. *Australasian Journal of Educational Technology, 30*(4), 440-454. dx.doi.org/10.14742/ajet.693

Biggs, J., & Tang, C. (2007). *Teaching for quality learning at university (3rd ed.).* Maidenhead, UK: OpenUP.

Carter, H., & Huber, E. (2013). Working in partnership: An authentic professional learning program to promote sustainable curriculum change. In *Electric dreams. Proceedings ascilite 2013 Sydney* (pp. 129-138). http://www.ascilite.org/conferences/sydney13/program/papers/Carter.pdf

Conole, G. (2013). *Designing for learning in an Open World.* New York, NY: Springer.

Garrison, D.R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *Internet & Higher Education, 7*, pp. 95-105. http://dx.doi.org/10.1016/j.iheduc.2004.02.001

Garrison, R., & Vaughan, H. (2008). *Blended learning in higher education: Framework, principles and guidelines*. San Francisco, CA: Jossey-Bass.

Gibbons, A.S. (2014). *An architectural approach to instructional design*. New York, NY: Routledge.

Gibbons, A.S., & Rogers, P.C. (2009). The architecture of instructional theory. In C. M. Reigeluth & A. Carr-Chellman (Eds.), *Instructional-Design Theories and Models* (Vol. 3, pp. 305-326). New York: Routledge.

Graham, C.R. (2006). Blended learning systems: Definition, current trends, and future directions. In C.J. Bonk & C.R. Graham (Eds.), *The handbook of blended learning: Global perspectives, local designs* (pp. 3-21). San Francisco, CA: Pfeiffer Publishing.

Graham, C.R., Henrie, C.R., & Gibbons, A.S. (2014). Developing models and theory for blended learning research. In A.G. Picciano, C.D. Dziuban, & C.R. Graham (Eds.), *Blended learning: Research perspectives* (Vol. 2, pp. 13-33). New York, NY: Routledge.

Graham, C.R., Woodfield, W., & Harrison, J.B. (2013). A framework for institutional adoption and implementation of blended learning in higher education, *Internet & Higher Education*, 18, pp. 4-14.

Herrington, J., Reeves, T.C., & Oliver, R., (2010). *A guide to authentic e-learning*. New York: Routledge.

Hoffman, J. (2006). Why blended learning hasn't (yet) fulfilled its promises: Answers to those questions that keep you up at night. In C.J. Bonk & C.R. Graham (Eds.), *The handbook of blended learning: Global perspectives, local designs* (pp. 27-40). San Francisco, CA: Pfeiffer Publishing.

Howland, J., Jonassen, D., & Marra, R. (2011). *Meaningful learning with technology.* Columbus, OH: Merrill.

Kenney, J. (2013). Getting results: Small changes, big cohorts and technology. *Higher Education Research and Development Journal, 31*(6), pp. 873-889.

Laurillard, D. (2002). *Rethinking university teaching: A conversational framework for effective use of learning technologies (2nd ed.)*. London: RoutledgeFalmer.

Littlejohn, A., & Pegler, C. (2007). *Preparing for blended e-learning*. New York, NY: Routledge.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies.* Washington, DC: U.S. Department of Education. https://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

Oliver, R., & Herrington, J. (2003). Exploring technology-mediated learning from a pedagogical perspective. *Journal of Interactive Learning Environments, 11*(2), pp. 111-126.

Salmon, G., Jones, S., & Armellini, A. (2008). Building institutional capability in e-learning design, *Association for Learning Technology Journal, 16*(2), pp. 95-109. http://dx.doi.org/10.1080/09687760802315978

Sankey, M.D. & Hunt, L. (2013). Using technology to enable flipped classrooms whilst sustaining sound pedagogy. In *Electric dreams. Proceedings ascilite 2013 Sydney* (pp. 785-795). http://www.ascilite.org/conferences/sydney13/program/papers/Sankey.pdf

Stacey, E., & Gerbic, P. (2008). Success factors for blended learning. In *Hello! Where are you in the landscape of educational technology? Proceedings ascilite 2008 Melbourne* (pp. 964-968). http://www.ascilite.org.au/conferences/melbourne08/procs/stacey.pdf

Taylor, J.A., & Newton, D. (2013). Beyond blended learning: A case study of institutional change at an Australian regional university. *Internet & Higher Education, 18*, pp. 54-60.

Torrisi-Steele, G. (2011). This thing called blended learning – a definition and planning approach. In K. Krause, M. Buckridge, C. Grimmer and S. Purbrick-Illek (Eds.) *Research and Development in Higher Education: Reshaping Higher Education, Gold Coast.* (Vol. 34, pp. 360-371).

Twigg, C.A. (2003). Improving learning and reducing costs: New models for online learning. *EDUCAUSE Review, September/October 2003*, pp. 28-38.

Vaughan, N. (2007). Perspectives on blended learning in higher education. *International Journal on E-Learning, 6*(1), pp. 81-94. Chesapeake, VA: AACE. Retrieved from https://www.learntechlib.org/p/6310

Westbrook, K. (2008). The beginning of the end for blended learning? In P. Sharma (Ed.), *IATEFL CALL Review, Summer 2008*, pp.12-16. http://ltsig.iatefl.org/wp-content/uploads/cr0802.pdf

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Developing low-barrier courses using open textbooks: A University of Southern Queensland case study

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Open Educational Resources (OER) have continued to gain significant global traction over the last decade, with research claiming the transformative power of these resources for broadening access and participation in Higher Education and driving new pedagogical approaches. In 2015, the University of Southern Queensland funded four open textbook grants as a pilot project that aimed to not only provide students with free and open learning materials, but also purposefully support staff as open practitioners. As part of an institutional commitment to open education, this project actively sought recommendations and strategies from the grant participants to mainstream the creation, use, and reuse of openly-licenced resources within holistic course design to support critical 21st century literacies. A community of inquiry model was used as the mechanism to support a discovery approach to the creation of open materials and qualitative participant data was gathered at key milestones during the grant through semi-structured interviews.

Keywords: open textbooks, open educational resources, open educational practice, 21st century literacies, case study, regional university

Introduction

Open textbooks refer to textbooks that are freely available (usually online) through an open copyright license. The use of open textbooks within higher education has been popularised by initiatives such as Rice University's *OpenStax College* (a collection of free textbooks), and the *BC Open Textbook Project* (a Canadian initiative providing flexible and affordable access to higher education resources). Open textbooks were identified in the New Media Consortium's *2015 Horizon Report* (Johnson, Adams Becker, Estrada & Freeman, 2015) as indicative of developing traction of OER in higher education. According to this report open textbooks are a "viable means for cutting excess costs with the goal of making education more affordable for students" (p. 14).

This paper outlines an open textbook project at a major regional Australian university. The paper first provides the background to the study, by introducing existing literature and initiatives that have explored the use of open textbooks within higher education. Next the paper describes the 2015 USQ Open Textbook Grant scheme including application process, selection criteria and activities undertaken by the grant recipients. This is followed by an overview of the current study, providing details of the data collection method and analysis as well as presenting the study's findings. The paper concludes with a discussion of how the study's findings relate to current literature, the study's practical implications and suggestions for future iterations of the grant offering and process.

Open textbooks and higher education

Whilst the superficial focus of open textbooks is financial, the underlying concern is about equitable and inclusive access to higher education – a long-term issue of concern to the Australian higher education sector (James, 2012). Textbook prices continue to rise in Australia (Soos, 2013) and, unlike US counterparts, Australian students cannot add textbook costs to HECS – meaning financially disadvantaged students must seek alternatives to access their required reading. The growing demand for university placements (both in Australia and internationally) challenges traditional approaches to course delivery, the role of resources in student-centred pedagogies, and the need for authentic content. Additionally, this demand calls for a holistic view of equitable access to education. Open educational systems, of which open texts are a part, offer practices that align with meeting these challenges.

Openly-licenced textbooks have been the focus of institutional projects and policy, especially in the UK, US, and Canada. Open textbook projects have been previously mentioned, but localised and national supporting policies are being developed to enable wider authoring and dissemination of open resources. The University of Leicester and University of Nottingham, for example, both have policy to encourage an open-first approach to course resources. At the legislative level California Senate Bill 1052 identifies the fifty most used textbooks in the state and will fund the creation and storage of openly-licenced replacements. However, the primary motivation of the Bill is reducing financial burden on students and their families – not explicitly improving the quality of teaching and learning, despite assertions that the decision will "bring California's college and university experience into the 21st century" (State of California, 2012, n.p.).

Open texts represent a financially viable alternative to commercial texts, and the student experience of textbook purchase is often used in an attempt to leverage change. A report by the US Public Interest Research Group (Senack, 2014) found that 64% of students surveyed (n=2039) did not purchase a required text due primarily to price, and that of these 94% felt "significant concern" (p. 4) about the impact of this decision on their overall grade. Furthermore, over 50% of the students admitted that the cost of text was significantly factored into their choice of courses.

Whilst perceived quality has been a significant barrier for OER, research continues to emerge regarding Faculty and learner acceptance of open content. A 2013 study (n=125) found Faculty and learner respondents reported no significant differences in quality after a semester of using open texts (Bliss, Hilton, Wiley, Thanos, 2103). Allen and Seaman (2014) likewise found that Faculty perceptions of OER quality were favourable, of the 34% (from n=2144) who were aware of open texts, 61.5% indicated their trust in OER quality was comparable to commercial resources.

The open licencing of these texts allows for content to be remixed, revised, and reused. Whilst the immediately identified benefit is local contextualisation of learning resources by Faculty staff, there is an increasing trend for student-generated open content to be the basis for assessment (Wiley, 2012). Open textbooks become an attractive proposition when Faculty staff traditionally invest time producing study guides that situate learning examples and exercises in the Australian context.

In contrast to these experiences, Australian awareness and adoption of OER remains low (Bossu, Brown & Bull, 2015) and whilst the Australian Government has adopted open policy in relation to research data and software, this has yet to gain traction in the education sector at any level. More broadly, the Asia-Pacific sector experiences challenges similar to Australia. Research conducted in China (Hui, Li & Li, 2015), Korea (Lee & Kim, 2013), India (Roy, 2015), Pakistan (Malik, 2013), and Hong Kong SAR (Yuen & Wong, 2013) identify a *lack of*:

- awareness of open resources by Faculty staff
- time to search for open texts; or uncertainty about where to search
- awareness of open licencing implications for learning and teaching practice
- material for specific disciplines (Senack, 2014)
- incentive to move beyond traditional texts, especially in light of increased accompanying publisher content (such as lecture slides and quizzes)
- reward and recognition for using/authoring open texts
- start-up funding for original authoring of open texts (Senack, 2014)

Whilst the foci of many open text grants are awareness-raising and the production of open resources, it represents the first phase of an institutional journey to progress from OER to Open Educational Practice (OEP). OEP aims to create sustainable environments wherein OER can be produced and used to support high-quality educational outcomes (Ehlers & Conole, 2010). Creating this OEP environment therefore requires a deep understanding of practitioner experience and the manner in which it interacts with, and is impacted by, the broader institutional environment. By extrapolating this approach, one comes to see OER as simply one aspect of OEP – rather than a wholly discrete issue. It is this translational research approach that is able to link literature, practice, and policy (Wethington & Dunifon 2012).

The Research Project

Research Aims

The aim of the research was to explore the experiences of the university staff participating in a newly established USQ Open Textbook Grant scheme. The research investigated the challenges participants faced, the enablers that assisted them in achieving their goals, the skills and knowledge they learned, and the community supporters who assisted them throughout the process. The wider significance and purpose of the research and the Open Textbook Grants was to foster a wider engagement with OEP throughout USQ, and to improve future iterations of the Openness grants through the implementation of recommendations derived from the participants' experience.

USQ Open Textbook Grant

The University of Southern Queensland (USQ) is based in Toowoomba, Queensland, Australia, with additional campuses also in Springfield and Ipswich. USQ has two faculties, the Faculty of Business, Law and Arts, and the Faculty of Health, Engineering and Sciences. In addition, the University has three colleges: The Open Access College; College for Indigenous Studies, Education and Research; and the Queensland College of Wine Tourism. USQ has a diverse student population, including undergraduate and postgraduate students from more than 100 countries, with more than 80 nationalities. The current student enrolment is approximately 28,000 and of this total, more than 20,000 study off-campus by online/distance learning. Just over 54% of the students are female, over one quarter are classified as low socio-economic status and only 10% are first school leavers. As a higher education provider USQ is committed to partnering "with learners in the pursuit of their study objectives regardless of their background, location or stage of life" (USQ, 2013, p. 6). In 2015 USQ released the Educational Experience Plan, an aspirational document "leading the USQ community to important and practical investments in our educational experience" (USQ, 2015, p. 2). The first educational objective articulated in the Plan is that "learning and teaching at USQ is to be characterised by flexibility and accessibility, enhancing opportunities for learner access engagement, and learner defined success". The USQ Open Textbook Grant scheme introduced in 2015 was designed to help meet this objective.

The USQ Open Textbook Grant was developed to encourage the use of technology, development of 21st century literacy skills and use of information resources to support students' learning and to assist academics that are interested in pursuing OER as an alternative to the traditional textbook (Beetham & Sharpe, 2013). The goal of the Grant was to provide the opportunity for USQ academics to experiment in finding new, better and less costly ways to deliver learning materials to their students.

Participants

To decide upon successful participants in the Open Textbook Grant, an Advisory Board consisting of representatives from across the university was established. The Board was responsible for reviewing all applications, with successful applicants selected based on the following criteria: (i) quality of the application and how well it responds to the questions stated in the form; (ii) innovative and creativity of approach proposed; and (iii) well-articulated evaluation plan; and (iv) transferability to other USQ courses and to other institutions or the open environment.

Fifteen grant applications were received, of which four met the above criteria and were funded. The successful applications covered tertiary preparation, arts education, education, and knowledge management. Three chose to submit as individuals and one as a team of nine, with an overall participant pool of twelve academics. The participants formed a community which met fortnightly and was facilitated by the eLearning Designer. This community was a space for shared inquiry and dissemination of practice, and often included 'guest speakers' from specialist areas in the university who could offer support and assistance. They were also required to present at a whole-of-institution event later in the year, and to prepare an interim and final report, where feedback was provided for both tasks.

Data collection

Semi-structured interviews were used for data collection. Kvale (2007) describes interviews as "a conversation that has structure and a purpose determined by the one party – the interviewer" (p. 7). Through this conversation, the interviewer has a "unique opportunity to uncover rich and complex information" (Cavava, Delahaye & Sekaran, 2001, p. 138). Semi-structured interviews were an appropriate choice for this study because of their suitability in obtaining information about people's views, opinions, ideas and experiences (Arskey& Knight, 1999).

All interviews were conducted face-to-face and were audio recorded. There was no predetermined length for the interviews and participants were free to continue talking for as long as they wished. On average interviews lasted approximately thirty minutes. One member of the research team conducted all the interviews, and this helped to reduce interviewer bias and to limit variation in interview technique. All twelve people who took part in the grant scheme were invited to take part in an interview. Seven people were interviewed, three males and four females. Interviews were conducted in the last month of the twelve month grant scheme.
The general aim in the interviews was to see through the participant's eyes by having them explain their experiences. The interview was divided into three parts. The first part involved what Kvale (2007) calls the "briefing" (p. 55). It involved the interviewer introducing themselves, describing the interview process and establishing a basic profile of the interviewee. Kvale (2007) notes that the briefing is an extremely important part of the interview as it sets the interview stage and helps encourage the interviewee to feel relaxed enough to talk freely. The second part of the interview was aimed at orientating the participants to the concept being examined.

A protocol was developed and used to guide the interview. The protocol included questions exploring the participants experience with, and understanding of, open textbooks and OER, before and after their involvement in the grant scheme. In addition, the participant was invited to provide comments on the lessons learnt, barriers and enablers to undertake the activities of the grant. Unstructured follow up probes were used to further explore points as they emerged during the interview. During the life of the grant, the Facilitator maintained a field journal where they recorded reflections and observations of the participant's progress and interactions during the regular meetings. These reflections and observations were used to inform the design of the interview protocol.

The semi-structured interview, perhaps more than other any other type of interview, depends upon the rapport established between the interviewer and interviewee (Kvale, 2007). The skill and ability of the interviewer is therefore very important in establishing a quality interview. To ensure this was achieved, the interviewer followed the advice of Kvale (2007). The interviewer was sensitive to the respondent and listened actively to the content of what was said, and the many nuances of meaning in an answer. The interviewer was open and willing to hear which aspects of the interview topic were important to the interviewee, and followed new aspects when they were introduced by an interviewee. The third and final part of the interview was the "debriefing" (Kvale, 2007). This is when the interviewer thanked the respondent for their involvement and answered any questions they may have had with respect to the research project.

Analysis

Cavana, Delahaye and Sekaran (2001) noted that thematic analysis is undertaken to "identify the underlying themes, insights and relationship within the phenomenon being researched" (p. 69). Qualitative analysis is not just about "counting or providing numeric summaries", instead its purpose is to "discover variation, portray shades of meaning and examine complexity" (Rubin & Rubin, 1995, p. 202). The data analysis process undertaken in the current study was an iterative one, constantly grounded in the interview data. Using NVivo software the interviewer spent time listening to the audio recordings, coding and reviewing the transcripts, with the aim of identifying the emerging themes in the data. Additionally, coding was used to determine the similarities, differences and potential connections among keywords, phrases and concepts within and among each interview. Furthermore, analysis considered the concepts and themes indirectly revealed. Rubin and Rubin (1995) noted that "you may discover themes by looking at the tension between what people say and the emotion they express" (p. 210).

Findings

The findings from this study highlighted three key themes that relate to the participants' experience of the Open Textbook project:

- challenge
- community, and
- learning

These three themes were observed in the data following a linear pathway, where **challenges** participants' faced resulted in them seeking support from their **community** and which facilitated participants' **learning** from the community support.

Each theme can be further separated into three interdependent sub-themes. These sub-themes interact between the main themes: the participants' experience of challenges (*time*, *technology*, and *Openness*) influenced the type of interaction (*collaboration*, *support*, or drawing upon *connections*) that they sought from the community, which then influenced their key learnings (*project management*, *technology literacy*, and *understanding Openness*) from the project.

Arrows denote which sub-themes were found to have relationships in the data, if no arrow is present the sub-themes did not appear to have a strong thematic relationship. A visualisation of the interactions and relationships between the themes and sub-themes can be seen in Figure 1 below.

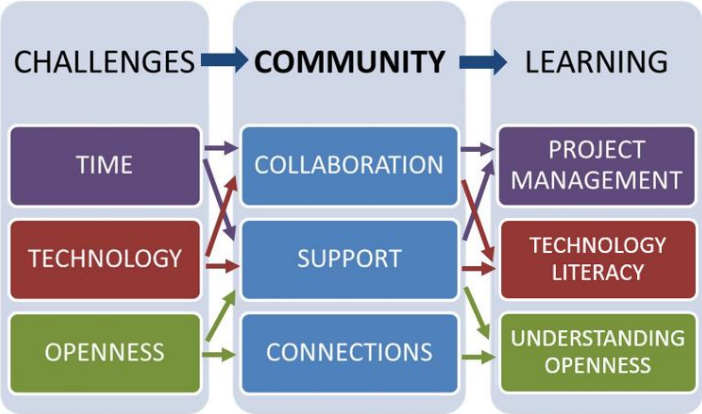

FIGURE 6: THEMES AND SUB-THEMES ARISING FROM THE ANALYSIS

An outline and description of each of these themes and sub-themes will now be discussed. Where relevant a de-identified participant quote is provided for richer contextualisation.

Challenges

The theme of challenge encompasses the issues and barriers experienced by participants across three main sub-themes of time, technology and Openness. These challenges were often framed as barriers to the progression towards completion of their OER, and across these sub-themes participants described their experience of these challenges as “difficult” (P1, P2) and “confusing” (P2) to navigate.

Time

Time was reported by the majority of participants to be the greatest barrier to completion of their project. Time challenges were experienced by participants through deadlines, workload and staff availability.
Firstly, the challenge of time was felt by participants through deadlines for the OER content and reports, as these participants demonstrate through the following statement:

> “There was so much to do, I think, so much to learn, in a reasonably short time, as well as writing the material that it could be a little bit problematic.” (P1)

This statement alludes to balancing concurrent, interdependent activities, such as building open discipline knowledge, enacting the knowledge for specific projects, navigating internal institutional networks, and meeting grant deadlines.

Furthermore, all participants expressed concern regarding their ability to dedicate time to developing their OER due to their already high workload which had been allocated to them before the grant funding began.

> “The only limitations, the only questions that I had, was about just workload and the amount of work and being able to fit it in. And that’s just academic life at the moment, so it hasn’t changed. It was, yes, I can do it, given time and everything else, no problem. It was just whether or not time would permit it.” (P7)

Lastly, multiple participants identified that time spent waiting for staff availability to attend meetings or the amount of time available for staff members to dedicate to supporting them was a challenging experience.

> “I found it really difficult waiting for other people around the uni to… do the technical things that we couldn’t do. So they’ve got their waiting lines of jobs and their workflow things and that was just all difficult because I wasn’t a very good time sequencer for jobs like that.” (P2)

Overall, the sub-theme of time, encompassing the stress of deadlines, the burden of their set workloads and waiting for support staff availability was a major challenge that participants faced.

Technology

This refers to participants' varying levels of knowledge in using technology such as computer software and Open platforms such as WordPress and Moodle, and how this challenged their ability to progress in completing their OER. This challenged the participants in both small and significant ways. For example, two participants highlighted issues interacting with platform interfaces:

> "Probably the technical issues because… Even little things like using Airdrop and drag activities that seem so simple, but they weren't." (P1)

> "The particular module part of Moodle that I'm working with, hasn't been changed regularly and there's been problems that have been known about for years, which haven't been done. So, I mean, the simplest one is an ability to search all the Moodle books." (P7)

Another participant highlighted that their knowledge of software technology and coding was outdated, and they faced the challenge posed by both the sub-themes of time and technology in learning this technical knowledge:

> "I will mention; another problem is just my own knowledge. I have a background where I'm able to do some of these things but that background, that knowledge, hasn't kept up with some of the more recent things. So, my hindrance was that I had to learn a bit, and that took time, which I didn't have a lot of time." (P7)

Openness

The Openness sub-theme refers to the participants' reported lack of understanding of how OER interact with the legalities and permissions of copyrighted materials and creative commons licensing. For example, one participant commented that they "… hadn't even heard of open education resources before, or creative commons licencing, before this experience." (P5).

Furthermore, the reported severity of Openness challenges was moderated by the participant's previous experience and confidence in engaging with OER, this is demonstrated through the following participant comment:

> "And of course copyright is, I suppose that's where confidence comes in…copyright's something that if you don't know about it, it makes you frightened of making mistakes and people limit themselves and, you know, they don't want to risk getting into trouble with copyright." (P2)

Another participant identified a specific instance of how their limited knowledge of Openness and copyright concepts impacted their assumptions that YouTube clips could be used in OERs:

> "I had an idea how I assume that all the YouTube clips might be open sources or not copyrighted. But then again, I meant to understand "Oh that's not the case, so we had to go through these copyright issues. And then yes, to find out whether they are off copyright or not, we had to go through the process of these copyright offices." (P4)

The participant also reported that the challenge of Openness and copyright issues were also experienced alongside the challenge of technology.

Community

The theme of community was the dominant emergent theme from the data collected, and encompasses the participant's experiences of collaboration between grant participants and team members; support and guidance from other USQ staff members to enhance 21st century learning and innovation skills (Trilling & Fadel, 2009); and connections forged with academics from other higher education institutions and with the Openness community. Therefore, the sub-themes of community are collaboration, support and connections.

Collaboration
The sub-theme of collaboration can be further separated into a subset of the participants' experience of teamwork in a group of nine, and the entire pool of participants' experience of collaborating with each other. Participants reported that collaborating within their team was a very positive experience due to the opportunity to share ideas.

> "The team worked well, we found the resources we needed, we applied ourselves to the task… I couldn't have asked for much better really. There haven't been many hurdles." (P2)

Additionally, the team dynamic for participants was a major enabler for their OER progress, as all team members were retained without any problems or disagreements which is evident in the following quotes:

> "The only good enabler over our side was that we were a team of nine, at the beginning we were a team of nine, nine at the end and everybody in the group did what they said they would and nobody had any disputes. I mean, it's almost unbelievable really but essentially it just was a cohesive group all the way through and that was a big enabler. I mean if it hadn't been the case, it would have been very different." (P2)

The participants were also able to draw upon the support of the whole OER grant community through regular meetings, with participants reporting a feeling of connection between the grant participants, as can be seen in the following statement:

> "As we've gone through this project, we have regularly met and so we've had that shared experience of going through a particular project, coming from different perspectives, but we still had that shared experience and that's created somewhat of a connection or a bond between the participants." (P7)

Through this connection, group members were able to share their knowledge with each other to assist in their collective learning experience, as one participant commented that "there were times… because I had more knowledge, I would share that knowledge." (P7). From this shared knowledge, participants reported a rich learning experience from the expertise and mistakes of other group members, as can be seen in the following participant quotes:

> "The whole set of group members and their expertise and knowledge - it was also enabling us to do this along the pathway." (P4)

> "Listening to the other people, when we go to …meetings… there are other people doing their own projects and the way they were doing them, was a real eye-opener. It was something that gave me ideas, things to aspire to." (P1)

Support
The sub-theme of support refers to the participants' experience of "wonderful" (P4) "step-by-step guidance" (P4) from USQ staff members and technology and media services towards their goal of creating an OER. Participants reported that the support of the USQ staff in the face of challenges was very positive.

> "As grant participants, the grant organisers were very… encouraging of us. I never felt as if we were being judged or pushed. We were being enabled and, you know, for me and my group that really felt great." (P2)

Additionally, most participants identified that their new knowledge of the USQ staff members and services which were available to support them in this project was an important learning experience.

> "[Most valuable learning] That there are possibilities to develop things, that there are people in this university who will want to support those things, that there is an opportunity in this university to put money towards supporting those things - that is the greatest thing, because it encourages further work, it encourages further research, and it encourages the people working on the ground to communicate more with other people. I hate the word "network", but at least learn from other people who were involved in the same thing, and get the chance to be involved in building things, so that the next time that it comes to me going, "Okay, what are the resources that I need to develop for a course?", I'm going to have a much better idea of where I'm headed and where I can go for help." (P6)

Connections
The sub-theme of connections refers to the participant's interactions with the community of other academics and university institutions outside of USQ, and support from the Openness community. Connecting with other universities has allowed participants to receive feedback for areas to improve upon in their OER projects and provided inspiration for ideas or concepts to integrate into their OER.

> "The sort of stuff I'm researching here, it's just given me the impetus to read a lot further and see beyond USQ, what other universities might be doing, and thinking, "Oh, that's really great, you know, that's an idea I could think about, and incorporate something like it." (P1)

> "In terms of enablers… our critical friends from <another university> because they had a program like the same as ours so they had already finished it. We used to have contacts with them and they were just going through our drafts… and they gave us some feedback which was really good." (P4)

Connections with the Openness community and their values and philosophy has created a sense of community and belonging in participants, as can be seen in the following participant statement:

> "There was that learning that I mentioned before, about the spirit of generosity within the openness environment and what that means. I love that mindset of wanting to really share and be generous. And then you know, I think that it encourages the same from others." (P2)

Learning

The theme of learning is interwoven throughout the narratives of each participant, and can also be seen in the themes of challenges and community. This theme is divided into three sub-themes of learning as a response to the three sub-themes of challenges, with the vehicle of this learning being the collaboration, support and connections from their various communities. To describe the participants' '*strong learning experience*' (P2) in detail, the three sub-themes of project management, technology and Openness learning will now be described.

Project Management
The sub-theme of project management connects the theme of time challenges to the themes of community support and collaboration and which has resulted in learnings surrounding project management, a sub-theme reported by the majority of participants. Participants in the team of nine project group reported that the challenge of time was able to be addressed through seeking collaboration within their team community to divide up tasks and by using communication and discussion to drive progress on their OER, as summarised in the following quote:

> "I thought my involvement with this would be a three to four month thing. It's turned out now eight or nine months, but by changing my strategy, and rather than just sending off emails to people, sitting down with people, walking them through." (P6)

The entire pool of participants also learnt to address time challenges by learning about project management through support from the USQ staff community who provided them with feedback, awareness of deadlines, and assistance with funding management: "I learnt a lot about project management too … in a really nice supported way. It was a very supported, gentle, kind way to learn about that." (P2)

Technology Literacy
The sub-theme of technology literacy refers to participants overcoming the challenges of technology and any gaps in knowledge though seeking collaboration and support from their community. Through collaboration with other grant recipients, participants have been able to share their technical knowledge and learn key 21st century literacies from others within the group, as highlighted by the following participant quote:

> "With technology… we used to contribute our expertise with the expertise of knowledge within those areas… I also got to learn more from the other group members as to how they do what they do and about their areas." (P4)

Additionally, though the community of USQ staff, participants have learned that there are a range of people and resources they can turn to for developing their technical skills and knowledge of software and platforms, as explained in the following quote:

> "Learning, to a fuller extent, what kind of resources exist at our university to create things like audio-visual material for our courses." (P3)

Understanding Openness
The sub-theme of Understanding Openness and OER concepts refers to the influence of the sub-themes of Community Support and Connections in assisting with the challenge of understanding Openness concepts, resulting in a rich learning experience for participants. Through the support of USQ staff members sharing their knowledge, participants have learned about copyright, licencing, and the possibilities that Openness provides as a vehicle for knowledge.

> "One other thing that shifted is that I probably ended up with a deeper understanding, though, of what openness means, because, of course, "open" can mean a variety of things. The licensing terms can be quite different, from a Creative Commons license to Use With Modification, Use With No Modification, Use With Credit, whatever, so I did discover that "open" actually has many shades to it, and you do need to be aware of the licenses very carefully." (P3)

Furthermore, through interacting with their connections in the Openness community, participants have learned more about the concept of Openness and the values of the Openness community.

> "I know I started this interview saying I've already worked in the open space, but that doesn't mean I knew everything about it. Far from it. So I… just kept finding our thinking would shift, and the space around us would change, and we would have to adjust." (P3)

Overall, the findings of this research can be encompassed in the following quote, which highlights the relationships between the themes of challenges, community and learning:

> "Things will go wrong, deadlines will be impossible, your health may go wrong, family problems will crop up, technology problems will crop up, work problems will crop up, things will go wrong and you need to know who to call on for support, and you need to be brave enough to go out and say "Look, I'm in an awful mess at the moment", and actually, not to see that as a bad thing – to see that as part of the human domain of learning… I've also learnt that sometimes, when really awful things happen, they're opportunities. They're opportunities to rethink and start again, and wipe the table and re-weave all of those ideas." (P5)

Implications for practice and future directions

The intentional use of a participant-driven community for the grants was validated by the respondents. This remains the core of the experience and mirrors open practice groups internationally. The current grant recipients modelled a consultative, non-judgemental group that was tolerant to risk and failure. However, this did highlight the need for more explicit support options especially in the use of technology; assistance to navigate internal processes; and a revision of timelines. In response to the latter point, internal permission was received to extend the grant funding for an additional twelve months to give the recipients additional time to refine and revise their resources.

In terms of meeting some of the aforementioned challenges in the Asia-Pacific region, this grant represents the first institution-wide steps to raising awareness, and demonstrating (through completed grant work) that open resources are a viable, achievable approach for higher education. However, the pedagogical discussions over the last year have challenged the institution to critically examine the role of resources in course design. In particular, there is the question of the goal of open texts as a discrete focus: "Let's assume a world where textbooks are free. Did we win? Or did we just make the act of passively interacting with information less expensive?" (Croom, 2015, n.p.)

Notionally the rationale behind open texts has been affordability and access, but larger questions need empirical research. Merely providing access to free texts may support broader participation in higher education, but does not guarantee the success of these students. Likewise, using the concept of openness to simply replicate traditional activities does a disservice to the sector. The more fruitful conversation occurs when the discussion moves from *resources* (OER) to *practice* (OEP) as identified in the Introduction of this paper, and this has been realized in re-focus for USQ's 2016 grants. These practice-based grants are one aspect of a broader institutional journey that will see openness gain traction as a viable and achievable teaching and learning approach.

Conclusion

The open textbooks grant represented an exploratory whole-of-institution mechanism to foster a wider engagement with OEP. It provided participants with a supportive learning community that was valued by the recipients and actively leveraged local skills to collaboratively develop open resources and frameworks. The inclusion of a formal evaluation has provided evidence for revision when offering the next round of grants, and for informing institutional strategic planning. As a low-barrier, supported activity it could be replicated and transferred to other Australian institutions seeking to purposefully engage with OEP.

References

Arskey, H., & Knight, P. (1999). *Interviewing for social scientists.* London: Sage.

Bossu, C., Bull, D., & Brown, M. (2015 – in print). Enabling open education: A feasibility protocol for Australian higher education. In C. Bonk, M. Lee, T. Reeves & T. Reynolds (Eds.), *MOOCs and Open Education Around the World*. Routledge

Cavana, R., Delahaye, B. &Sekaran, U. (2001). *Applied business research: Qualitative and quantitative methods*. Brisbane, Australia: Wiley.

Croom, A. (2015). Is this what we meant? [blog post], *Adam Croom*. Retrieved February 1, 2016 from http://adamcroom.com/2015/11/is-that-what-we-meant/

James, R. (2012). Social inclusion in a globalised higher education environment: The issue of equitable access to university in Australia. In Basit, T. & Tomlinson, S. (Eds.), *Social inclusion and higher education* (83-108). Bristol: Polity Press.

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). *NMC horizon report: 2015 higher education edition*. Austin, Texas: The New Media Consortium. Retrieved January 9, 2016, from http://www.nmc.org/publication/nmc-horizon-report-2015-higher-education-edition/

Kvale, S. (2007). *The Sage qualitative research kit*. London: SAGE.

Lee, H., & Kim, M. (2013). Student voices in a peer-to-peer open education project at Korea University, *Proceedings for the OCWC Global 2013*, Bali, Indonesia: OCWC Global.

Malik, N. (2013). The genesis of OER at the Virtual University of Pakistan. In Dhanarajan, G.; Porter, D. (Eds.) *Open educational resources: An Asian perspective* (pp. 135-142), Perspectives on open and distance learning. Vancouver: Commonwealth of Learning.

Roy, M. (2015). Some perspective of open and distance education in India, *International Journal of Applied Research*, 1(9), 501-506.

Rubin, H. J., & Rubin, I. (1995). *Qualitative interviewing: The art of hearing data*. Thousand Oaks: Sage Publications.

Senack, E. (2014). *Fixing the broken textbook market: How students respond to high textbook costs and demand alternatives*, The Student Public Interest Research Groups, Washington D.C. Retrieved January 30, 2016, from http://www.uspirg.org/sites/pirg/files/reports/NATIONAL%20Fixing%20Broken%20Textbooks%20Report1.pdf

Singh, S., Singh, A., Singh, K, & Sharma, A. (2012) Academic motivation in open versus traditional education in India, *Asian Journal of Distance Education*, 10(1), 45-51.

Soos, P. (2013). *Required reading: Here's why textbooks are so expensive*, The Conversation, February 6. Retrieved January 30, 2016 from http://theconversation.com/required-reading-heres-why-textbooks-are-so-expensive-10502

State of California (2012). *Senate bill 1052*. Retrieved January 26, 2016, from http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120SB1052

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times.* San Francisco: Jossey-Bass.

University of Southern Queensland (2013). *USQ strategic plan 2013-2015*. Retrieved January 26, 2016, from http://www.usq.edu.au/about-usq/about-us/plans-reports/strategic-plan

University of Southern Queensland (2015). *USQ educational experience plan*. Retrieved January 26, 2016, from https://www.usq.edu.au/about-usq/about-us/plans-reports/educational-experience-plan

Wiley, D. (2012). The best OER revise/remix ever? [blog post], *Iterating toward openness*. Retrieved December 5, 2015 from http://opencontent.org/blog/archives/2629

Yuen, K., & Wong, A. (2013) Open educational resources in Hong Kong, In Dhanarajan, G.; Porter, D. (Eds.) *Open educational resources: An Asian perspective* (pp. 41-52), Perspectives on open and distance learning. Vancouver: Commonwealth of Learning.

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On the role of 'digital learning designer' for non-indigenous designers collaborating within culturally grounded digital design settings

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This is a conceptual inquiry into the nature of the role of learning designer from mainstream cultural groups working within culturally-grounded digital design settings. This paper stems from the co-design of an online transition-to-study resource developed specifically for Māori and Pacific students about to begin postgraduate study at the University of Auckland in Aotearoa New Zealand. The resource is the culmination of an extensively planned design project amongst primarily non-indigenous designers in partnership with both indigenous and non-indigenous academics. These reflections from both non-indigenous and indigenous members of the project team are offered for other tertiary-sector designers as reflections and potential sparks - theoretical "seed sowing" (Bihanic, 2015, p. vi-vii) - about the inherently positional and necessarily culturally-grounded nature of the role of digital learning designer.

Keywords: role of digital learning designer, positionality, indigenous, social justice

Introduction

This paper represents the reflections of designers and a project leader from mainstream cultural groups (i.e. as New Zealand European/Pākehā) and an indigenous academic staff member involved in the creation of culturally-embedded digital resources designed to support potential postgraduate students. This contemplative 'conversation' stems from our reflection on an 18-month collaborative pilot design project in the University of Auckland in Aotearoa New Zealand (NZ). The intended users of the design project outcomes are applicants who are Māori and Pacific. In NZ these groups, though having different backgrounds, are frequently considered together as the target of a range of equity provisions designed to reduce educational disadvantage. Māori are the indigenous people, or tangata whenua, of NZ. The Pacific population in NZ, known collectively as Pacific peoples, reflects a diverse group made up of people who, at an earlier time, immigrated to New Zealand from many different Pacific nations (Pacific Perspectives, 2013; Wright & Hornblow, 2008).

The term *indigenous* is used here to refer to both Māori and Pacific students and reflects the status of both Māori and Pacific peoples within their own respective ancestries and nations. As Smith notes, we acknowledge that the "term 'indigenous' is problematic in that it appears to collectivise many distinct populations whose experiences under imperialism have been vastly different." (1999, p. 6). As co-authors of this paper we use this term to broaden the discussion beyond Māori and Pacific communities given that the issues are likely to be relevant among designers who are also working within other indigenous cultures and nations. Similarly, we use the term "non-indigenous" as a global term to denote the broad mix of people, significantly of European-descent, living within these nations. The term "digital learning designer" is used here to link the role of tertiary-sector designers to a broader, multidisciplinary community of designers exploring design problems and "design for design empowerment" via technology-mediated solutions (Vardouli, 2015, in Bihanic, 2015, p. 15). This includes a community of designers working digitally across the public sector as well as private sector service and product industries. An aim of this paper is to offer a conceptual starting point for future inquiry into this topic, particularly for designers who seek, like the authors, to co-design digital learning objects, and spaces, from a more culturally-framed, culturally-safe, centre.

As academic staff committed to equity and social justice in digital spaces, we initiated a design- thinking (Brown, 2008) approach to conceptualising the issue of *transitions* – trying to comprehend and plot points along the journey of Māori and Pacific postgraduate students in our faculty from pre-enrolment through to study completion and beyond. Analysis of focus group and pre-pilot survey data, suggested that ineffective transitions into postgraduate study is a significant barrier for these students. Thus transitions became a focus around which we sought to improve these students' experiences. We did this through a pilot digital design project, PG Poutama STEPPS (Student Tools for Effective Preparation for Postgraduate Study). The aim of the pilot project resource was to offer better-supported, culturally-framed transitions to postgraduate study via online self-access tools.

The argument: for, and within, complex cultural spaces

As tertiary-sector designers who support the development of diverse online resources and communities of learning, we also work within inherently complex (Urry, 2003), uncertain (Campbell, 2016), and yet also necessarily culturally-bound, globalised and technologically-mediated spaces (Verbeek, 2011, discussed in Bihanic, 2015, p. 36). Exploring these themes Campbell posits:

> … education for complexity must always examine and reframe the reflexive question of what constitutes education - and it must teach each learner … [so they may participate in] examining and reframing that question for themselves (2016, p. 2).

To start to 'examine and reframe' the role of the non-indigenous digital learning designer participating within indigenous collaborations requires a move beyond an academic exercise in role definition. Rather, a careful unpacking of *the act of being a designer* is required. We position this work within wider explorations about what a typically euro-centric, culturally positioned space might look like, were digital designers' roles refined and reimagined. We argue that what is required is a culturally mediated and defined conceptual space firmly situating the role of being and becoming a digital designer within the theoretical frames of positionality (Merriam et al., 2001), design for empowerment (Vardouli, 2015, in Bihanic, 2015, p. 16) and reflexivity (Bourdieu, 1997).

The re-framing: situating ourselves as culturally-grounded designers

To start to conceive of a 're-framing' of non-indigenous design roles requires acknowledgement first, that we are *all* culturally-grounded beings. As such, the act of design - and therefore, the role of all designers - becomes an inherently positional, contestable, fluid, multivariate and potentially uncertain space. This complexity applies equally across indigenous, and across non-indigenous communities and designers; however, design within indigenous communities may require additional reflections and conceptualisations about culture from non-indigenous designers. This needs to be substantively explored, unpacked and understood for non-indigenous designers to be able to engage in more purposeful, culturally-grounded and appropriate design. It may involve (but is not limited to):

- scrutiny of power relations based on historical and contemporary marginalisation and colonisation;
- examination of personal explicit and implicit assumptions and/or biases (van Ryn et al., 2015; van Ryn & Saha, 2011); and
- defining what collaboration mores and norms are in play within differing groups and how participation may unfold.

We advance the notion that through self-reflection on the nature of the learning designer role itself, specifically through a lens that views all technology, and designing, as inherently *non*-neutral, we may as designers begin to interrogate how best to realise a genuinely participative design "cultural interface" (Nakata, 2003, p. 285) – a digital design space within which indigenous and non-indigenous designers and learners might co-construct knowledge and ultimately thrive together.

Origins of a design project: design thinking meets the cultural interface

Reedy and Sankey (2015) highlight a growing body of research that speaks to the impact of culture on the experience of indigenous learners in online learning spaces. They identify barriers concerned with aspects of relatedness, connectedness and identity. Research from Māori communities as well as Pacific peoples echoes similar themes of dis-connection and lack of identity or 'cultural place' in varied learning spaces (Airini, Rakena, Curtis et al., 2009; Curtis, Wikaire, Kool et al., 2014). Additionally, analysis of pre-pilot evaluation data identified disparities experienced by Māori and Pacific postgraduate student cohorts. These included: quality of learning experience, retention in postgraduate programmes, academic achievement and experiences with implicit and/or overt racism throughout their study journey (Faletau, Wikaire, & Curtis, 2014; Curtis, Wikaire, Kool et al., 2014).

Problem definition

We asked ourselves the following questions initially and throughout our design process:

- How could our team best develop an environment where Māori and Pacific students could feel ‘at home’ online – i.e. a deliberately culturally-constructed digital space where students could build meaningful cultural networks and personal connections within an indigenous-framed setting?
- To what extent might indigenous postgraduate students be able to access such online spaces (including, but not limited to, technical access barriers)?
- To what extent would they choose to engage with this type of digital cultural community, when much indigenous relationship building focuses on face-to-face connections?
- To what extent could this sort of space help mitigate experiences such as isolation, lack of relatedness and/or cultural alienation, which have been described by previous Māori and Pacific postgraduate students during their transitions into postgraduate study (Morunga, 2009)?

Designing a culturally framed digital design pilot project

A reference group of senior leaders from the wider university was established and they nominated a project team. This team met together, guided by the reference group, regularly over 12 months. This was essential to forge strong relationships, to define the conceptual foundations for the project and to develop a shared cultural framework to inform subsequent online digital tools development. After conducting an extensive literature review, we hosted a range of focus groups where both quantitative and qualitative data were gathered. The groups included Māori and Pacific current and former students, teaching, library and support staff and relevant employer representatives. From these, we forged a cross-university pilot project: PG Poutama STEPPS. Phase one of the pilot focused on developing culturally-grounded theoretical frameworks signed off by the reference group. While this phase was intensive, it was integral to the later project success. Phase two involved the project team exploring, developing, prototyping and user-testing an open access digital delivery platform. The tool was designed to accommodate a set of culturally-framed transition tools, to be self-accessed by prospective postgraduate Māori and Pacific students entering our faculty. Phase three of the project involved sourcing and developing a suite of related ‘preparation’ pages and tools. We have just completed phase four of the project where we have launched the online site in a small-scale pilot in pre-Semester 2, 2016 (with 17 pilot student users). As a collaboration, the pilot project has been successful in drawing together diverse expertise and experience across a wide range of Māori and Pacific academic, cultural, pastoral, library and support staff as well as non-indigenous designers and academic staff.

“Seed sowing” – future directions

The following areas delineate a few prompts for reflection with links to relevant academic research. They stem from our shared reflections about how our pilot project has been able to achieve our aims to develop a culturally-framed set of digital learning tools intended to reduce transition barriers into tertiary study. They may serve as springboards for others wishing to probe, debate or research more deeply their role as non-indigenous learning designers working within culturally-grounded indigenous settings. Indigenous designers entering into design work with non-indigenous designers may also wish to consider some of these same aspects with a slight reframing of the following points, exploring:

- Ways in which non-indigenous beliefs/practices around *communication* are the same/different from indigenous communication beliefs/practices (Orbe, 1996).
- Individual perceptions about the *role of a designer* (Bihanic, 2015).
- *Unexamined assumptions* held that might influence how effective co-cultural collaborations can be, especially around notions of *power* and legitimacy of Kaupapa Māori methodology (see, for example, Bishop, 1999; Smith, 1999; Smith & Ayers, 2006).
- Theoretical and practical *considerations* to take into account when working on design projects within indigenous communities i.e. ones that may be unique/distinctly different from those experienced when working within multicultural/other diverse cultural groups. Considering:
    - Significance of *time* – with regards to relationship building, required consensus-making process in indigenous communities and implications for project plans/deadlines as well as impact on notions of ‘agile design’ in cultural groups with longer-term orientations.
    - Significance of *scarcity* of *resource* – thinking about potential burdens placed on indigenous team members who may be the <u>single</u> representative for an entire community.
    - Significance of *relationship building* – identifying norms in western cultural group-building and understanding potential differing norms for indigenous groups; drawing on strengths of relationships from indigenous networks that can be tapped into once relationships exist. See Reedy and Sankey (2015) for more on significance of relatedness and connection building.

Conclusion

Central to this discussion has been signposting of relevant themes including the consideration of positionality in the role of being a designer, in recognising situated knowledges, processes and concepts of power, and the purpose of non-indigenous learning designers seeking to engage in critical self-reflection to better embody their role as designers. In outlining these thoughts, the authors hope to spark thinking (both theoretical and practical) around what design at the "cultural interface" (Nakata, 2003) might look and be like for non-indigenous and indigenous design co-creators. Nakata argues:

> … that theoretically there are real problems with beginning from principles based in a duality between culture and mainstream (Luke et al., 1993). Not only do they obscure the complexities at this intersection, but they confine indigenous peoples to the position of 'Other' by reifying the very categories that have marginalised us historically and that still seek to remake and relegate us within the frameworks of Western epistemes (2003, p. 26).

Our intention, in this paper, has *not* been to further perpetuate such segregated dualities by presenting the discussion in terms of indigenous versus non-indigenous designers. Rather, the aim has been to sketch a preliminary vision of a supple, culturally-safe and culturally-capable designer; one who can inhabit, frame and realise "multiple 'utilities'" (Bihanic & Huyghe in Bihanic, 2015, p. 4) through co-cultural collaborations across varied communities. The purpose of this paper has also *not* been to offer the results of 'data' analysis or of 'solutions' to questions raised. Rather our intention is to prompt consideration of theoretical and practical reference points by offering our own reflections about our roles in a digital design pilot project. Future work requires greater scrutiny of what crucial elements may contribute to an individual becoming a more reflective, culturally-grounded, culturally-safe digital learning designer – one who can co-create within varied indigenous, and other, design communities.

References

Airini, Rakena, T. O., Curtis, E. T., Sua-Huirua, T., Townsend, S., Savage T., Ulugia-Pua, M., Brown, D., Sauni, P., O'Shea, M., Tarawa, M., Reynolds, G., Johnson, O., & Luatua, F. (2009). Success for all: Improving Māori and Pasifika student success in degree-level studies. *Proceedings ECER Conference Gothenburg, Sweden 2009.*

Bishop, R. (1999). Kaupapa Maori Research: An indigenous approach to creating knowledge. In Robertson, N. (Ed.). (1999). *Maori and psychology: research and practice - The proceedings of a symposium sponsored by the Maori and Psychology Research Unit*. Hamilton: Maori & Psychology Research Unit.

Bihanic, D. (Ed.) (2015). *Empowering Users through Design Interdisciplinary Studies and Combined Approaches for Technological Products and Services*. Springer International Publishing. (E-book).

Bourdieu, P. (1997). The Forms of Capital (R. Nice, Trans.). In A. H. Halsey et al. (Ed.), *Education Culture Economy Society* (pp. 46-58). Oxford: Oxford University Press.

Brown, T. (2008). Design thinking. *Harvard Business Review*, *June*, Periodical review, Brief article, 84-92.

Campbell, G. (2016). Educating for uncertainty. *HERDSA NEWS Feature, 38*(1), 2-3. https://herdsa.org.au/sites/default/files/HERDSANews20163801.pdf

Curtis, E., Wikaire, E., Kool, B., Honey, M., Kelly, F., Poole, P., Barrow, M., Airini, Ewen, S., & Reid, P. (2015). What helps and hinders indigenous student success in higher education health programmes: A qualitative study using the Critical Incident Technique. *Higher Education Research & Development, 34*(3), 486–500. 10.1080/07294360.2014.973378

Faletau, J., Wikaire, E., Curtis, E. (2014). *Māori and Pacific Postgraduate support in the Faculty of Medical and Health Sciences MAPAS*. Auckland, University of Auckland.

Hughes, G., Oliver, M., Kitagawa, K., Creese, B. & Swain, J. (April, 2012). Assessment Careers: Project Baseline Report Institute of Education. *JISC Assessment and Feedback Strand A Project.* UK. Accessed online 17 June 2014. https://assessmentcareers.jiscinvolve.org/wp/files/2012/05/Baselinereportfinal.pdf

Merriam, S. B., Johnson-Bailey, J., Lee, M-Y., Kee, Y., Ntseane, G., & Muhamad, M. (2001). Power and positionality: negotiating insider/ outsider status within and across cultures. *International Journal of Lifelong Education*, *20*(5), 405-416. http://dx.doi.org/10.1080/02601370120490

Morunga, E. (2009). Māori student participation in psychology. *MAI Review 1*, 1–7.

Nakata, M. (2003). Indigenous Knowledge and the Cultural Interface: Underlying Issues at the Intersection of Knowledge and Information Systems. In Hickling-Hudson, A., Mathews, J. & Woods, A. (Eds.) (2003). *Disrupting Preconceptions: Postcolonialism and Education.* (pp. 281-291). Flaxton: Post Pressed.

Orbe, M. P. (1996). Laying the foundation for co-cultural communication theory: An inductive approach to studying "non-dominant" communication strategies and the factors that influence them. *Communication Studies, 47*(3), 157-176. doi: 10.1080/10510979609368473

Pacific Perspectives. (2013). *Pacific health workforce service forecast: Report to Health Workforce New Zealand and the Ministry of Health*. Wellington, New Zealand: Pacific Perspectives.

Reedy, A. & Sankey, M. (2015). Designing for relatedness: learning design at the virtual cultural interface. *Proceedings ascilite Perth 2015*. http://www.2015conference.ascilite.org/wp-content/uploads/2015/11/ascilite-2015-proceedings.pdf

Smith, D. R. & Ayers, D. F. (2006). Culturally Responsive Pedagogy and Online Learning: Implications for the Globalised Community College. *Community College Journal of Research and Practice*, 30(5-6), 401-415. doi. 10.1080/10668920500442125

Smith, Linda Tuhiwai. (1999). *Decolonizing Methodologies: Research and Indigenous Peoples.* Dunedin: University of Otago Press, and London: Zed Books Ltd.

Urry, John (2003), Global Complexity, Malden MA, Polity.

- van Ryn, M., Hardeman, R., Phelan, S., Bugess, D., Dovidio, J. F., Herrin, J., Burke, S., Nelson, D., Perry, S., Yeazel, M., and Przedworski, J. M. (2015). Medical school experiences associated with change in implicit racial bias among 3547 students: A medical students CHANGES study report. *Journal of General Internal Medicine, 30*(12), 1748-1756.

van Ryn, M. & Saha, S. (2011). Exploring unconscious bias in disparities research and medical education. *The Journal of the American Medical Association 306*(9), 995–996.

Wright, S., & Hornblow, A. (2008). Emerging needs, evolving services: The health needs of Pacific peoples in New Zealand. *New Zealand Journal of Social Sciences Online, 3*(1), 21–33.

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Multimodal feedback is not always clearer, more useful or satisfying

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Feedback comments on summative assessment tasks are an important part of students' learning experience. Recently, researchers have noted that digitally recorded comments can be beneficial for both students and educators. This paper compares the clarity, usefulness and satisfaction of digitally recorded and text-based feedback comments produced by 14 tutors in a large Master's level Education unit. A sample of 164 students completed the online survey. Initial analysis of the data reveal mixed results. When secondary variables are accounted for and outliers discounted it is revealed that digitally recorded multimodal feedback processes, in general, can be clearer, more useful and more satisfying. However, it is also clear that using technology such as video is not a silicon bullet to improving feedback. Several potential factors are identified and are discussed in terms of micro- and meso-level contextual conditions that need to be further researched.

Keywords: multimodal feedback; assessment; feedback; tutor differences; higher education

Introduction

Feedback is a broad and complex process. It can be understood as a cycle in which performance related information flows between agents, such as between the student and lecturer. A key criterion for any feedback cycle is that the information relates to performance, and that it has an impact on future activity. Despite the deeply embedded discourse within education, it is not a unidirectional communication stream. Indeed, Boud and Molloy (2013) challenge us to reconceive feedback as necessarily requiring some action or change to occur. Feedback that has no impact on learning is simply information. Although this paper focuses on student reaction to comments provided on their assessment, it is useful to note that this is just one of the fundamental elements of the feedback cycle. In fact, it is widely acknowledged that such comments are an essential part of learning (McConnell, 2006), as they enable students to achieve learning objectives and develop the skills necessary to becoming independent learners (Adcroft, 2011).

A growing body of research has demonstrated that performance related comments on assessment tasks can also effect positive outcomes in students, such as enhanced achievement (Adcroft, 2011), motivation (Pitt & Norton, 2016), development (Crisp, 2007; Lizzio & Wilson, 2008), and future performance (Zimbardi et al., 2016). To maximise the potential of engendering such outcomes, comments should be timely, unambiguous, educative (not just evaluative), proportionate to learning criteria/goals, locate student performance (i.e. assess how students performed in relation to the goals of the task, what they did well and not so well, and what they should work on in the future), emphasize task performance, be phrased as an ongoing dialogue rather than an end point, and be sensitive to the individual (a more detailed review of the literature and explanation of these design principles can be found in Henderson & Phillips, 2014).

Achieving the principles above necessitates the timely creation of carefully constructed and detailed comments. Ideally, the comments should reflect an educators' understanding of individual students, and be sensitive to their particular context and needs. Unsurprisingly this balance can be difficult achieve, as many educators are faced with time-pressures that limit the amount of detail that can be presented. Moreover, written comments can be restricting, especially if limited to the margins of essays or through the use of rubrics. In response to these challenges, the authors have experimented with using digitally recorded comments, such as audio, video, and screencast recordings (see Henderson & Phillips, 2015). In general, the response to recorded comments has been positive, in both secondary and higher education environments.

The potential benefits of digitally recorded comments have also been recognised in the academic literature. A number of studies within the higher education context have identified that students enjoy receiving audio visual comments (Luongo, 2015; McCarthy, 2015). In particular, this modality has been reported to deliver comments that are more detailed, clear, individualized and supportive (Henderson & Phillips, 2014). In addition, educators tend to consider recorded comments to be more useful and engaging for students (Crook et al., 2010), and to save significant amounts of time (Anson, 2015; Fawcett & Oldfield, 2016).

Broader research context

The research presented in the current paper is part of a larger mixed methods study aimed with assessing the impact and design of digitally recorded comments on assessment tasks in a range of diverse contexts. That research project focuses on six units of study from five disciplines: one from Business and Economics, two from Education, one from Engineering, one from Law, and one from Pharmacy. All units are delivered at Melbourne based campuses of a large international university. At the time of writing this paper, data had only been collected from two of the six units (one from Education and one from Engineering).

The first phase of the larger study involves a selection of tutors from each unit creating digitally recorded comments on assessment tasks while the remainder continue to use text-based comments. After all comments have been returned to students, a 26-item online survey is used to assess attitudes toward the modality of comments students have received.

The online survey used in the larger study comprises 26 items. It should be noted that the word ‘feedback’ was used in the survey rather than ‘comments’, as it aligns with the vernacular typically used by students. The items are based upon previous research by Henderson and Phillips (2015), and include five demographic questions, four questions related to the modality of comments received, and Likert-type items (5-point) designed to assess students’ perceptions of the clarity and usefulness of the comments, their level of satisfaction with the comments, and the degree to which the comments made them feel motivated, prompted them to reflect on the quality of their work, and improved their confidence for completing future assessment tasks. An additional seven items were presented to students who received digitally recorded comments. Five of these items measure preferences and attitudes toward digitally recorded comments in comparison with text-based comments (Likert scale), and two collect open ended responses detailing what students liked and disliked about the comments. The second phase of the broader study involves semi-structured interviews with the tutors who created the digitally recorded comments, and focus groups with students who received those comments. Tutors are asked questions relating to their teaching experience, their context for understanding feedback, the workflow and processes used to create the digitally recorded comments, their perceptions of how students felt about receiving recorded comments, and their thoughts about the appropriateness of digitally recorded comments. Students are asked questions focusing on the impact of the digitally recorded comments, whether the comments changed their perception of their tutor, and their thoughts regarding whether digitally recorded comments are more appropriate in certain circumstances.

The current paper

Through the process of analysing the initial survey data, it became apparent that there was not a clear-cut relationship between student’s perceptions of the impact of the comments and the modality (i.e., text-based vs digitally recorded comments). In the interests of investigating this result further, this paper presents a subset of the data and explores some of the potential factors that may influence student’s perceptions of whether digitally recorded comments are more clear, useful, and satisfying than text-based comments.

The data subset is drawn from a cohort of Education students enrolled in the first semester of a Masters of Teaching unit. The unit was delivered both on-campus (at three Melbourne-based campuses) and off-campus (in an online format). The majority of the 624 students (59%) were enrolled at Campus 1, while the remainder were split between Campus 2 (26%), Campus 3 (4%) and online (11%). The unit focused on effective learning models, and the ways in which cultural and socio-economic contexts influence learning. The unit was held in the first semester of 2016, and classes ran for 9 weeks.

On-campus students were expected to attend a one-hour lecture and two-hour face-to-face workshops each week. Off-campus students were also expected to watch the one-hour lecture online, and spend two-hours per week engaging with online workshop materials and completing hands-on activities. Due to the size of the cohort, and the fact that the unit was run across three campuses, there were 23 workshops held weekly by 14 tutors. The feedback comments rated by students in this study were provided on the first assessment task of the unit; an essay in which students were asked to compare and contrast learning theorists. Although this was a postgraduate course, it was designed for students who had been out of the higher education system for some time. As such, the comments on this assessment task were likely to have been the first many students had received in a higher education context in several years.

Method

Participants

All of the 624 students enrolled in the unit were invited to complete an online survey. Overall, 193 students (31%) began the survey but only 85% of these completed the survey. The final sample consisted of 164 students, of which 78% (n = 128) were women and 59% (n = 96) identified as English as their first language. The across-campus representativeness of the final sample was similar to the overall cohort: 67% were enrolled at Campus 1, 20% were enrolled at Campus 2, 6% were enrolled at Campus 3, and 7% were enrolled in the online version of the unit.

Materials

For the scope of this paper, data from nine of the 26 survey items are explored: the two open-ended questions, and seven of the closed Likert-type questions. The closed questions, referred to here as the *Feedback Attitudes Scale*, comprised three items related to the clarity of the comments, three items related to the comment's usefulness for future work, and one item measuring satisfaction with the comments. There was one negatively worded item in the survey, *'The feedback was confusing'* and this was reverse-coded and changed to *'The feedback was not confusing'* for the purposes of reporting. The total *Feedback Attitudes Scale* had high internal consistency (α = .89), as did the two subscales of clarity (α = .72) and usefulness (α = .87).

Procedure

At the beginning of the semester, one of the researchers (who was the chief examiner of the unit) contacted all of the unit tutors to identify which of them might be interested in creating digitally recorded comments for Assessment Task 1. Five tutors volunteered (henceforth referred to as Tutor 1, Tutor 2, Tutor 3, Tutor 4, and Tutor 5), and each selected their preferred mode of digital recording (one of the benefits of digitally recording comments is the potential to create them more quickly than text-based comments, therefore it was important that tutors selected a modality that they felt most comfortable with). Tutor 1 and Tutor 2 selected audio recordings, Tutor 2 and 3 selected screencast recordings, and Tutor 5 selected inking. The remaining nine tutors elected to create comments using text.

All 14 tutors were informed by the chief examiner about the importance of timely and effective comments on assessment tasks. They were asked to return comments and a grading rubric to students three weeks after the submission deadline. In addition, the five tutors who volunteered to create digitally recorded comments were shown a diagram illustrating a recommended structure for the recordings (see Figure 1). In past studies, both students and teachers have commented on the positive benefits of recorded comments when this structure has been used (for more information, see Henderson & Phillips, 2015). However, in the interests of making the medium work for the individual, tutors were advised to follow the structure that worked best for them.

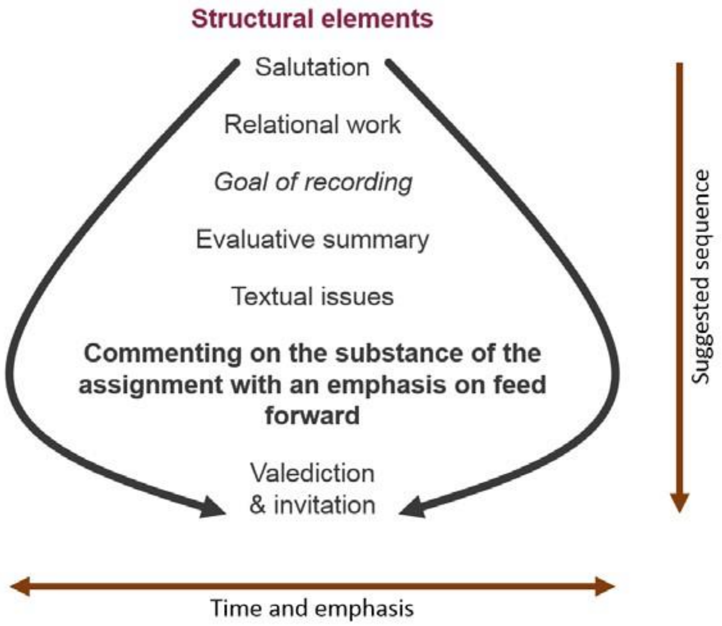

Figure 1: Recommended sequence and emphasis of digitally recorded comments on assessment tasks

In April 2016, students submitted Assessment Task 1 electronically via the online learning platform *Moodle*. Most of the tutors created comments using the modality that they had selected; however, two tutors had technical difficulties which altered their choice of modality. Tutor 3 had difficulties using the screencast software and created audio recordings instead, while Tutor 5 had difficulties using the inking process and elected to provide text-based comments to all students. As a result, Tutor 5 is henceforth considered to be part of the group of tutors who provided text-based comments (n = 10).

Almost all of the comments were returned to students by the predetermined deadline of three weeks after submission. The exception was those created by Tutor 1, who had trouble uploading some of the audio recordings to Moodle. After all comments had been returned, a link to the online survey was placed on the unit's Moodle site, and sent via broadcast email to all students enrolled in the unit. Approval was sought from the university's Human Research Ethics Committee before any data collection occurred. Students who received digitally recorded comments were also given the opportunity to complete the survey in their tutorial workshops using iPads.

Findings

To examine whether students perceived digitally recorded comments to be clearer, more useful, and more satisfying than text-based comments, the mean scores for each of the seven quantitative survey items were compared for the two groups (see Table 1). For all analyses, ranked means were used instead of raw means, as the survey collected ordinal data (Field, 2009). The results of these analyses are presented in Table 1.

Table 1. Comparison of Students' Ranked Means for Survey Items by Comment Modality

Theme	Item	Ranked means for text only comments	Ranked means for digitally recorded comments
Clarity	The feedback used language that was easy to understand	83.75 (n=108)	80.09 (n=56)
	The feedback had a clear message	78.69 (n=108)	89.86 (n=56)
	The feedback was not confusing	84.68 (n=108)	78.29 (n=56)
Usefulness	The feedback provided constructive comments that you could use to improve your work	76.75 (n=108)	93.59 (n=56)
	The feedback was useful	78.01 (n=108)	91.16 (n=56)
	The feedback improved your confidence for completing future assessment tasks	80.53 (n=108)	86.30 (n=56)
Satisfaction	How satisfied were you with the feedback?	80.69 (n=108)	84.56 (n=55)

According to these descriptive results, students who received digitally recorded comments had higher ranked means than students who received text-based comments for all items, except for two of the clarity items. This result was somewhat unexpected; the extant literature generally indicates that students find digitally recorded comments to be clearer than text-based comments. Further analysis was performed to explore this finding: rather than performing inferential procedures based on the initial descriptive results, ranked means of student responses were calculated for each tutor on the three clarity items (see Table 2). As demonstrated, the ranked means of Tutor 1's students are generally lower than those from students of the majority of other tutors (regardless of whether they provided digitally recorded or text-based comments) for all three items. In fact, for the item, 'the feedback was not confusing', Tutor 1 had the lowest ranked mean of all tutors.

Table 2. Comparison of Students' Ranked Means for Clarity Survey Items by Tutor

	Ranked means													
	Digitally recorded comments				Text-based comments									
Tutor	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Student responses (n)	18	9	11	17	5	20	13	15	8	9	10	7	6	12
The feedback used language that was easy to understand	62.2	92.5	86.7	84.3	103.7	56.9	76	84.5	69.5	84.5	108.1	91.4	108.5	78.5
The feedback had a clear message	70.3	95.6	92.7	100.5	100.8	59.4	64	93.2	71.0	96.5	102.1	70.4	75.5	58.3
The feedback was not confusing	50.2	96.4	68.7	98.5	101.5	58.2	88.9	75.5	97.0	102.2	93.5	79.8	90.8	82.2

Note: Four respondents are excluded from this table as they could not recall which tutorial workshop they attended, however their scores were included in the calculation of ranked means in Table 1.

To provide some additional background information to the quantitative results presented above, a random selection of five feedback comment artefacts were analysed from each tutor who provided digitally recorded comments. The results of this analysis are displayed in Table 3, as are several additional details about the context of each tutors' comments. It is apparent that unlike all other tutors, Tutor 1 did not return the grades and comments by the stipulated deadline, nor did the tutor return the publicised rubric to students.

Table 3. Analysis of Digitally Recorded Comments across Tutors

Tutor	Modality	Native English speaker	Range of recording length (mins)	Structural elements (in order of presentation)	Rubric provided	Text comments provided	Grade and comments returned to students on time (3 weeks)
1	Audio	No	2.30 - 5.00	Salutation, goal of recording, substantive comments (including feed forward and textual issues), valediction and invitation	No	No	No (provided after grades and comments were released for all other students)
2	Audio	Yes	5.30 - 7.00	Salutation, relational work, goal of recording, invitation, evaluative summary, textual issues, substantive comments (including feed forward), second invitation (including specific provocation)	Yes	No	Yes
3	Audio	Yes	1.30 - 3.00	Salutation, goal of recording, evaluative summary, substantive comments (including feed forward and textual issues), valediction and invitation	Yes	Yes	Yes
4	Screencast	Yes	2.46 - 11.30	Salutation, goal of recording, evaluative summary, textual issues, substantive comments (including feed forward), invitation, relational work	Yes	No	Yes

Open-ended responses from students of Tutors 1 to 4 were thematically analysed. The data relating to Tutor 1 were striking in comparison with the other three tutors. The main theme that emerged from these comments (seven references), supported the notion of a lack of clarity in the comments. While some responses were generic in nature such as "[I] found it confusing," others suggested issues relating to clarity of expression such as "I had a hard time understanding [the tutor] sometimes, maybe because of [their] voice." This may be related to the fact that Tutor 1 had a heavy accent, however, additional data were not collected to confirm this as the cause of the issue. Further comments indicated a complaint around the specificity of commentary, for example, "lacking in specific feedback, whereas the text manages to pin-point and locate specifically and directly on the assignment key errors." Another prominent theme (five references) in the responses referred to the absence of the rubric, for example, "Though I understand that the recording cannot touch on all aspects of my assignment, it did not refer to the way I did/didn't score well based on the rubric." The lack of a rubric stands out as an abnormal practice in this context. All other tutors used the rubric, which was advertised through the official subject guide and learning management system.

Based on the combination of results discussed thus far, it was evident that students who received comments from Tutor 1 had had a different experience to those receiving comments from the other three tutors who used the digital recording modality. As such, the scores of these students were potentially reducing the overall ranked mean scores compared in Table 1, and leading to the unexpected results. To further explore this notion, a series of Kruskal-Wallis tests were performed to compare the ranked means of the three clarity survey items from each of the four tutors who provided digitally recorded comments. The Kruskal-Wallis test is a non-parametric alternative to an independent-samples ANOVA, and it compares ranked means for three or more groups. As shown in Table 3, the ranked means for Tutor 1 were lower than each of the other three tutors for each clarity item. In addition, the item, '*the feedback was not confusing',* showed a statistically significant main effect. To explain this result, a post-hoc Mann-Whitney U test was performed for all pairwise comparisons. To control for Type I error, adjusted significance levels were observed. A significant difference with a close-to-large effect was found between the ranked means of Tutor 1 and Tutor 4 (p = .02, r = .49). This result implies that students of Tutor 1 were significantly more likely to consider the comments to be confusing than students of Tutor 4.

Table 4. Comparison of Ranked Means for Clarity Survey Items by Students whose Tutors who Provided Digitally Recorded Comments

Variable	*N*	Ranked means	$\chi 2$	*df*	*p*
Clarity					
The feedback used language that was easy to understand			4.44	3	.22
Students of Tutor 1	18	22.28			
Students of Tutor 2	9	32.67			
Students of Tutor 3	11	30.73			
Students of Tutor 4	17	29.82			
The feedback had a clear message			3.65	3	.30
Students of Tutor 1	18	22.89			
Students of Tutor 2	9	30.22			
Students of Tutor 3	11	28.27			
Students of Tutor 4	17	32.06			
The feedback was not confusing			10.98	3	.01
Students of Tutor 1	18	19.56			
Students of Tutor 2	9	34.50			
Students of Tutor 3	11	25.41			
Students of Tutor 4	17	35.18			

The comparison of ranked mean scores from students who received text-based comments and students who received digitally recorded comments (as shown in Table 1) was recalculated with Tutor 1's results omitted. The results of this analysis are presented in Table 4. As suspected, these results showed that students provided higher ranked means for digitally recorded comments when compared to text-based comments on all items, including the three items measuring clarity. Furthermore, a series of Mann Whitney U tests revealed statistically significant differences, with small-to-medium effects, in the ranked means for three of the items: '*The feedback had a clear message*', z = 2.50, p = .01, r = .21; '*The feedback provided constructive comments that you could use to improve your work*', z = 2.97, p = .003, r = .25; and '*The feedback was useful*', z = 2.81, p = .005, r = .23.

Table 5. Comparison of Students' Ranked Mean Attitudes by Modality (Excluding Students of Tutor 1)

Theme	Item	Ranked means for text only comments	Ranked means for digitally recorded comments
Clarity	The feedback used language that was easy to understand	72.51 (n=108)	76.30 (n=38)
	The feedback had a clear message	68.75 (n=108)	87.00 (n=38)
	The feedback was not confusing	71.91(n=108)	78.03 (n=38)
Usefulness	The feedback provided constructive comments that you could use to improve your work	67.81 (n=108)	89.68 (n=38)
	The feedback was useful	68.10 (n=108)	88.86 (n=38)
	The feedback improved your confidence for completing future assessment tasks	70.57 (n=108)	81.82 (n=38)
Satisfaction	How satisfied were you with the feedback?	70.21 (n=108)	81.14 (n=37)

Discussion

This paper presents preliminary results from a larger study aimed with assessing the impact of digitally recorded feedback comments. The data explored here suggest that students do tend to perceive digitally recorded comments as more clear, useful, and satisfying than text-based comments. However, it appears that these outcomes can dramatically vary as a result of a number of factors. For example, in this paper, students of Tutor 1 rated the clarity of the digitally recorded comments they received to be lower than the other tutors who provided recorded comments. Moreover, they also indicated that Tutor 1's comments were more confusing that all other tutors, regardless of modality.

In contrast to earlier work examining the modality of comments provided to students (Henderson & Phillips, 2015) the current investigation reveals that there is more to effective feedback than mere considerations of modality. These results may be partly due to contextual factors; as highlighted earlier in this paper, the processes by which Tutor 1 provided comments to students varied from the other three tutors. These included the structure of the comments, the timing of the return of comments to students, the length of audio recordings, the provision of additional written comments or the assessment task rubric. Additionally, there is some evidence to suggest that clarity of the comments was compromised by expression, possibly due to Tutor 1's accent.

In addition to these contextual elements, there are likely to be a myriad of other factors that influenced student perceptions of the clarity, usefulness, and overall satisfaction of the comments. For example, a growing body of research highlights the complex nature of the interplay between technological, pedagogical, and content (TPACK) factors (for a more detailed discussion see Henderson & Phillips, 2014). Some scholars have suggested that the interplay between these factors is a 'wicked problem' (Mishra & Koehler, 2016) that cannot ever be solved due to the incomplete, sometimes contradictory, and ever changing requirements that are often difficult to recognise. When one aspect of a wicked problem is resolved, such as the desire to provide effective comments to students, the complex and interdependent nature of the problem means that the resolution may reveal or create other problems.

This can be further understood by examining research describing the interplay between contextual factors at three different levels: micro, meso, and macro (Porras-Hernández & Salinas-Amescua, 2013; Rosenberg & Koehler, 2015). Micro-level contextual factors are those related to individuals, including preferred learning style, individual relationships within a tutorial group, or the content being taught in one particular tutorial session. Meso-level factors, such as access to technology on University campuses and faculty assessment policy, also have the potential to influence students' understanding of what is considered valuable or important. Finally, macro-level issues, such as national or international policy agendas and cultures of assessment, have also been shown to shape the way individuals value different aspects of their education.

With regard to the present paper, the relationship between the various micro-level contextual factors that impact on the perceived clarity, usefulness, and overall satisfaction with the comments are evident in the practices of the tutors and the students' themselves. For example, Tutor 1's accent may have become a greater factor in students' perception of the clarity (and therefore, the usefulness and satisfaction) as a result of that tutor's choice to provide students with audio comments. Had Tutor 1 selected a different technology platform, such as screen casting or video, the influence of the accent may have been reduced, as students may have been able to draw on other cues such as connecting comments with specific sections of their work or the facial expression of the tutor to enhance the clarity of the message. Similarly, if Tutor 1 had made the pedagogical decision to provide some written comments or the rubric to students, it may have been possible for students to gain a clearer understanding of tutor's comments.

Similarly, meso-level factors such as the Universities policy of a three week timeframe in which students are supposed to receive comments on their work may have contributed to the level of satisfaction expressed by students in Tutor 1's class. This factor may also have been amplified as students from Tutor 1's group would have been aware of their peers receiving their comments prior to their audio comments being uploaded as a result of the structure of the learning management system to which they were all enrolled. As such, it is possible to see technological and pedagogical contextual factors woven through both micro- and meso-levels that shape and are shaped by tutors as well as students. This dialogic relationship is a difficult one to unpack and to allow attributions of causality to be made.

While examination of these multifarious factors are outside the scope of this investigation, it is clear that simple examinations of modality are not sufficient to provide satisfactory explanations of student perceptions of these digital artefacts. If the provision of effective feedback commentary to students is an essential part of learning (McConnell, 2006), it is important that the interplay between various contextual factors, including the modality in which comments are provided to students, is more clearly understood.

There are several limitations with the present paper that need to be acknowledged. First, the scope of the paper precluded the ability to present in-depth analyses. For example, while an analysis of the digitally recorded comments was provided in Table 3, there was no similar comparison of the text-based comments. Moreover, there was no exploration of whether student feedback ratings differed as a result of individual differences, such as gender, age, English-language ability, or experience with feedback in higher education. However, these are some areas that the authors would like to address in further research. Second, the fact that only one tutor produced screencasts meant that there was not enough data to support comparisons of recorded feedback based on modality (i.e., audio vs screencast). In defence of this design limitation, it was a feature of this research that the preferences and practices of tutors were supported. Third, the generalisability of the results presented here are limited, given that the data were derived from a small sample of Education students. It is also worth noting that the attitudes of Education students may differ from students from other disciplines; the former are developing their own skills with regarding to feedback processes, and thus may have higher expectations of their tutors. Finally, this paper serves a predominantly descriptive function and, as such, further research is recommended to support the assumptions presented here. Longitudinal research that aims to establish whether feedback modality leads to differences in student performance would be of particular value in this domain.

Conclusions

This paper presents a subset of the data collected from students and tutors in one subject and as a consequence cannot be taken to generalise across all contexts. However, this initial analysis offers a clear caution for overly positive and deterministic claims about the impact of multimodal feedback practices. Our primary, and arguably unsurprising conclusion is that multimodality does not, in itself, guarantee an improved learner experience. In this case, when student responses were considered in terms of individual tutors, it was evident that modality was not the only factor involved. Nevertheless, it was also evident that modality did have a generally positive correlation with improved student experience, for example, when anomalous data was excluded, the students who received digitally recorded assessment comments ranked it as being clearer, more useful and more satisfying than students who received text-based comments. This calls for a qualified approach to claims of impact, and is somewhat contrary to recent literature that lauds the potential of technology enabled assessment feedback practices. However, rather than dissuading us from pursuing multimodality further, we argue that it simply reminds us that educational applications of technologies should be considered in relation to micro, meso, and macro level contextual factors.

The data collected in this first phase of the study does not allow us to confidently identify all of those factors. However, some tentative propositions can be made through the consideration of the broader context as well as open ended responses. First, careful staff preparation and training needs to occur with regards to the technology. In this case three of the tutors reported technical difficulties with the recording or the uploading of files to the virtual learning environment. In the later example, it impacted on the timing of the return of marking. Second, staff should engage in moderation and/or training for the quality of the feedback comments. The variations among staff in length, structure, content and pedagogic engagement with students are likely to help explain some of the variation of results. Third, staff should be mindful of student expectations with regards to the return of the comments. In this paper it was clear that Tutor 1's late return of marking coupled with the omission of the rubric negatively impacted on the students' perceptions. Fourth, the rich media of audio or video is often thought to be advantageous, however, it can serve to exacerbate issues if the voice or message is inherently unclear.

References

Adcroft, A. (2011). The mythology of feedback. *Higher Education Research & Development, 30*(4), 405-419.

Anson, I. G. (2015). Assessment Feedback using Screencapture Technology in Political Science. *Journal of Political Science Education, 11*(4), 375-390.

Boud, D., & Molloy, E. (2013). *Feedback in Higher and Professional Education*. New York: Routledge.

Crisp, B. R. (2007). Is it worth the effort? How feedback influences students' subsequent submission of assessable work. *Assessment and Evaluation in Higher Education, 32*(5), 571-581.

Crook, A., Park, J., Lawson, C., Lundqvist, K., Drinkwater, R., Walsh, J., et al. (2010). *ASSET: Moving Forward Through Feedback*: Univeristy of Reading.

Fawcett, H., & Oldfield, J. (2016). Investigating expectations and experiences of audio and written assignment feedback in first-year undergraduate students. *Teaching in Higher Education, 21*(1), 79-93.

Field, A. (2009). *Discovering Statistics using SPSS* (3rd Edition ed.). London: Sage.

Henderson, M., & Phillips, M. (2014). *Technology enhanced feedback on assessment*. Paper presented at the Australian Computers in Eductional Conference 2013. Retrieved from http://acec2014.acce.edu.au

Henderson, M., & Phillips, M. (2015). Video-based feedback on student assessment: scarily personal. *Australasian Journal of Educational Technology, 31*(1), 51-66.

Lizzio, A., & Wilson, K. (2008). Feedback on assessment: students' perceptions of quality and effectiveness *Assessment & Evaluation in Higher Education, 33*(3), 263-275.

Luongo, N. (2015). Missing the Chalkboard: Using Screencasting in the Online Classroom. *Computers in the Schools, 32*(2), 144-151.

McCarthy, J. (2015). Evaluating written, audio and video feedback in higher education summative assessment tasks. *Issues in Educational Research, 25*(2), 153-169.

McConnell, D. (2006). Chapter four: Assessing learning in e-groups and communities. In D. McConnell (Ed.), *E-Learning Groups and communities*. Maidenhead: Open University Press.

Mishra, P., & Koehler, M. J. (2016). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record, 108*(6), 1017-1054.

Pitt, E., & Norton, L. (2016). 'Now that's the feedback I want!'Students' reactions to feedback on graded work and what they do with it. *Assessment & Evaluation in Higher Education*, 1-18.

Porras-Hernández, L. H., & Salinas-Amescua, B. (2013). Strengthening TPACK: A Broader Notion of Context and the Use of Teacher's Narratives to Reveal Knowledge Construction. *Journal of Educational Computing Research, 48*(2), 223-244.

Rosenberg, J., & Koehler, M. J. (2015). *Context and Teaching with Technology in the Digital Age*.

Zimbardi, K., Colthorpe, K., Dekker, A., Engstrom, C., Bugarcic, A., Worthy, P., et al. (2016). Are they using my feedback? The extent of students' feedback use has a large impact on subsequent academic performance. *Assessment & Evaluation in Higher Education*, 1-20.

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Tracking discipline mastery: The development of an online program assessment and evaluation tool

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An online formative program assessment and evaluation tool was created by discipline leaders covering five discipline-specific domains as well as transferrable skills and personal dispositions. Students in first year complete this program assessment, often failing, but the experience is used to motivate them to start their learning journey - that's why they've come to University. Second year students participating in the same program assessment can see their annual progress. Third year students participating in program assessment can confirm how far they have progressed towards discipline mastery, as defined by their discipline leaders. The tool can also evaluate the overall effectiveness of the multiple course-based teaching and learning environments that make up the students' program and provide evidence to support external accreditation requirements. An initial trial of the tool in environmental science and geospatial science has been conducted.

Keywords: program assessment, mastery, evaluation, perseverance, passion

Introduction

Mastery is the attainment of a high degree of competence and the ability to fluently apply this to the chosen discipline (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010). The development of mastery progresses over time. Novices at the first state of mastery may not even be aware that they are incompetent (Figure 1). When they first meet challenges in their learning, novices become aware of how little they really do know. This signifies that they have moved on to the second state of mastery - conscious incompetence. From here the learner is motivated to engage in studies to develop their competence. Through various assessments, learners become aware of their growing achievements and reach the third state of mastery, conscious competence. They can think through and analyse situations when provided with adequate support. The final fourth state of mastery occurs when learners are fluent in the discipline and are able to apply their craft wisely in a variety of contexts. This final state is called unconscious competence, as the discipline and its practices have been internalised in the professional (Ambrose *et al.*, 2010).

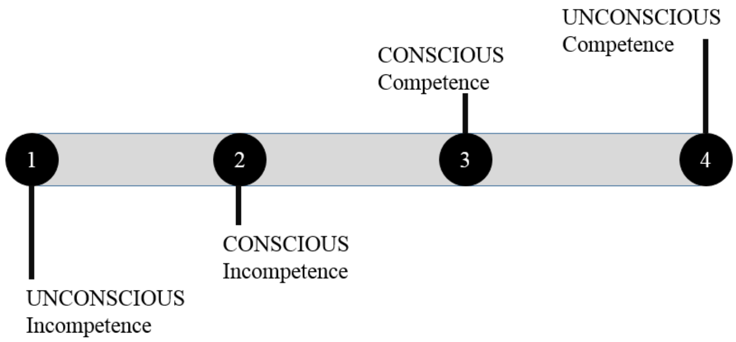

Figure 1: Stages in the development of Mastery (Ambrose *et al.*, 2010)

University students need to work through these four stages as they complete their course assessments, ideally progressing beyond conscious competence by the time they graduate. While the time taken to reach the various stages of competence will vary among students, and may not correlate conveniently with the stages in a degree program, it is important motivator for students to be able to see their progressive development.

It has been argued that academic staff (Arum & Roksa, 2011) and professional societies (Arum, Roksa, & Cook, 2016) are ideally placed to define the essential discipline concepts and competencies for tertiary graduates. As an example, the professional society, Engineers Australia, has defined 16 mandatory elements that they believe describe the stage one competencies for graduating professional engineers. These are grouped into three areas – knowledge and skill base, engineering application ability and professional and personal attributes that encapsulate discipline mastery. Other disciplines do not have well-defined professional competencies for which learners can strive.

At the University level, well-written program and course learning outcomes capture the contribution each course makes towards the development of each of these desired graduate qualities. Aggregations of constructively-aligned course assessments presumably lead to the development of suitable graduates (Biggs & Tang, 2011). But how can program teams be sure that their programs are doing what they say they are doing?

To get a sense of the effectiveness of a degree program, it can be useful to indirectly assess what learning gains students have made during their time studying a program. A classic example of this type of test is the Collegiate Learning Assessment (CLA), which is a critical thinking, moral reasoning and writing assessment. Arum & Roksa (2011) compared student performance in 24 institutions using the CLA and found that 45% of the 2300 students examined did not show a statistically significant improvement in their performance over the first 2 years of their program (Arum & Roksa, 2011). While there is a need to collect longitudinal data across whole degree programs, as learning may be unlikely to accrue in a perfectly linear nature, these results, which were verified by others (Pascarella, Blaich, Martin, & Hanson, 2011), raise serious questions about the value for students and society of the university experience (Arum & Roksa, 2011).

In an effort to assure that these qualities are being realised in our Environmental Science and Geospatial Science graduates, an online formative program assessment tool was created by discipline leaders. There were 13 component parts to the Tracking Mastery Tool (TMT) that aimed to assess the discipline knowledge, skills and attitudes of a graduating student. This paper is a work-in-progress report of the initial implementation of the TMT in an online environment for program assessment and evaluation purposes.

Method

Five domains of knowledge common to the two programs of study were identified. To assess students' knowledge of each of these domains, a bank of 25 multiple-choice questions was created for each domain using Moodle-based quizzes. The Moodle feedback tool was used to collate students' responses to questions in relation to how confident respondents were in their responses and where they had learnt this discipline knowledge (in, or outside of the program). In a similar way, students' motivation to study and confidence in a range of graduate qualities was assessed including attributes such as effective teamwork, the pursuit of lifelong learning, and the consideration of social and ethical perspectives in professional contexts. In parallel, students completed the validated survey of perseverance and passion (GRIT-S) as these elements have been linked to positive academic outcomes such as grades and program retention (Duckworth, Peterson, Matthews, & Kelly, 2007; Duckworth & Quinn, 2009).

Students studying a core first year course (n=126) were invited to participate in the 13 components of TMT during their first weeks of university study. Quiz scores and Feedback responses were analysed using embedded statistics reports within the Moodle tools and thematic analysis of text (Bryman, 2015).

Results

Student respondents (n=126) to the TMT indicated that they were largely motivated to study the programs as it matched their personal interests (42.5%; data not shown). In answer to the question 'How you believe your university education will change you?', the responses (n=371) could be categorised into 4 broad themes; knowledge (26%), career (28%), personal development (21%) and a range of graduate attributes (25%). When respondents self-assessed their current development of seven defined graduate attributes, they indicated that they were least prepared in the body of knowledge and international perspectives, and were best prepared for ethical action and social responsibility within professional contexts (Figure 2).

Student score results to the five knowledge domain quizzes are presented in Table 1 as percentages of average grade, median and standard deviation (SD). The proportion of students who identified that their learning about the subject matter had occurred outside of the program ranged from 6.6 to 29.4%. In addition respondents indicated how confident they were with their responses to the quiz questions as a whole. Students were most confident about the topics assessed in the Eco-literacy quiz and less confident about the topics assessed within the Geospatial Science quiz (Table 1).

Respondents also self-assessed their current knowledge of a range of graduate skills (Figure 3). Statistical analyses associated with professional practice was identified as an area where students identified they had inadequate skills (Figure 3). The average grade for the GRIT-S quiz was 69.67% (mostly gritty); median 71.2% and SD 11.24%.

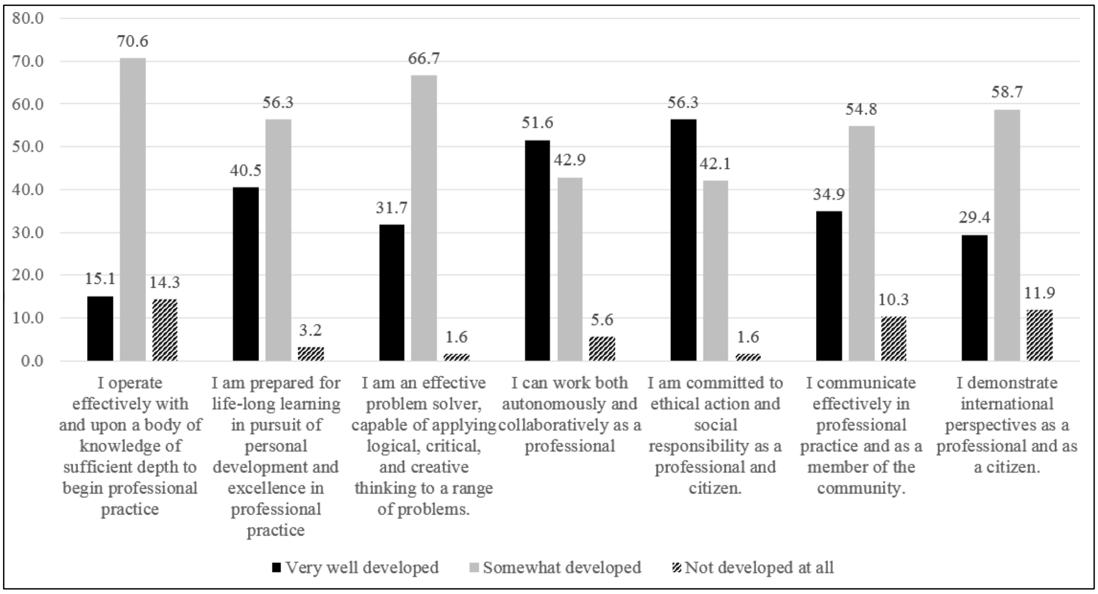

Figure 2: Student self-assessment of their development of seven defined Graduate Qualities – one component of the Tracking Mastery Tool

Table 1: Student results and confidence within the five knowledge domain quiz components within the Tracking Mastery Tool

	Average grade %	Median %	SD %	Previous studies %	Very confident %	Somewhat confident %	Not very confident %
Human Dimensions	49.9	52.0	10.0	19.2	1.6	48.8	49.6
Earth Science	46.9	44.0	12.9	20.2	1.6	39.5	58.9
Geospatial Science	37.1	36.0	12.5	6.6	1.6	20.5	77.9
Ecological Science	58.4	56.7	12.0	24.8	3.4	53.9	42.7
Eco-literacy	65.0	66.7	11.5	29.4	6.9	58.4	34.7

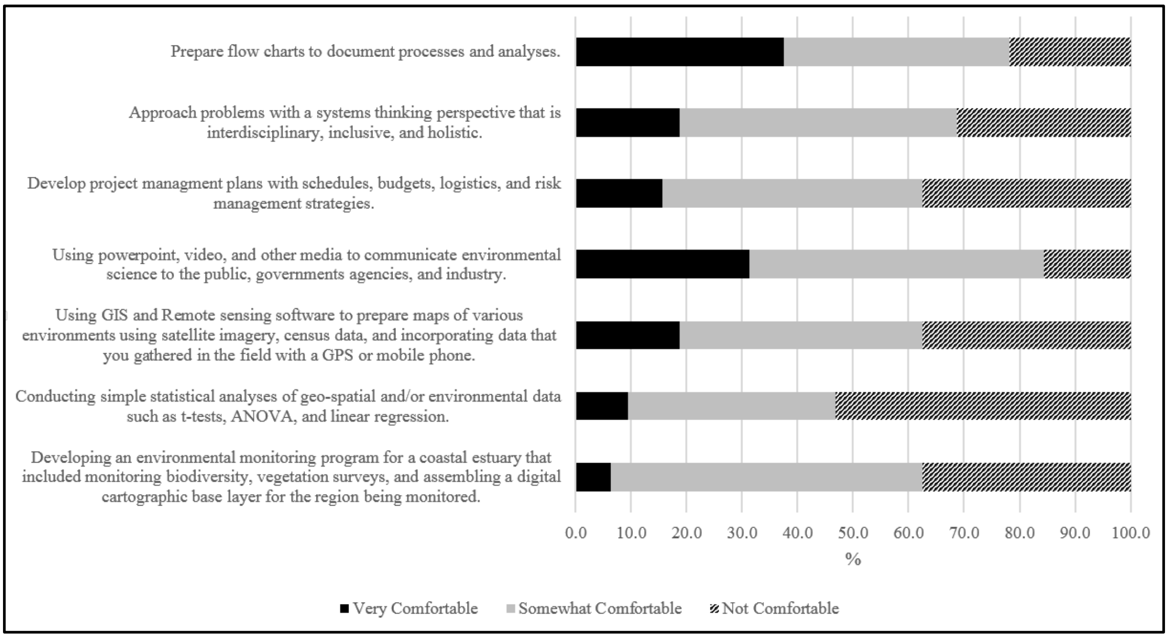

Figure 3: Student comfort with performing discipline specific skills (%) – a component of the Tracking Mastery Tool

Discussion

This paper represents a work-in-progress report for tracking mastery using a discipline-specific program assessment and evaluation tool. Its eventual aim will be to measure annual achievement of key discipline-specific competencies over a program. The tool fills a gap in those disciplines where professional competencies are yet to be defined. Similar indirect assessment approaches have been used in Information Technology and Business (Joseph, Nair, & Kumar, 2015).

Tool design

The CLA used by Arum and Roska (2011) is a standardised test used in the United States to measure advanced analysis, critical thinking and communication skills. No equivalent tool is available in Australia. In this study we have used a simple performance tool (quizzes and surveys) to track students' progress towards mastery. We admit that tests are not necessarily a perfect assessment of anything that students do, but they do offer us hope of some level of external validity of our programs. We need to continue to verify that the quiz items in the TMT are accurately representing the achievement of the desired program learning outcomes with internal and external stakeholders. We will also need to correlate data from the TMT with actual grades in each of the five domains and students' grade point averages, as in Major Field Tests in IT and Business (Joseph *et al*., 2015).

Another limitation of this indirect assessment strategy is that there is no control group, that is the annual assessment of the discipline-specific learning gain in age-matched adults who are not doing university study (Pascarella *et al*., 2011). As such we need to interpret changes in scores and confidence levels with caution.

A Tool for Assessment

The data collected by the TMT in this study of students studying a core first year course represents a baseline for each participant and can be used as a reference point to track their development of mastery in successive years of their program. Quantitative changes in the five knowledge domain quiz score components of TMT can be used to indicate students' learning gains and thus growing competence. Comparative changes in the self-assessment of confidence in quiz responses, as well as self-reported career relevant skills and motivators, can be interpreted as measures of growing conscious competence, the third state on the mastery development spectrum (Ambrose *et al*., 2010).

One of the components of the TMT is the validated GRIT-S survey. Grit is a measure of willingness to persevere and passion for long term goals and is validly measured using a 8-item survey (Duckworth & Quinn, 2009). Academic success requires focus, commitment and stamina. People with Grit are less likely to change direction as situations become challenging or when they experience setbacks. The first round of TMT participants were found to be 'mostly gritty'. As Grit has been correlated to higher grades, higher completion rates and fewer career changes (Duckworth *et al*., 2007) this finding augurs well for student retention and perseverance with their programs.

Our intention is to ask students undertaking courses within their final year of these programs, to assess their state of mastery using the TMT. Used in this way, the TMT can confirm for graduating students that they have mastered the discipline-specific knowledge, skills and attitudes to make a positive difference to their communities. The students will have a clearer sense of what they are getting from their tertiary education as they collect their reports to demonstrate their progress and accomplishment.

Ultimately the TMT will reside within program-specific online environments allowing students to have a ready litmus test of where they are in their development of the core competencies and concepts in their chosen discipline. The application of the TMT also serves as an approach that encourages student ownership of the learning process and in the long term, will be linked to a celebration of mastery.

A Tool for Evaluation

The university experience prepares people for the rigors of professional life. Graduates need a range of discipline-specific skills and knowledge, accepted behaviours and attitudes that can be applied fluently in their chosen professional context (Ambrose *et al*., 2010). University program evaluation is a systematic method for collecting, analysing and using information to answer questions about programs, particularly about their effectiveness, but also efficiency. In Australia, the Australian Qualifications Framework (AQF) regulates the purpose, knowledge, skills, application and volume of learning associated for each level of qualification (AQFC, 2013). Within this framework, program development teams decide what graduate learning outcomes are required and what course assessments would be needed to demonstrate achievement in any given program.

A secondary purpose for the TMT is to support program evaluation. Used over time, TMT can demonstrate and track the learning gain of students over successive years of a program. However, if students show little or no learning gain, as represented by the component quiz scores and confidence levels, then it is reasonable to conclude that there are issues with the program design and assessment (or of course, with the tool design itself). As the academic staff themselves have been involved in the design and development of the TMT, their involvement in the analysis and interrogation of current courses to reveal any deficiencies, is more likely, helping to drive appropriate course and program development. In effect, TMT provides academic staff with an annual reminder to evaluate the effectiveness of the program outcomes using a tool that allows systematic review of where and when problems have arisen. Given the busy context within most academics operate, TMT can help engage course-based academic staff in meaningful program assessment activities.

Program evaluation tools such as the TMT are a useful counterbalance to the more widely-used student perceptions of "overall satisfaction" surveys that are commonplace in Australian universities. These types of surveys can inadvertently shift actual program outcomes away from the intended program outcomes. These type of program learning outcome shifts originate because individual academic staff have lost awareness of how their course contributes to the achievement of the program objectives. Re-engaging current academic staff in program evaluation using the TMT is one way to help reconnect course delivery teams with the overall program direction and avoid this type of curriculum drift from the intended program learning outcomes.

The TMT can also be used to support accreditation audits. Data demonstrating student learning gains can complement the body of evidence required to satisfy auditors. Another evaluation application of the TMT is in benchmarking of similar programs nationally and internationally.

Conclusion

Programs are large and complex structures for both staff and students to navigate. By attempting to track the development of discipline mastery over time using simple Moodle quizzes and surveys aggregated into the TMT, academic staff are able to sense the pulse of their program and their students' progress through it. In turn, students also gain an appreciation of what they do and don't know within their discipline and have the capability to demonstrate their mastery and justify their investment in the university experience. In time these specific disciplines and their professional societies may define assessments of competencies and skills, but in their absence, the TMT goes some way to capturing these desired attributes for a range of stakeholders. The TMT provides a very tangible way to demonstrate to students that they are learning and growing in their competence, and provides a valuable evaluation tool for academic staff to pinpoint areas within a program requiring greater attention.

References

Ambrose, S. A., Bridges, M. W., DiPietro, M., Lovett, M. C., & Norman, M. K. (2010). *How learning works: Seven research-based principles for smart teaching*. San Francisco, CA.: John Wiley & Sons.

AQFC. (2013). *Australian Qualifications Framework*.

Arum, R., & Roksa, J. (2011). *Academically adrift: Limited learning on college campuses*. Chicago: University of Chicago Press.

Arum, R., Roksa, J., & Cook, A. (2016). *Improving Quality in American Higher Education: Learning Outcomes and Assessments for the 21st Century*. Hoboken, New Jersey: Wiley.

Biggs, J., & Tang, C. (2011). *Teaching For Quality Learning At University* (4th ed.). Maidenhead: McGraw-Hill Education.

Bryman, A. (2015). *Social research methods* London: Oxford University Press.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of personality and social psychology, 92*(6), 1087.

Duckworth, A. L., & Quinn, P. D. (2009). Development and Validation of the Short Grit Scale (Grit–S). *Journal of Personality Assessment, 91*(2), 166-174.

Joseph, P. M., Nair, J., & Kumar, B. (2015). Major Field Test: An Assessment Tool Used For Program Learning Outcome Measurement. *Journal of Computations & Modelling, 5*(4), 97-104.

Pascarella, E. T., Blaich, C., Martin, G. L., & Hanson, J. M. (2011). How Robust Are the Findings of Academically Adrift? *Change, 43*(3), 20-24.

Please cite as: Quinn, D., Sutton, P., Corcoran, P. & Weber D. (2016). Tracking discipline mastery: The development of an online program assessment and evaluation tool. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 523-528).

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Correcting tool or learning tool? Student perceptions of an online essay writing support tool at Xi'an Jiaotong-Liverpool University

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This paper reports on the initial data from an extension project that intends to further develop *Marking Mate*, a self-directed assignment writing support programme developed at Xi'an Jiaotong-Liverpool University (XJTLU) by Eoin Jordan and Andy Snyder. The study explores how students currently use the programme and how they would like to see it being improved. In this paper, we explore the apparent tension between students wanting to use *Marking Mate* as a correction tool and its potential as a learning tool, with reference to the specific Chinese context of the university. An additional tension between a highly contextualised and locally developed programme (such as *Marking Mate*), and widely available online tools that allow for potentially similar outcomes (such as *Grammarly*), is also discussed. It is argued that the programme may be more effective if it is explicitly presented as a learning tool, rather than a correction tool.

Keywords: Student Writing Support Tool, *Marking Mate*, Online Learning

Introduction and background

Marking Mate (n.d.) is a "free web-based academic writing feedback tool for East Asian learners of English" (Jordan & Snyder, 2012), developed at XJTLU by Eoin Jordan and Andy Snyder. It was created in response to the perceived needs of learners in an East Asian context, and the related suggestion that commercial options of Automated Writing Evaluation (AWE) tools, such as *Grammarly* or *Writer's Work Bench*, were not context-specific enough to address the needs of Chinese students studying at an English Medium of Instruction (EMI) institution. In addition, while there is considerable literature about automated grading tools (e.g. Ware & Warschauer, 2006), there is significantly less about automated systems to provide students with feedback (e.g. Czaplewski, 2009), and even then, it is still often linked to grading (Matthews, Janicki, He, & Patterson, 2012).

Automated Writing Evaluation (AWE), which is about providing feedback to students, has been the subject of some research in recent years, including a focus on how it can be used to provide formative writing feedback (e.g. Li, Link, & Hegelheimer, 2015; Wang, Shang, & Briody, 2013; Grimes & Warschauer, 2010). However, there is a lack of freely available AWE software, and commercial options are not tailored to the needs of English for Academic Purposes (EAP) learners in an East Asian context (Jordan & Snyder, 2012; Jordan, 2012). *Marking Mate* allows users:

> …to input texts, such as essays or reports, and receive instant formative feedback on common stylistic issues for East Asian learners, as well as on some grammar problems. Issues that users are currently able to search for include: emotional, informal or clichéd language, use of contractions, lack of hedging language, excessively repeated vocabulary, conjunctions at the start of sentences, the presence of many consecutive short sentences, redundant phrasing, personal pronoun usage, question and exclamation usage, citations not matching references, and uncountable noun plurals. (Jordan & Snyder, 2012)

Marking Mate has been in use at XJTLU since 2012, and the project that we report on in this paper is aimed at evaluating both its current use and potentially different uses, depending on what student users (and lecturers) tell us. The project is funded by the XJTLU Teaching Development Fund, the objective of which is to stimulate innovation in learning and teaching at the university.

XJTLU is a joint venture between Xi'an Jiaotong University in China, and Liverpool University in the UK. The university is based in Suzhou, Jiangsu Province, and was founded in 2006. It is unique in that it merges two different higher education systems. While this creates exciting opportunities, it also creates potential challenges, especially as they relate to culture and differences in educational traditions. XJTLU, as an EMI Institution in China, is unique in that it offers a degree which is partly UK-designed and needs to comply with UK Quality Assurance Agency (QAA) requirements, and partly contextualized, making it distinguishable from the 'home' degrees in terms of format and content (Eland & King, 2015). However, different expectations about learning outcomes and educational values are not the only challenge in this context. Other factors include cultural differences, language issues, and differences in educational backgrounds in a context where the vast majority of students are mainland Chinese, while most of the teachers are from a wide variety of cultural backgrounds. Thus, as Zhou, Xu, and Bayley (2011) note, "EFL teachers [or any other teachers in the XJTLU context] are both teachers and learners of intercultural competence in their teaching" (p. 163). This is significant in the context of this project as it affects the way some students respond to a tool like *Marking Mate*.

As has been widely documented, in general the Chinese education system is characterised by a heavy emphasis on exams and rote learning (Li & Cutting, 2011; Wang & Byram, 2011; Yu & Suen, 2005), which reflects particular educational traditions. However, it is also important to emphasise firstly that there is considerable diversity within Chinese education, and secondly that the education system in China is undergoing significant changes and shifts, and the establishment of XJTLU is in itself part of such changes. As Jin and Cortazzi (2011) note, China has in recent years officially emphasized 'quality education', which includes "a turn to more modern approaches to teaching and learning, including learner-centred ones" (p. 2). However, such changes do not necessarily have much impact in the short term, for "the reform of teaching methodology does not necessarily go hand in hand with a change in teachers' beliefs, especially where these are closely linked to cultural heritage" (Li & Cutting, 2011, p. 40). It is not our intention here to present a value judgment about culturally-based approaches to teaching and learning, but rather to suggest that educational traditions are likely to have an impact on how students perceive an online writing tool such as *Marking Mate,* and in particular, how they then engage with such a tool, and furthermore, how they would *prefer* to engage with such a tool.

The project we report on here was originally conceptualised with the aim of extending *Marking Mate*'s use and potentially improving students' experience with the tool. Based on students' and lecturers' feedback we will then develop some improvements and features. In response to a student's question of "What's a comma splice?", we thought it would be inconceivable that the explanation would not be on the *Marking Mate* site, but perfectly possible that the student would not have been able to find it. Thus, we have set out to make the site potentially more user-friendly and/or clearer in its functions. Moreover, if students are willing to find out more as a result, why not provide them with the tools to learn how to address their errors themselves directly from within *Marking Mate*? We believe that it is 'just in time' when it matters most (Carless, Salter, Yang, & Lam, 2011), for example when preparing an essay for assessment, that students will most likely use self-study tools. As noted, in this paper we report on the first stage of the project, which is student feedback on *Marking Mate* as an online tool.

Method

The research question for this project was: How can *Marking Mate* be optimized to enhance student writing, self-directed learning, and the overall user experience? The approach and methods were as follows:

Disseminate an online questionnaire about *Marking Mate* to all XJTLU Language Centre (LC) tutors and use the results to guide specific improvements and refine our thinking; 17 out of 185 LC staff replied.

Disseminate an online questionnaire to students across all departments. This included students who may or may not have used, or may or may not be aware of, *Marking Mate*. The survey was made available to all first and second year students at XJTLU, 129 of whom responded and took the survey, out of a possible 5217. 88% of those who responded replied that they knew what Marking Mate was, while 84% of respondents said they had used the program in the past. This gives an indication of the penetration of the program within XJTLU, albeit with significant limitations due to the overall response rates. Thus, we needed to exercise caution in making generalisations based on these data.

Conduct a series of focus groups with student who have used *Marking Mate* to gauge their perceptions and collect their feedback on the tool. We held a total of four focus groups from June 3 – 15, 2016, which consisted of first and second year students, with 4, 4, 4, and 8 students attending, respectively.

Based on the feedback of stage one, the next (second) stage of the project is expected to map potential improvement and apply those improvements to the tool.

This is then expected to be followed in the third stage by another round of testing and student feedback, in order to test if the improvements have the anticipated impact.

Results

Theme 1: How students currently receive/perceive feedback from Marking Mate

First and second year students at XJTLU generally use *Marking Mate* as a tool to find errors in written work to be submitted for assessment, fulfilling a function within an EAP context by looking for commonly assessed items such as: informality, excessive repetition, lack of hedging, unsophisticated sentence structure, and too-brief paragraphs. At a basic level, students expressed satisfaction with *Marking Mate*; however, some responded to the 'emoticons' system it uses to indicate the level of students' work. Some students expressed confusion about the meaning of the faces, while they also asked for a percentile score based on particular areas of focus within *Marking Mate*. To get more specific information, users need to rollover the highlighted and comment sections for definitions and examples, which are all presented in a small font. In addition, students repeatedly complained of the lack of variety in feedback provided.

Theme 2: Informal versus formal language

Perhaps the most commonly expressed desire by students was for more guidance on substituting formal, academic language for terms flagged by the software as informal. Regularly updated word banks, examples uses of specific terms, and a range of synonyms and examples of usage were some further desires expressed by students. As one focus group participant commented, "[I]f the website provides you with some synonyms maybe you could [write more formally], but we don't know which one is better in this situation".

Theme 3: Usability

A repeated theme was the difficulty of finding information on *Marking Mate* about what students' individual issues actually were and how to fix them. Related to this is the fact that many of the tools and instructions are hard to locate, and therefore often go unused by students. The grammar, spelling, punctuation, formal language and length measures are clear, and this is what students use.

Theme 4: Repeated words and discipline and subject-specific vocabulary

Marking Mate will flag words used frequently; however, students expressed frustration at receiving lower scores from the program when they repeat necessary content words. For example, an essay on the topic of 'bad credit' will feature the word 'bad', which would normally be highlighted by *Marking Mate* for replacement with a more 'academic' term. Students also repeatedly expressed frustration with *Marking Mate's* apparent ignorance of specialized discipline-based vocabulary, as well as a lack of recognition of names, particularly of academic authors. On a similar note, students expressed a need for different structures for different types of academic writing and genres; for example, an essay for an English student has a different form than a report for a chemistry student.

Theme 5: No references

Marking Mate does not check reference lists, which was of great concern to students given the centrality of citation and reference to academic writing, even if it does point out that in-text citations need coordinated references.

Theme 6: Just a checking tool

Some students indicated they used *Marking Mate* simply to check their work, not to learn how to fix mistakes when writing: "It can be just used for academic essays…That's for checking, last checking."

Discussion

Theme 1: How students currently receive/perceive feedback from *Marking Mate*

The more specific or advanced the context, the less well *Marking Mate* functioned. For example, students writing scientific lab reports were encouraged by lecturers to use short, clear sentences, which *Marking Mate* flags as insufficiently academic. If *Marking Mate* were to offer percentile markings, it would certainly cause friction if the resulting score differed from scores given by teachers and tutors.

Theme 2: Informal versus formal language

Students expressed frustration at not knowing which terms and phrases were actually suitable substitutions for informal language. They asked for a relevant dictionary to be linked to the site. Many students said that they begin the process of choosing different synonyms by going to *Youdao's* Chinese-to-English dictionary, even though they know it is inaccurate for the purposes of academic writing. They then go to other sources and programs such as *dictionary.com* or use the software available through *MS Word*, which they reported as being very time-consuming, or, as one focus group participant put it, "I think it's not convenient."

Theme 3: Usability

Student experience and learning could be maximized if they understood all the other features of the site, especially the links to help for specific areas of writing. Clearer instructions about the site and where students need to make decisions is necessary, specifically, it should be made clear to students exactly what an automated writing evaluation tool will and will not do. There are currently clear delineations on the site; however, these are given in a pop-up with a grey background, which are ignored by almost everyone who uses the site. An easier approach, such as a short video explaining and demonstrating the appropriate use would help to manage student expectations and to make their use of the site more effective. In addition, a better effort to explain the utility of the site should be coordinated by XJTLU's Language Centre. The low response rate by LC tutors to the survey request is cause for some concern in this respect.

Theme 4: Repeated words and discipline and subject-specific vocabulary

Students said they just ignored *Marking Mate* when it flagged a necessary word as repeated; however, they also expressed a disquiet about the apparent lack of accuracy in the tool. Students need to be made aware that issues such as repetition of key words and subject-specific vocabulary can be accounted for by customizing the settings of *Marking Mate* or by using their own judgment in appraising AWE-generated comments on their work. In addition, students pointed out that new expressions, like *netizen,* are not recognized as correct.

Theme 5: No references

Given the variety of referencing systems and requirements of different disciplines and lecturers, a versatile, accurate check of references is beyond the purview of *Marking Mate*. As citation and referencing are necessary components of academic writing, general guidance on referencing as well as links to different referencing formats and e-tools would be easy to provide, including exercises about constructing references in specific formats. As a basis, a clearer (multi-modal) statement of the limitations of any AWE should be provided.

Theme 6: Just a Checking Tool

Some students expressed a desire to be able to do more with *Marking Mate* so that they could self-study. Ideas included linking to a series of multi-level grammar exercises so that students could actually learn how not to make the errors *Marking Mate* flags, as well as providing models of essays at different levels and in different genres. Several students expressed their belief in the superiority of *Grammarly*, as it allows writers to edit their work while using it, which *Marking Mate* does not, and it also offers more detailed information in a visual parallel to a writer's essay, whereas *Marking Mate* requires rollovers with the mouse. Moreover, students expressed disappointment that feedback from the program can only be used on the site, not linked to a social networking system or email, nor does it automatically allow users to search for information about flagged issues. Many students also commented that while they were in the midst of composing, they would have liked examples for genre structures and styles made available. Linking the site with a lexical dictionary or language corpus would be able to directly give examples of words in use, providing context for students choosing appropriate academic language to assist with self-study in this specific area.

Finally, linking *Marking Mate* to a multi-level bank of exercises where students could find activities useful for learning grammar, which would leverage the potential of the tool as a 'just in time' self-study aid, provided students understand how to use it; this would make it a tool for learning rather than mere checking.

Conclusion

In a Chinese higher education context, and especially in the context of a transnational university such as XJTLU, where the focus is on increasing active learning approaches, rather than more teacher-centred exam-focused approaches, a self-directed online tool such as *Marking Mate* offers a lot of potential, which may be actualised if the tool can be clearly positioned as a learning tool, rather than a checking tool. The initial student feedback as reported in this paper will be used to inform that process, as another small step in a rapidly changing Chinese higher education environment.

References

Carless, D., Salter, D., Yang, M., & Lam, J. (2011). Developing sustainable feedback practices. *Studies in Higher Education*, *36*(4), 395-407.

Czaplewski, A. (2009). Computer-assisted grading rubrics: Automating the process of providing comments and student feedback. *Marketing Education Review*, 19(1), 29-36.

Eland, J., & King, S. (2015). You've internationalised me, now support me: building and supporting a global academic community – who, how, what, when and why. *Educational Developments*, *16*(3), 6-9.

Grammarly (n.d.). Retrieved 2 August 2016 from https://www.grammarly.com/

Grimes, D. & Warschauer, M. (2010). Utility in a fallible tool: A multi-site case study of automated writing evaluation. *Journal of Technology, Learning, and Assessment*, *8*(6), Retrieved 5 August 2016 from www.jtla.org.
Jin, L. & Cortazzi, M. (2011). Introduction: Contexts for researching Chinese learners. In L. Jin & M. Cortazzi (Eds.). *Researching Chinese learners: Skills, perceptions and intercultural adaptations* (pp. 1-18). Houndmills: Palgrave Macmillan.
Jordan, E. & Snyder, A. (2012). Marking Mate - A free web-based academic writing feedback tool for East Asian learners of English. *Beyond CALL: Integration, normalisation, or separation?* Konan University, Kobe, June 2012.
Jordan, E. (2012). Automated writing feedback for Chinese learners of English with 'Marking Mate'. *Centre for Research in Applied Linguistics (CRAL) public lecture*. University of Nottingham Ningbo, Ningbo, November 2012.
Li, J., Link, S., & Hegelheimer, V. (2015). Rethinking the role of automated writing evaluation (AWE) feedback in ESL writing instruction. *Journal of Second Language Writing*, *27*, 1-18.
Li, X. & Cutting, J. (2011). Rote learning in Chinese culture: Reflecting active Confucian-based memory strategies. In L. Jin & M. Cortazzi (Eds.). *Researching Chinese learners: Skills, perceptions and intercultural adaptations* (pp. 21-42). Houndmills: Palgrave Macmillan.
Marking Mate: standard version (n.d.). Retrieved 2 August 2016 from http://writingtools.xjtlu.edu.cn:8080/mm/markingmate.html
Matthews, K., Janicki, T., He, L., & Patterson, L. (2012). Implementation of an automated grading system with an adaptive learning component to affect student feedback and response time. *Journal of Information Systems Education*, *23*(1), 71-83.
Wang, L. & Byram, M. (2011). 'But when you are doing your exams it is the same as in China' – Chinese students adjusting to western approaches to teaching and learning. *Cambridge Journal of Education*, *41*(4), 407-424.
Wang, Y., Shang, H., & Briody, P. (2013). Exploring the impact of using automated writing evaluation in English as a foreign language university students' writing. *Computer Assisted Language Learning*, *26*(3), 234-257.
Ware, P. & Warschauer, M. (2006). Electronic feedback and second language writing. In K. Hyland & F. Hyland (Eds.). Feedback in second language writing: Contexts and issues (pp. 105-122). New York: Cambridge University Press.
Writer's Work Bench (n.d.). Retrieved 2 August 2016 from http://www.emo.com/
Yu, L. & Suen, H. (2005). Historical and contemporary exam-driven education fever in China. *KEDI Journal of Educational Policy*, *2*(1), 17-33.
Zhou, Y., Xu, S., & Bayley, J. (2011). Intercultural competence and EFL teaching in China. In L. Jin & M. Cortazzi (Eds.). *Researching Chinese learners: Skills, perceptions and intercultural adaptations* (pp. 138-166). Houndmills: Palgrave Macmillan.

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Contextualizing institutional strategies for technology enhanced learning

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An analysis of strategic planning documents for public universities in Australia identifies some patterns in institutional strategies for technology-enhanced learning (TEL). Institutional size, location and social mission are among some of the characteristics that shape TEL support. This study was part of a project to develop guidance on how institutions could contextualize use of the ACODE TEL benchmarking process. Text from publicly available documents was analysed to identify contextual characteristics that appear to be influencing institutional strategies and priorities for TEL. International studies identify a need for rethinking how institutions work. This study provides a snapshot of these rethinking processes in 2016, and some preliminary suggestions on how benchmarking might support these.

Keywords: institutional strategic context; technology enhanced learning; text analysis.

Background and context

There is international recognition of the need for the Higher Education sector to rethink how learning and teaching is done in 21st century technology-rich environments. This includes not only learning designs, assessments and learning spaces, but also 'rethinking how institutions work' (Adams Becker, Cummins, Davis, & Yuhnke, 2016; Johnson et al., 2016).

The starting point for any institution's strategic plan is the context and mission, which will shape priorities for technology-enhanced learning (TEL). So how will the interpretation of institutional performance criteria related to TEL support vary? A large city-centre research-intensive institution with mainly full-time students might be expected to have different priorities from a smaller regional university with large numbers of part-time distance students. For example, an article on the Chronicle of Higher Education website noted of US universities that:

> "… it appears as if online education for undergraduates at 'elite' colleges will mostly be dictated by individual professors introducing digital teaching techniques, such as video lectures and online quizzes, at their discretion."(Kolowich, 2015)

One implication from this quote could be that in an elite institution, TEL support may focus on services for individual voluntary adopters, and on technologies such as MOOCs for showcasing teaching beyond the campus. On the other hand, an institution that is seeking to enhance retention and progression for a large and diverse student cohort is more likely to invest in systemic institution-wide facilities for all their current students. Forward-looking studies such as Adams Becker et al. (2016) identify projects where technologies can transform the learning experience; introducing authentic assessment supported by redesigned learning spaces and interactive digital environments. Yet a survey of students in two Australian universities (Henderson, Selwyn, & Aston, 2015) found that digital technologies are "clearly not transforming the nature of university teaching and learning, or even substantially disrupting the 'student experience'".

The ACODE (Australasian Council for Open, Distance & E-learning) benchmarks, revised and updated in 2014, provide a framework for institutions to self-assess their support for TEL (ACODE, 2014). The first of the eight benchmarks provides performance indicators and guidance on standards for institution-wide policy and governance for TEL. The others deal with specific aspects of how the policy is enacted – such as planning, quality improvement processes, application in the curriculum, support for staff and support for students.

Methodology and methods

All publicly funded universities in Australia and New Zealand make their strategic plans and annual reports available on their websites. So it is possible to examine these to find out how universities have been articulating their thinking about the role of TEL in achieving their goals. There is also public information about objective characteristics of each university – student profiles, staff, locations, study modes offered, disciplines, etc.

As part of a project to provide evidence-based guidance on how to contextualize the ACODE benchmarking for different types of institution, the texts from 32 Australian public universities' 2015 annual reports were analysed. The aim was to identify what factors in higher education institutions' strategic contexts are most relevant and influential in their priorities for TEL, and to relate these to the benchmarking process and its value for the institution. Neuendorf (2002) characterizes this method as establishing links between the source of a message and its content. The aim in this case is to identify where patterns in the strategic 'messages' related to TEL are associated with institutional characteristics. The document analysis is a text mining exercise. Broadly, the methodology follows the 6-step cyclic CRISP-DM process (Cross-Industry Standard Process for Data Mining) outlined by Miner et al. (2012, Chapter 5). This paper covers steps 1-5 as shown in Figure 1.

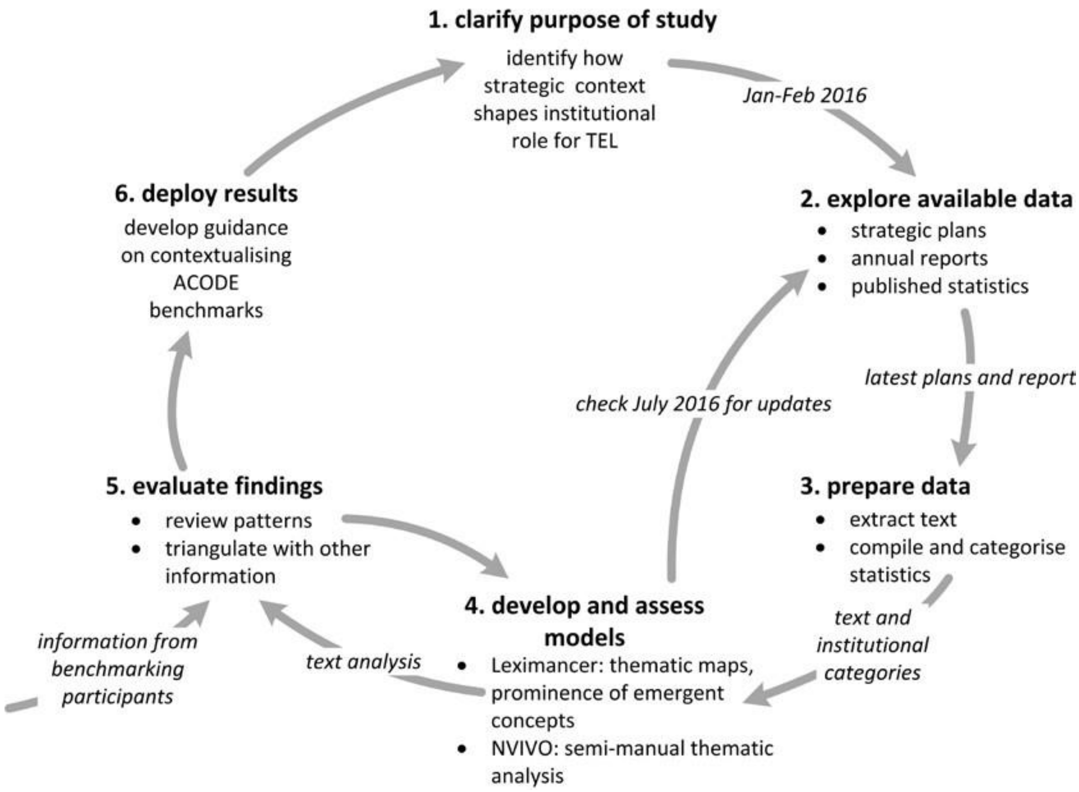


Figure 1: The CRISP-DM cyclic process as used in this study

Data preparation involved:

1. listing all the institutions and compiling a spreadsheet of potential characteristics that might be used to identify groups with common features
2. downloading the latest available institutional strategic plan and annual report for each institution, and extracting the text describing strategic plans and actions
3. creating groups of these documents corresponding to the characteristics in the spreadsheet (such as small, medium and large in terms of student numbers in Equivalent Full Time Student Load or EFTSL; regional or city-based; membership of formal university groupings; substantial distance education activities).

The main development of the models used Leximancer software, which searches the texts for words that occur frequently together, as the basis of concepts. After several iterations, it is possible to identify vocabulary related to TEL concepts and to build a thesaurus. The same thesaurus can be used to compare how concepts and themes occurred in different groups of documents. By assembling the texts into groups representing different institutional categories, the TEL-related language patterns can be compared. The automated thematic analysis using Leximancer relies on algorithms to cluster concepts around themes (Leximancer, 2011). Trial and error adjustments to the settings may be needed to suit the text format. For example the length of text blocks analysed could be too short (separating related words) or too long (linking unconnected words).

A first iteration (carried out in January-February 2016) used all the Australian universities' strategic planning documents as a single group; examining and editing the automatically generated thesaurus to focus on TELrelated concepts. The thematic maps would then show how these TEL concepts are linked into other concepts emerging in the texts, as part of broader themes. At that point the latest annual reports available were for 2014, and the current strategic plans had various dates, some being several years old.

By July 2016 all the annual reports for 2015 were available. These would have been compiled in the same period (early 2016) that the ACODE benchmarking self-assessment was taking place, so they provide a consistent and timely overview of institutional strategies and priorities. The results presented here are from analysis of the 32 Australian public university annual reports for 2015 that were available in a format suitable for processing through the text analysis software. (A few were only available as locked pdf files.) Before analysis, all financial and most of the other quantitative sections were removed, leaving only the statements of strategic intent and qualitative accounts of institutional activities and performance.

For the analysis, the text files were grouped in various different ways, to find out which institutional characteristics seemed to be most influential for TEL strategies. The groupings were based on data from the Department of Education & Training online database ("Ucube," 2016).

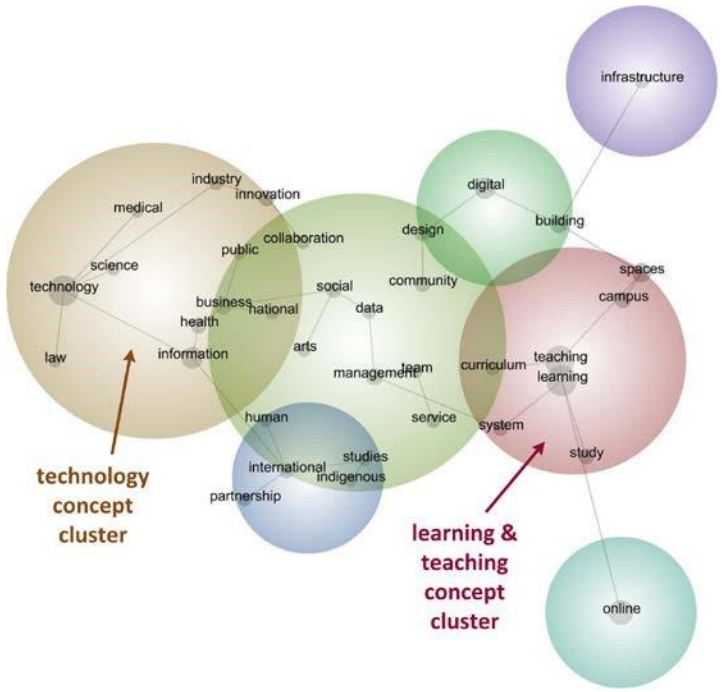
> **Distance education**: 13 universities with over 5000 distance enrolments and 19 with fewer than 5000 distance enrolments.
>
> **Size**: small (10 universities with < 10k EFTSL); medium (12 universities with 10-17k EFTSL); large (10 universities with > 17k EFTSL)
>
> **Location**: 18 universities in major city locations (where there are other universities) and 14 regional. **Affiliation to a formal Australian university grouping:** Australian Technology Network (ATN);
>
> Group of Eight (Go8); Innovative Research Universities (IRU); Regional Universities Network (RUN); or unaffiliated.

After mapping the emergent TEL-related concepts and themes across the whole dataset, further runs explored the various university characteristics. Leximancer can produce a dashboard report that compares the prominence of concepts between different categories. It can also generate examples for the most prominent concept links. The complete analysis shown in Figure 1 is still work in progress at the time of writing. However, it is possible to present a preliminary evaluation using information from the ACODE 2016 benchmarking.

Results

Text analysis

Leximancer has several ways of representing patterns in the texts. It creates maps of how the concepts are related, grouping them into themes. It also analyses the strength (connectedness) and frequency of concepts and in relation to document groups. Figure 2 shows the overall Leximancer thematic map for the 32 Annual Reports.



The map shows more frequent concepts as larger nodes and represents stronger linking between concepts by closer positioning.

The most dominant theme (in red) is a cluster of concepts around learning and teaching.

Technology (in brown) is the next most dominant theme and is associated with specific disciplines.

This is a qualitative visual representation that can emerge in different forms with each run. The 'prominence' scores in a dashboard report provide a more systematic and stable analysis.

Figure 2. A Leximancer map of text in Australian university annual reports for 2015.

In Leximancer, the prominence scores for a concept combine its frequency and its connectedness with other concepts. Table 1 lists the most prominent concepts for each of the university groupings, both for all mapped concepts and only those concepts related to learning and teaching (LT).

Table 1. Ranked concepts by category

Institutional characteristic	concept 1	concept 2	LT concept 1	LT concept 2
>5k distance students	online	study	community	campus
<5k distance students	health	digital	digital	management
Small	study	information	study	community
Medium	business	information	collaboration	digital
Large	building	campus	building	campus
City	building	mechanical	design	building
regional	study	business	service	community
ATN member	technology	industry	design	building
Go8 member	building	campus	building	campus
IRU member	teaching	learning	teaching	learning
RUN member	online	study	online	study
unaffiliated	campus	community	service	campus

The annual reports from distance providers and members of the Regional Universities Network (RUN) had 'online' and 'study' as their most prominent (i.e. frequent and strongly connected) concepts. References to 'community' and 'campus' are generally associated with online study too. Text examples:

> "Distance education provides students with the flexibility to undertake a university qualification without needing to visit a campus and the program content can be studied through a number of means including the use of online discussion forums, electronic library resources, by contacting lecturers, and receiving all study materials online."

> "… has capitalised on the opportunities of digital change to deliver premium courses wherever students are geographically (at home, on campus, in the workplace or in the community) …."

The institutions with fewer distance students refer most often to health-related discipline activity, and many of the references to 'digital' are in relation to 'digital manufacturing' or 'digital creative businesses'. Larger universities and Go8 members appear to focus most on 'campus' and 'building' concepts – mostly references to campus infrastructure projects, with online study references often citing MOOCs. Text examples:

> "…entailing a mix of office and open-plan accommodation, 3rd Year Teaching Laboratories, flatfloor teaching laboratories in highly transparent spaces, … and infrastructure services upgrades."

> "In late 2014, [the university's] Massive Open Online Courses (MOOCs) provider … and [a local] School began a collaboration to develop a MOOC to inspire students entering secondary school to study Science, Technology, Engineering and Maths (STEM) subjects. "

Overall the analysis of the annual reports does show some identifiable patterns of variation in strategic priorities that relate to the external context of the institution. From this analysis, the institution's size, distance education activity, location and identification with a particular grouping/institutional role all appear to be associated with differences in priorities for TEL as reflected in the annual reports for 2015.

Benchmarking activity

The benchmarks chosen by 15 Australian universities participating in the 2016 ACODE benchmarking exercise may provide a preliminary evaluation of the relevance of these findings. Table 2 shows the numbers choosing each aspect of institutional TEL support to benchmark, broken down by institutional characteristics.

While these numbers are too low to claim any statistical significance, it does appear that regional and distance education institutions in 2016 are checking out their central IT service support for TEL more than other groups. This is consistent with the larger-scale online learning activity in these groups. The most used benchmarks overall are related to staff support.

Table 2. numbers of institutions benchmarking each aspect of TEL support, by type of institution

Institution characteristic [number in group]	Strategy, planning, QA	IT services	use in curriculum	staff support	student support
>5000 distance students [5]	2	4	3	3	2
<5000 distance students [10]	5	3	3	6	4
Small [5]	3	3	1	3	3
Medium [8]	4	3	4	5	1
Large [2]	0	1	1	1	2
City [8]	3	1	2	5	3
Regional [7]	4	6	4	4	3
ATN member [2]	0	0	0	2	1
IRU member [1]	1	1	1	0	0
RUN member [4]	2	3	2	4	1
Unaffiliated [8]	4	3	3	3	4

Discussion and conclusions

The analysis of Australian university annual report texts shows some patterns in how TEL is represented. These patterns can be related to the universities' external contexts, represented by location, size and distance learning activity. From the 2016 ACODE benchmarking activity, the same factors also appear have influenced participants' choice of benchmarks. The broader project to develop practical guidance for ACODE benchmarks included visits to 13 different institutions in Australia and New Zealand, of which ten were in the midst of selecting benchmarks and planning how to compile evidence of performance. A separate publication will provide a more complete account including other data, such as the New Zealand university annual reports.

At this stage, discussions with 2016 benchmarking participants indicate that they are influenced not only by external strategies but also by internal change. Institutions usually selected benchmarks where they had relatively stable arrangements in place. The annual reports and the benchmarking self-assessment are both snapshots at one point in time. The snapshots may not be fast enough to capture the moving parts in a complex university system. Nevertheless, the benchmarks are a tool for institutions to assess how well they are adapting to TEL. This study shows how the benchmarks can be linked with institutional priorities – adding weight to arguments for acting on the resulting recommendations within each institution.

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References

ACODE. (2014). *Benchmarks for Technology Enhanced Learning*. Retrieved from Canberra: http://www.acode.edu.au/course/view.php?id=5#Project5

Adams Becker, S., Cummins, M., Davis, A., & Yuhnke, B. (2016). *2016 NMC Technology Outlook for Australian Tertiary Education: A Horizon Project Regional Report.* Retrieved from Austin, Texas: http://www.nmc.org/publication/2016-nmc-technology-outlook-australian-tertiary-education/

Henderson, M., Selwyn, N., & Aston, R. (2015). What works and why? Student perceptions of 'useful' digital technology in university teaching and learning. *Studies in Higher Education*, 1-13.

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Hall, C. (2016). *NMC Horizon Report: 2016, Higher Education Edition* Retrieved from Austin, Texas: http://cdn.nmc.org/media/2016-nmc-horizon-report-he-EN.pdf

Kolowich, S. (2015, 10 April 2015). How 'elite' universities are using online education. *The Chronicle of Higher Education.* Retrieved from http://chronicle.com/article/How-Elite-Universities/229233/

Leximancer. (2011). *Leximancer Manual version 4.0*. Retrieved from http://doc.leximancer.com/doc/LeximancerManual.pdf

Miner, G., Delen, D., Elder, J., Fast, A., Hill, T., & Nisbet, R. A. (2012). Applications and Use Cases for Text Mining *Practical Text Mining and Statistical Analysis for Non-structured Text Data Applications*. Waltham MA, USA and Oxford, UK: Academic Press.

Neuendorf, K. A. (2002). Beyond description: an integrative model of content analysis *The content analysis guidebook* (pp. 47-70). Thousand Oaks, CA: Sage.

Ucube. (2016). Retrieved 1 August 2016, from Department of Education and Training http://highereducationstatistics.education.gov.au/

Please cite as: Russel, C. (2016). Contextualizing institutional strategies for technology enhanced learning. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 534-539).

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Failing forward in research around technology enhanced learning

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There are lessons to be learned from undertaking ‘successful’ research, but we do not hear much about the lessons learned when your research doesn’t come-off. But in many cases there are some very important lessons that can be learned that others may benefit from, particularly for those who are new to research around the scholarship of teaching and learning (SoTL), as opposed to discipline based research that is ‘reputedly’ conducted from a more empirical perspective. This paper reports on some of the lessons learned by two researchers from two universities on research that could have been done better in relation to technology enhanced learning (TEL). Why do we need to hear about these lessons? For the sake of our students; we want to improve our teaching and don’t want to make the same mistakes that others may have done.

Keywords: Technology enhanced learning, SkillBox, Scholarship of teaching and learning.

Introduction

To begin with a popularist quote, Bill Gates, the founder of Microsoft, once said "It's fine to celebrate success, but it is more important to heed the lessons of failure." (cited in Brown, 2014). This is as true in educational research as it is in business and science. It’s great to celebrate the research that has worked, that has provided a clear way forward for those investigating certain phenomena, but equally, it can be just as helpful to learn how not to do things, or to learn that a particular intervention does not work. Why? So we don’t all run in and make the same mistakes. Lucy Goodchild (2014) puts it like this:

> The academic community has developed a culture that overwhelmingly supports statistically significant, “positive” results. Researchers themselves strive for these results and rush to publish them, leaving the “failed” attempts in the dust. (P. 3)

This is not particularly surprising, but it can skew the way research is perceived by others. As researchers we have a responsibility to report how things don’t work as well as how they do.

> The challenge is more than emotional; it’s cognitive, too. Even without meaning to, we all favor evidence that supports our existing beliefs rather than alternative explanations. We also tend to downplay our responsibility and place undue blame on external or situational factors when we fail, only to do the reverse when assessing the failures of others—a psychological trap known as fundamental attribution error. (Edmondson, 2011)

This paper will share two such instances where the research did not go as expected, but where definite lessons were learnt from these ‘failures’. The first case is from some research being conducted at Charles Sturt University (CSU) to assess the success and efficacy of a curated set of multimedia tools (SkillBox) to scaffold particular student skills. The SkillBox instrument itself appears to be successful, but the research around it did not produce the anticipated results. The second case comes from University of Southern Queensland (USQ) where an experiment working with a group of students using two multimodal learning environments did not reap the results that were hypothesized due to some real methodological issues.

The two universities in this paper have many similarities. Both are strong online and distance education providers with a clear focus on learning and teaching. In fact, the two institutions have a higher number of off-campus students than any other Australian University; CSU with 22967, 60.8% of the student body, and USQ with 17284, 72% of the student body (Australian University Rankings 2016). Inevitably this had led both institutions to have a very strong focus on L&T research due to ensuring their off-campus students are receiving an equivalent or, as some have found, better learning experience than other more traditional modes of delivery can provide (Lundberg, Castillo, Dahmani, 2008; Ya Ni, 2013). Similar also in these two universities, we see that although there is significant quantities of research (and scholarship) conducted in relation to teaching and learning (also known as SoTL), this research is perceivably not as highly regarded as some discipline based research, which inevitably increases the pressure of teaching academics to produce research outcomes without necessarily being provided enough time in their workloads to meet these demands. This was highlighted recently in a study conducted by Lanning et.al. (2014), where the authors concluded:

> Although the number of journal articles pertaining to SoTL is increasing and the concept is gaining momentum in higher education, both nationally and internationally, it may not be universally accepted or well understood and not valued equally with that of discipline-specific research. (p.1353)

However, as strong teaching institutions, research into learning and teaching needs to be valued as highly as discipline based research. For as we apply systematic approaches to asking questions about one's teaching, designing and using appropriate research methodologies, it is worth recognising that this provides the affordance necessary to elevate our good teaching to appropriate scholarship (Burcham & Shaw, 2010).

Two case studies

Researching SkillBox

In 2014, two academics at CSU identified a gap in provision of resources to students who might be lacking certain knowledge or skills assumed in their subjects. A tool called SkillBox was developed, a set of curated online adaptively scaffolded resources that guide students through a single knowledge area, allowing them to access the resources at their own pace and in their own time (Whitsed and Parker, 2015). Research around the SkillBox concept was encouraged through a CSU Distance Education innovation grant designed to support academic staff in a variety of areas related to online learning. While the SkillBox concept itself was and remains a useful contribution to innovative teaching and learning practices in the online space, it has become clear that the research component has not been as successful as it might have been, for reasons discussed below.

The research was designed to collect quantitative and qualitative data by surveying students before and after using SkillBox, to gauge their change in attitude, knowledge and confidence in the topic area, and to gather feedback on their experience of SkillBox. The first phase of research, in 2015, surveyed students who were provided with a Matrix SkillBox in two small (< 20 enrolments) online graduate subjects, with encouraging results (36% response rate). The second phase of research, in 2016, expanded to hundreds of students using three further SkillBoxes (R, descriptive statistics, and referencing) across eight subjects in two faculties. A number of issues have been discovered in this second phase, which led to very low response rates and in some ways threatened to sabotage the successful outcome of the research project.

The academics involved had no formal social research or SoTL training. Although ethics approval was gained, meaning the research plan was scrutinised to some extent by others, many good practices of social research were unintentionally not followed. For example, the survey was not piloted, some questions that should have been asked, were not, and questions were not necessarily phrased in the best way. This led to a redesign of surveys between research phases, which caused problems with inconsistent analysis.

Technology also proved a barrier. It was important to separate the research surveys from the SkillBox itself, allowing students to opt out of the research but still access the SkillBox itself. A combination of using a separate Blackboard Organisation site, quizzes to determine the students' eligibility to participate, adaptive release functionality and the surveys themselves, resulted in a disproportionate number of clicks needed to access the surveys and then continue with SkillBox. In addition, some students' unfamiliarity with Blackboard may have hindered progress. This resulted in very few students choosing to complete the final survey and contributed to the low overall response rate.

A number of elements could have been implemented to improve the success of this research. Firstly, while academics should be encouraged to undertake research in SoTL, more support is needed in the form of advice and collaboration in the research design and implementation. As with any project, planning and communication are key, and could have been better managed to ensure surveys were implemented at the best time to get maximum engagement. It is important to use technology in a way that encourages participation and provides a positive experience, and again advice and collaboration should be sought well before implementation deadlines. In this case study, SkillBox itself is a valuable innovation, but the research component has potentially made it less accessible to students, highlighting the need to be aware of when to stop researching (in this case, surveying students' knowledge and attitudes before and after intervention with SkillBox) and concentrate on development and championing of the innovation itself (simply providing the tool to students without requiring them participate in additional research surveys).

Researching students using multimodal learning environments

For the University of Southern Queensland multimodal learning is a big thing. It has to be, as most students don't come onto campus. Therefore, research into multimodal learning environments plays fairly high on the priorities of many academic staff. The pressure to perform research is also high, but not necessarily in relation to L&T, which can lead to some activities not being as well thought through, particularly when insufficient workload is allocated. A case in point is a project that was conducted to determine the impact (cause-and-effect relationship) of multiple representations of teaching content on learning outcomes across different learning styles (modal preferences). A quasi-experimental design was selected to allow for groups of students to be exposed to different configurations of study materials and presentation modes and then measurement of students' learning performance. Sixty participants were recruited, allowing for ten each to be placed in six different experimental groups. Participation was voluntary; although a small incentive was offered to encourage participation. Once students had expressed their intention to participate, they were asked to undertake a learning styles inventory. The aim was to include two participants from each of the five learning styles (visual, aural, read/write, kinaesthetic, multimodal) in each of the six groups. Once allocated, students attended the test venue where they undertook a pre-test of the concepts, before exposure to two of six study conditions containing different combinations of materials, ranging from just a Text and Study Guide through to using Text, Study Guide, printed PowerPoint, recorded PowerPoint with audio, and interactive diagrams with script and audio. After exposure to each (2) of the learning scenarios they then completed of post-test and finally completed an online survey about their experience.

At the end of the day this methodology proved to complicate the statistical analysis used in this study, due primarily to the limited number of participants (60) and the limitations of the quasi-experimental methodology. Although there was an improvement in the scores between the pre- and post-test (to be expected) the quantitative data for this study did not necessarily indicate that they performed better because of the presence of multiple representations. However, the qualitative data did indicate that students perceive that the learning resources containing additional representations helped them understand and retain content, and were more interesting and enjoyable to use.

In addition to the small sample size, it was seen that there was a predominance of: higher-achieving students; multimodal learners who typically learn across a range of conditions; and a lack of aural and visual learners in the sample. Given the literature indicates that multimodal learning may be of greater benefit to lower-achieving students, while higher achieving students perform well regardless of how it's presented, this may be one factor that explains the lack of impact of multiple representations of content on learning performance within this experiment.

If this was to be done again it would need to involve a much larger sample, a higher representation of lower-achieving students, and a more even representation across the different learning styles. Future research could also involve more complex concepts to allow for a stronger measure of improvements in learning across the pre- and post-tests. Moreover, the unnatural study conditions (for some) and difficulties in controlling for extraneous factors in a quasi-experimental design should be addressed. Ideally, future research would involve investigating learning performance under more natural study conditions to reduce possible testing effects. The difficulties experienced with the quasi-experimental methodology in this study may provide some explanation for the dearth of empirical data on the impact of multimodal presentation of teaching content on learning styles.

Discussion – lessons learned

Some common threads can be found in these two case studies. Firstly, the pressure – perceived or real – to be active in SoTL can lead to academics being underprepared and under-supported. Discipline-based academics often lack the theoretical grounding to conduct social research, or this particular type of social research. This can lead them to underestimate the preparation and planning required to complete the research successfully, or lead to experimental designs with insufficient participants. Time (workload), funding and support from SoTL specialists are crucial for academics to develop successful SoTL research programs.

Effective communication was another common theme. Communication between researchers, as well as clearly communicating expectations to participants, is critical, and these two case studies show that when all expectations are not clearly and thoroughly set out, it can be easy to miss collecting valuable data. Cultural barriers can also play in part in the quality of data collected, with the potential for some participants to misinterpret instructions or not fully understand what is expected.

Having realistic expectations, and working out what to do if the data collected does not meet expectations, is another issue identified in both studies. It is important to identify and be honest about limitations in the research. When response rates are low, it can be tempting to make claims that cannot really be substantiated, or to stretch the data past what it shows in reality. Perhaps some of these issues stem from unfamiliarity with social science research, particularly for academics not trained in this discipline.

Troubleshooting and identifying barriers to participation is another important skill to have in this kind of research. In the SkillBox study, technology proved to be a barrier to participation, which could have been overcome with more assistance at the design stages. In addition, it is possible that students are over-surveyed (The Guardian, 2016), making them disinclined to participate in yet another research survey.

Many of the issues identified stem from the fact that social science educational research does not seem to get the same level of support or kudos as discipline-based research - it often does not "evoke the same respect or carry the same weight as traditional scholarship" (Schroeder, 2007). Universities are arguably trying to change this culture, for example making it easier to apply for promotion based on SoTL and teaching excellence. However, there are still some critical questions that need addressing around professional development, support, awards and promotion based on innovations in SoTL (Devlin and McKay, 2016), particularly since there is a particular genre of discourse that many discipline academics are not particularly familiar with (Miller-Young & Yeo, 2015).

Conclusion

The lessons learned from these two research projects, as seen in the discussion section above, although providing some key lessons of things to avoid while conducting research, also point to the need for institutions to take more seriously their commitment towards the scholarship of learning and teaching. This is particularly important for those institutions who would pride themselves on being good teaching institutions. However, as we have seen, most scholars are trained in research methods associated with their discipline, and there is little training available for these academics if they want to further investigate their teaching of that discipline, that is, undertaking the informed scholarship of their L&T.

Until that is the case what are we left with? We are left with a lot of academics demonstrating an extraordinary amount of good-will because they want to make their teaching practice hit the mark. This will invariably mean some projects will not go as well as others, but that's OK, if that's the best we can do for the time being. The important thing is that we need to learn from each other, from the professional communities of practice that exist around the use of technology enhanced learning, not just sharing the wins, but also sharing some of the losses. That's because:

> "Determining what went wrong in a situation has value. But taking that analysis another step and figuring out how to use it to your benefit is the real difference maker when it comes to failing forward. Don't let your learning lead to knowledge; let your learning lead to action." (Maxwell, 2000)

The action in this case is better outcomes for our students. So by taking the time to step back and reflect on these two research projects it has allowed these two researchers to critically analyse some of the steps they need to take in the future to ensure better outcomes, but more importantly it has alerted the community of scholars to things to look out for as they pursue the scholarship of learning and teaching.

References

Australian University Rankings (2016) Australian Education Network. Available online from: http://www.universityrankings.com.au/distance-education-numbers.html

Burcham, J.G., & Shaw, K.A. (2010). Publish or Perish: Can Scholarship and Teaching Coexist? *Perspectives in Learning: A Journal of the College of Education & Health Professions*, 11*(1),* 47-52. Spring.

Brown, J. (2014). 27 Inspirational Bill Gates Quotes. Accessed online from http://addicted2success.com/quotes/27-inspirational-bill-gates-quotes/ 20 July 2016

Devlin, M. and McKay, J. (2016) Teaching students using technology: Facilitating success for students from low socioeconomic status backgrounds in Australian universities. *Australian Journal of Educational Technologies*, 32*(1)*, 92-106.

Edmondson, A. C. (2011). Strategies for Learning from Failure. Harvard Business Review: Leadership. Accessed online from: https://hbr.org/2011/04/strategies-for-learning-from-failure April.

Goodchild, L. (2015). Why it's time to publish research "failures". *Elsevier Connect: Science Communication,* Elsevier Publishing. Accessed online from: https://www.elsevier.com/connect/scientists-we-want-your-negative-results-too 5 May.

Lanning, S.K., McGregor, M., Crain, G., Van Ness, C.J., Keselyak, N.T., & Killip, J.W. 2014. The Status of the Scholarship of Teaching and Learning in Dental Education. *Journal of Dental Education*, 78*(10)*, 1353-1363.

Lundberg, J., Castillo, D., Dahmani, M. (2008). Do Online Students Perform Better than Face-to-face Students? Reflections and a Short Review of some Empirical Findings. *The Economics of E-learning*, 5*(1)*, 35-44. ISSN: 1698-580X

Maxwell, J. (2000). *Failing Forward: Turning mistakes into stepping stones for success.* Thomas Nelson Publishers. Nashville.

Miller-Young, J., & Yeo, M. (2015). Conceptualizing and Communicating SoTL: A Framework for the Field. *Teaching & Learning Inquiry*, 3*(2)*, 37–53.

Schroeder, C. M. (2007). Countering SoTL marginalization: A model for integrating SoTL with institutional initiatives. *International Journal for the Scholarship of Teaching and Learning*, 1*(1)*, 1-9.

The Guardian (2016) Student surveys are a waste of everyone's time. Academics Anonymous, Higher Education Network, The Guardian (Australian Edition). Accessed online from: https://www.theguardian.com/higher-education-network/2016/jul/01/student-surveys-are-a-waste-of-everyones-time 5 August 2016

Whitsed, R. & Parker, J. (2015) SkillBox - a pilot study. In T. Reiners, B.R. von Konsky, D. Gibson, V. Chang, L. Irving & K. Clarke (Eds.) Globally connected, digitally enabled. Proceedings ascilite 2015 in Perth, pp. CP:252-CP:256.

Ya Ni, A. (2013) Comparing the Effectiveness of Classroom and Online Learning: Teaching Research Methods. *Journal of Public Affairs Education*,19*(2)*, 199-215.

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Visualising Individual Profiles and Grouping Conditions in Collaborative Learning Activities

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Collaborative learning has been shown to be conducive to better and deeper learning for particular tasks, but is dependent on a number of factors, including how students are grouped together. We are interested in finding out whether data captured from students working individually and/or collaboratively can reveal useful information about the impact of the grouping conditions on learning. We explore whether these findings can be detected early on (possibly, before students start working in groups). If such information can be reliably captured, then it could be used to drive group formation dynamically and at a large scale. This paper presents our initial visual exploration with two case studies: one from a first-year programming course (N = 372) where students alternately worked individually and in pairs; and another (N = 60) from a concept-mapping environment where students first worked individually and then in groups.

Keywords: Collaborative Learning, Group Formation, Visualisation, Clustering

Introduction

Collaborative learning activities require a strategy to determine how groups are formed. In very small classes, teachers generally know their students well and can use their pedagogical knowledge to assign students to groups in a way that is expected to maximise their learning benefits. However, such a strategy is not scalable to larger cohorts as the complexity of the task increases exponentially with the number of students (Sinha, 2014). As a result, teachers often rely on other techniques, such as self-arrangement (students decide who they work with and what roles they enact) or random assignment (e.g. using a systematic process such as alphabetical order to achieve random group allocation) (Cohen, Goodlad, Darling-Hammond, & Lotan, 2014). However, none of these methods directly attempt to maximise the learning benefits for the students. Some group formation algorithms have been proposed to facilitate group allocation. These algorithms automatically assign students to groups based on specific criteria selected by the teacher (Craig, Horton, & Pitt, 2010; Demetriadis & Karakostas, 2008; Konert, Burlak, & Steinmetz, 2014). However, the teacher may not always be aware of which are the most relevant criteria for the given task. If teachers were able to deepen their understanding of how certain aspects of students' activities have an impact on collaborative work, they would be able to better select the student's activity features that are most relevant for the desired collaborative task. Examples of features include past performance on individual assessments, demographic data, or previous group work strategies. Educational technologies are commonly present in teaching environments, especially as student cohort sizes increase. These tools, when supporting students in their learning tasks, capture unprecedented amounts of data about the students' learning behaviour and progression, sometimes at very finegrained levels (Verbert et al., 2014). Research communities, such as Learning Analytics and Knowledge (LAK) and Educational Data Mining (EDM), use these data as an opportunity to improve education by understanding its processes; plan and select interventions; and improve assessments (Siemens & d Baker, 2012). It is possible that these data can also reveal useful information about what makes students work better in groups.

In this paper, we explore two questions. First, can data captured from students' previous individual or group work reveal useful information about whether and how grouping conditions affect learning? Second, can this information be made easily accessible to teachers, using visualisations? We present a data-driven approach for understanding how the student's individual profile, inside a group, is related to group collaboration and performance. By datadriven, we mean relying on data to formulate our assumptions, instead of theory-driven, where a hypothesis is based on theories and data is used to validate them (Choi et al., 2016). We explore this by clustering the students, using different individual information, and plotting it against several measures of group performance. Our aim is to help teachers understand the individual profiles in the collaborative task, which will assist them in planning collaborative activities in future iterations. We illustrate our approach with two very different datasets: one collected in a classroom of 1st-year programming students working both individually and in pairs over a semester through an online programming tool (N=372), and another from a cohort who worked with concept maps, first individually and then face-to-face around an interactive tabletop (N = 60).

Background

Learning is commonly a social process and thus collaborative learning research focuses on unveiling the complex social mechanisms that are associated with learning. There are several important aspects to come to play in collaborative learning: the notion of what a group is, what learning means, and what collaboration is (Dillenbourg, 1999). The notion of group is already quite complex. Researchers investigating collaborative learning and psychological researchers studying groups have been trying to understand how groups behave for almost 60 years (Beal, Cohen, Burke, & McLendon, 2003). Some important dimensions that can strongly shape the collaborative learning process include the size of the group (e.g. 2, 10, 40 students or a community of learners); the length of time the group works together (e.g. 30 minutes, one day, the whole semester, life-long learning); the task involved (e.g. solve a puzzle, write a proposal, code a system, build a robot); and the subject matter (e.g. Science, Technology, Engineering, Maths (STEM), Humanities, Health and so on). Researchers all agree that there is no ultimate solution fitting all the different group configurations as the final outcome and the collaborative processes depends on the different combinations of all the possible dimensions of the collaborative activity (Stahl, 2006).

One important question in collaborative learning research is knowing which students are going to work together more effectively– in other words, how to arrange the groups in a classroom in order to maximise their opportunities for learning. Some research has addressed the problem of group formation in learning contexts by satisfying constraints defined by the teacher. In these scenarios, it is assumed that the teacher knows which selection criteria are best. Konert et al. (2014) compared many other alternative solutions to form learning groups, including assisting the teacher in forming groups through algorithms that maximise the opportunity of collaborative learning higher achievement (teacher-driven approaches). Group formation algorithms can be classified by local and global evaluation methods (fitness function); the number of criteria; criteria weighting; and homogeneous, heterogeneous and mixed-group options. An example of these algorithms is FROG (Craig et al., 2010) which allows the teacher to choose different types of attributes, such as numeric, categorical, and timetable attributes. For each attribute, it is possible to choose an evaluation method, such as homo/heterogeneity, average, at least one, or at most one. The evaluation method is defined for groups and/or overall for the whole class. Another example is GroupAL (Konert et al., 2014) which redefined the evaluation method, introducing performance indices for pairs of students, groups, and the entire cohort, as well as matching approaches that are group-centric and participant-centric. However, these teacher-driven approaches require the teacher to know exactly what parameters and weights to use, which often is not the case. Our work aims at addressing this important step: we propose a visual approach to assist teachers exploring how various criteria influence their students' group performance.

In regards to previous research on visualisations or dashboards to enhance a teacher's awareness, very few of them targeted visualising different aspects of collaborative learning. Most researchers have focused on visualising what occurs during the collaborative process. For example, (Martinez, Kay, & Yacef, 2011), created a dashboard that shows the teacher, in real time, three aspects of the collaboration: students' verbal and physical participation in the group; interactions between participants; and overall collaboration level as assessed by a machine learning algorithm. At Class-on, Rojas and García (2012) created a map of the classroom using colours and numbers to present information of the groups, such as time taken in a task, progress, and information that will help manage student assistance. A more extensive survey on learning dashboards counted only four studies targeting collaborative learning (Verbert et al., 2014). Our research aim is not to assist collaboration during the activity, but after it, and to support the teacher in gaining understanding about the data that can be useful to tune their group formation strategies.

Approach

Our general approach is to keep the teacher in the loop and support them to make informed, data-driven decisions.
We explore in this paper whether or not the data captured from students' previous activities – either individual or collaborative – can reveal relationships between the combination of certain student profiles and learning or collaboration outcomes. For this, we extract these student profiles and then provide a visualisation that can be used to explore these relationships. The proposed visualisations are initial building blocks towards assisting teachers in making data-driven decisions for forming student groups. Our approach is two-stepped:

1. Generate student profiles through a data-mining technique that clusters students according their individual data (e.g. behaviour, performance).

2. Create a visual learning analytics interface allowing teachers to rapidly examine these profiles according to specific criteria of group performance.

Clustering Method

Given that the social and epistemic aspects of the groups can strongly shape both the collaborative activity and the learning task itself (Carvalho & Goodyear, 2014), we illustrate the potential of our approach with two datasets captured in two very different collaborative learning contexts. Understanding the context where the data comes from is a crucial step, as it needs to be pre-processed before applying statistical or data-mining algorithms to extract meaningful information.
We decided to use a clustering algorithm to extract common student profiles, as it provides good results for profiling students according to their behavioural or performance traces (Bovo, Sanchez, Héguy, & Duthen, 2013; Kardan, Roll, & Conati, 2014; McBroom, Jeffries, Koprinska, & Yacef, 2016). The clusters provide a high-level description of the different types of profiles found among students. The number of clusters was decided based on a voting system using several indexes[16]. Those indexes compute the optimal number of clusters based on metrics, such as cohesion inside the cluster member and separation between different clusters. After, we experimented with different clustering algorithms and chose the ones that extracted profiles with the most meaningful characteristics. As a result, we used the K-means and EM clustering algorithms and visually selected the resulting clusters that provided a better representation of different student profiles. The next step was to design a simple visualisation tool for helping teachers investigate the contrasting characteristics occurring in the different profiles and associate the co-occurrence of these profiles with collaborative performance.

Visualizations

Two types of visualizations are proposed in this paper. Together, they may help the teacher understand their collaborative design more deeply. The tile chart, shown in Figure 1, presents all the students in the classroom distributed in their respective groups. This visualisation may assist the teacher in identifying patterns relating the students' individual profiles and group performance. Each student is represented as a tile coloured by their cluster profile. Each group is organized in one column, where every line of the column includes the students in that group. Inside each group column, the students are ordered by their cluster number. This helps the teacher identify patterns among groups with the same or similar profiles arrangement. A gradient bar is presented below the first part of the chart, presenting the performance of each group, with the intensity of colour ranging from white to dark green, where white indicates low performance and dark green indicates high performance. The gradient bar is also divided by tiles, where each tile represents one group. For instance, in Figure 1, the first column shows that the group that achieved the lowest performance consisted of three students, who were respectively in cluster 3 (green), 2 (blue) and 1 (red), whereas the highest performance group was composed of students in cluster 4 (yellow), 1 (red) and 1 (red) respectively. Looking at the overall distribution, students from cluster 4 (yellow) tend to have good results, while students in cluster 2 (blue) have poor results. More specifically, cluster 1 (red) had good results when working with cluster 4 (yellow), but poorer results when working with cluster 2 (blue).

[16] https://cran.r-project.org/web/packages/NbClust/NbClust.pdf

The second visualisation, shown in Figure 2, is a boxplot chart (Tukey, 1977) of the student profiles extracted from the clustering algorithm. This chart may assist the teacher in understanding how one profile is different from the others and gain understanding about the data that was used to define each cluster. Each boxplot represents the population distribution of one cluster. The thick line in the middle of the bar is the median of the population. The bar represents the interquartile range (IQR) of the population. The upper limit of the bar is the upper quartile (Q3), the lower limit is the lower quartile (Q1), and the upper (Q3 + 1.5 * IQR) and lower (Q1 - 1.5 * IQR) whiskers represent the maximum and minimum value of the population, respectively. Values beyond the whiskers are consider outliers and represented by dots. In Figure 2, we also present the same data that is presented in the boxplot chart, plotted in a histogram chart to visually explain how the boxplot represents the data. To explore this problem, in the next section, two versions of this chart are provided, each one containing different dimensions from the student's individual profile and also different measures of group performance. This would allow the teacher to choose which perspective most represents their intention when designing the new collaborative activity.

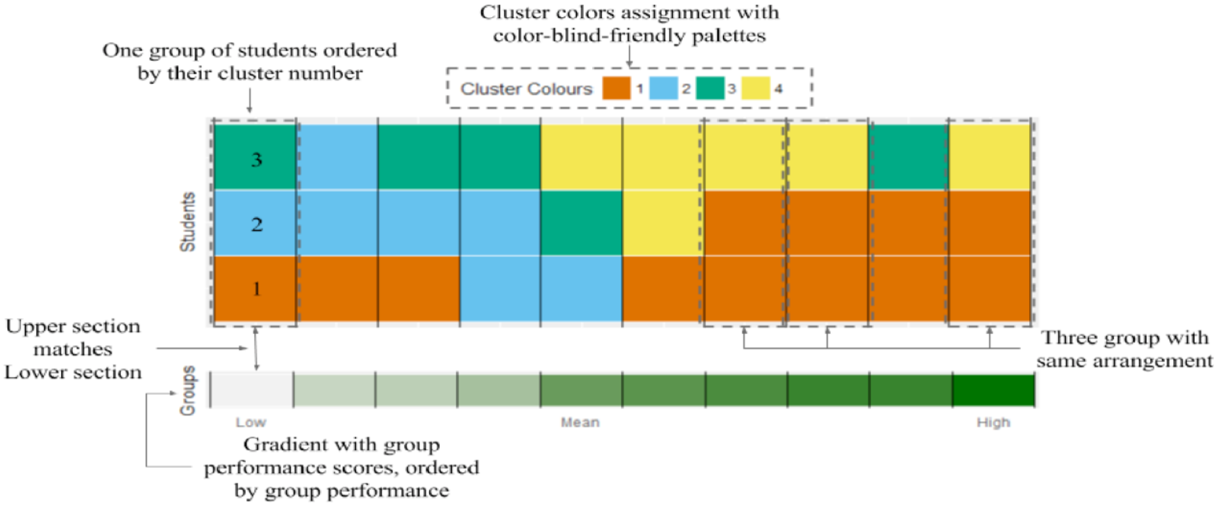

Figure 1: Example of Tile Chart

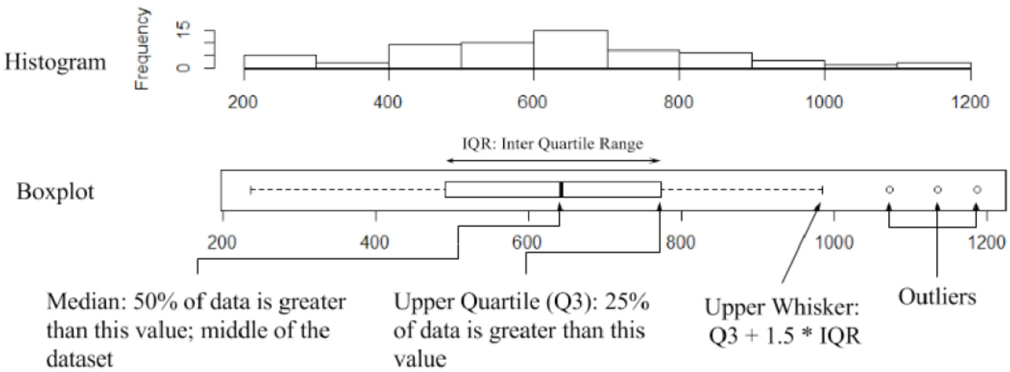

Figure 2: Example of Boxplot Chart compared with Histogram

Case Studies

To illustrate our clustering and visualisation approach for showing the relationship between students' individual profiles in a collaborative learning context, we used data from two different case studies. The datasets from these two studies (1 and 2) present very different characteristics, which enriches the illustration of our approach, and justifies the need for a flexible data-driven methodology as well as a tool to enhance teachers' decision-making by including the teacher into the analysis loop. The learning situations vary in terms of scale (n = 372 for Study 1 and n = 60 for Study 2), group sizes (dyads and triads respectively), learning modalities (blended collaboration and full face-to-face group work), time-scale (1 university subject and only 1 group session), learning tasks (pair programming and concept mapping) and domains (engineering and nutrition). The following subsections provide more details about the studies, present the clustering analysis, show the resulting visualizations, and provide a discussion of the results for each case.

Study 1: PASTA - Automated Programming Assignment Assessments

Learning Situation and the Dataset

The first dataset was collected through an in-house automatic marking and instant feedback system named PASTA (Koprinska, Stretton, & Yacef, 2015). This system was used during the second semester of 2015 for the Data Structures unit of the Computer Science at the University of Sydney. There were 372 students enrolled to this unit. The assessment comprised of individual weekly programming tasks (from weeks 2 to 12) and two group programming assignments (in weeks 8 and 11). For each student we therefore had individual activity data interspersed with group assignments. We tested our methodology on the outcome of the first group assignment (in week 8) by visually exploring the students' profiles, which we clustered using the data from individual tasks from week 2-5 (groups were formed in week 6 so, for authenticity, we only used the individual data across these weeks). Each of these weekly activities consisted of a series of programming tasks that students submitted to PASTA. The system uses unit tests to provide feedback. The students could re-submit their solutions as many times as they needed before the deadline. A progress bar showed the number of tests they passed on each attempt, with the final percentage being used to calculate their mark for their submission. More technical details about PASTA can be consulted in Gramoli et al. (2016).

Out of the 372 students, 162 submitted the first group assignment in pairs, while the remainder worked alone or did not submit at all. For each assessment, the PASTA logs contain: 1) information about the student's behaviour (e.g. number and timing of submissions) and 2) submission quality as assessed by the system. Table 1 summarizes the attributes from the data used in this study, where each attribute is replicated in each week, from week 2 to week 5.

Table 1: Nine individual attributes description for each weekly individual task

Attribute	Description
percent_early	Percentage of attempts made three days or more before the due date
percent_normal	Percentage of attempts made that were neither early nor late
percent_late	Percentage of attempts made on the due date
num_compile_errors	Number of attempts involving compilation errors
first_mark (0-100)	Percentage of tests passed on first attempt
last_mark (0-100)	Percentage of tests passed on last
num_submissions	Number of attempts not involving compilation errors
time_taken (seconds)	Time taken from the first to the last submission
avg_improvement	Average improvement from the first to the last submission

Students Profile Generation

A number of student profile clusters were generated aggregating the weeks from 2 to 5 for each feature. For instance, the feature first_mark from week 2 to week 5 was summarised using mean and standard deviation. So, first_mark_mean represents the average first mark of the student when doing the submission, and first_mark_sd describes how regular/irregular their first submissions were. The resulting summarised features, for each of the students, were then used as an input for the cluster methods (K-means). Our intent is to extract the student's behaviour using the platform over the weeks that anticipate the group formation for the first group assignment. The charts are ordered based on the group's first assignment result. On the left side of the chart, are the groups with the lower scores, and on the right side of the chart are the groups with higher scores.

Students Clustered by First and Last Marks

For this clustering task, we only selected the first and last marks feature to cluster students. The resulting clusters are shown in Figure 3. Cluster 1 (red, 38 students) is comprised of students with a first mark average of 66 and an improvement to 73 in the last mark. These students did not have a regular first and last mark over the four-week assignment, with a high standard deviation of 42 in both the first and last mark. Cluster 2 (blue, 29 students), aggregates students with low marks and no improvement from the first to the last attempt. Their average mark was 38.5 and a high variability of 51 standard deviations between assignments. Cluster 3 (green, 74 students) had the
best students with high marks, low variability and a mild improvement from 96 to 99. Cluster 4 (yellow, 21 students) contains students that started well and finished with excellent marks. They have a high improvement rate, from 79 to 96, and a decrease on the variability from 29 to 5, in the last mark.

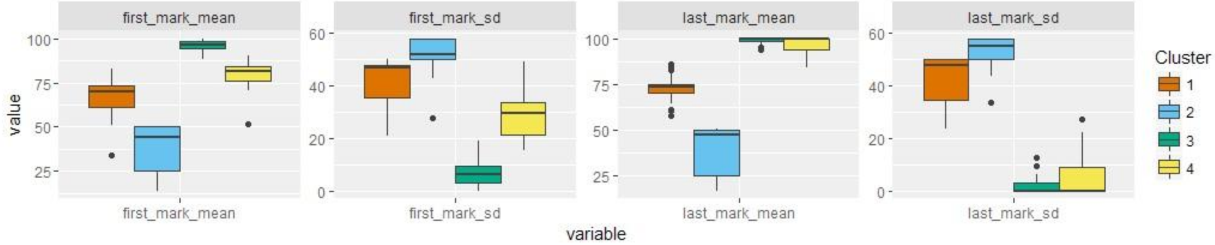

Figure 3: Students clustered by first and last mark

Figure 4 depicts all the dyads that performed the first group assignment. Each column represents a dyad and the coloured squares represent the cluster that each student belongs to. The dyads are ordered by score on the first group assignment (from left to right). Interestingly, the visualisation shows how most of the groups had a really good performance in the first group assignment (e.g. the mean indicator is leaning to the left side and most of the gradient bar show a high value, dark green colour). The average is 5.8 from a maximum score of 8, and the standard deviation is ±1.7. In this figure, we can observe that:

1. Students that individually have good marks tended to have good marks when in groups, especially when working together with another student from the same cluster. Cluster 3 (green) is more prevalent in the right part of the chart.
2. Students with low individual performance tended to also have low marks when working with groups, especially when working together. Cluster 2 (blue) has a tendency to the left of the chart.
3. Clusters 1 (red) and 4 (yellow) are spread throughout the chart showing no trend when working in groups.

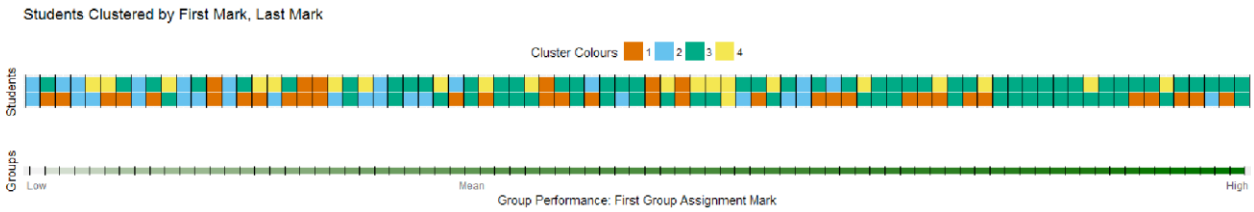

Figure 4: Students in their groups, coloured by their profiles and ordered by group performance

Students Clustered by Percentage Early, Normal, Late

The second analysis in this dataset consisted of exploring group behaviour based on other individual features. The next group of features that resulted in meaningful profiles was related to the submission times – that is, the percentage of early, normal, and late submissions.

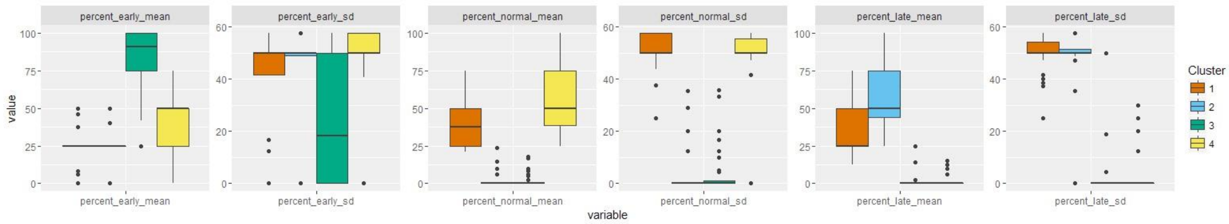

Figure 5: Students clustered by percentage early, normal, late

In Figure 5, it is possible to compare the four profiles of students with regards to the timing of their submissions. Cluster 1 (red, 49 students) contains students that presented irregular behaviour, submitting early, normal and late, with high variability along the four-week assignments. In cluster 2 (blue, 29 students) students tended to submit late.

Cluster 3 (green, 44 students) contains students who were generally consistent in making early submissions. Cluster 4 (yellow, 40 students) includes students who made submissions early and normal, but never late. In this analysis, the results are not as clear as in the analysis described in the previous subsection. For example, there is no evident trend regarding the profile distributions in Figure 6, such as the ones we saw in Figure 4. However, it is possible to observe some group behaviours, shown in Figure 6:

1. Some students that consistently performed late submission were associated with low group performance. Cluster 2 (blue) gathers at the left end of Figure 6.
2. Some groups with both students from students that made early submissions, cluster 3 (green), did not perform well together.
3. Students with irregular submissions are gathered around the mean group score, especially when working together.

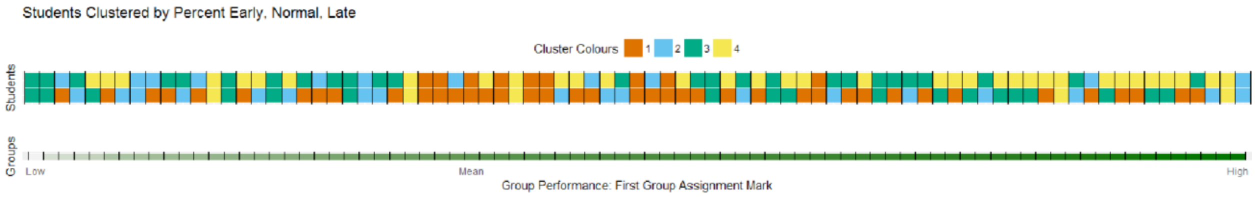

Figure 6: Students in their groups, coloured by their profiles and ordered by group performance

The previous charts show how some simple visualisations may help to make visible certain trends happening as the semester unfolds. It also may give the teacher the ability to understand how the arrangement of students in groups can influence group performance. We changed the variables used to cluster students to explore different profiles of students. Even though the results were simple, they provide insights for further investigations.

Study 2: CMATE - Building Concept Maps Using Tabletop

Learning Situation and the Dataset

In an experiment involving 60 students from science courses, participants were asked to build a concept map after reading the Australian Dietary Guidelines 2011(Martinez-Maldonado, Dimitriadis, Martinez-Monés, Kay, & Yacef, 2013). The experiment had three phases: first, the students built the concept map individually; second, grouped in triads, the students built concept maps together; and third, students were asked to build the concept map again individually. During the individual phases, the students were asked to build the concept map using CmapTools that recorded each student's steps when building the map. At the group phase, the students built the concept map in an interactive tabletop system called CMATE, where all the touches were recorded, together with audio and video. A method that uses nine qualitative dimensions was used to assess the group's collaboration quality level. We aggregated the scores to come up with a single indicator of quality of collaboration that we will refer in this paper as a Spada score. More technical details about the learning situation and CMATE can be found in Martinez-Maldonado et al. (2013).

In this analysis, we mainly focused on how the individual profiles of the students, which were extracted from individual concept maps (hence data collected prior collaborative task) influenced the group collaboration. We used two measures of group performance: the Spada score and a comparison score with a Master Map created by an expert of the subject matter (Martinez-Maldonado et al. 2013).

The individual features that were extracted from the individual concept maps are shown in Table 2.

Table 2: Features extracted from the concept maps

Type	Description	Examples
Graph Analysis	Reading the concept map as a graph, producing features.	Avg Links per Concept, Avg Words per Concept, Taxonomy Score, Proposition Count
Time Analysis	Sum of how much time the student spends before executing each action.	Add Concept Time, Delete Connection Time, Move Concept Time, Resize Concept Time
Process Analysis	Coding each action as a letter and producing triples and quadruples of sequences, and analysing the most frequent sequences.	CBB: Add Linking Phrase → Add Connection → Add Connection JJJJ: Move Concept → Move Concept → Move Concept → Move Concept

Student Profile Generation
We also explored different combinations of features to cluster students. The one that produced the most meaningful profiles was based on Time Analysis features. This cluster schema was designed to extract peculiarities of each student when building their concept map. In contrast to the previous dataset, and to show the potential of the proposed visualisation, we plotted the same students' profile clustering over different measures of group performance. The cluster profiles are shown in Figure 7. Cluster 1 (red, 5 students) is comprised of students that did not spend much time adding new concepts but a lot of time moving them around. Cluster 2 (blue, 13 students) gathers students that spent more time adding and moving linking phrases. Cluster 3 (green, 11 students) has students that spent more time adding concepts and linking phrases. Cluster 4 (yellow, 31 students) contains students that spent much less time working on their individual concept map compared to the other profiles.

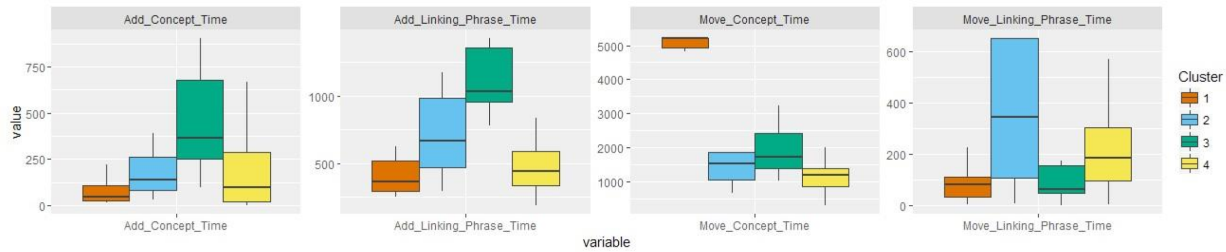

Figure 7: Students clustered by time analysis features

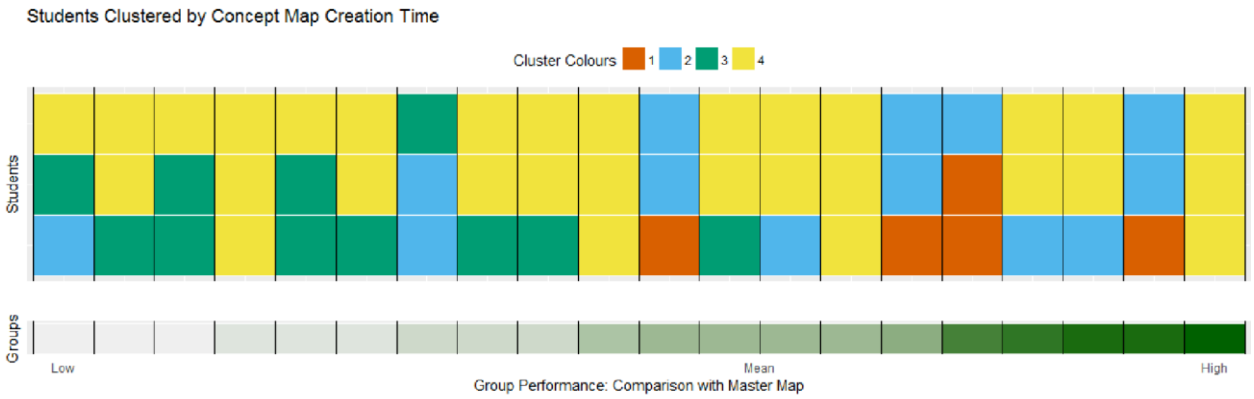

Figure 8: Students in their groups, coloured by their profiles and ordered by comparison with master map

We can observe the following from Figure 8 and Figure 9:

1. Students who spent more time adding concepts, Cluster 3 (green), had performed poorly when compared with Master Map, probably because they did not initially use the concepts available, and created concepts with names different from the master map. At the group phase, they may convince others to use the new names.
2. Students who spent more time moving elements, Concepts for Clusters 1 (red) and Linking Phrases for Cluster 2 (blue), had a good interaction working together regarding the Spada score and when compared with the Master Map.
3. Cluster 4 (yellow), when analysed against the Spada score are in both the left and right ends of the chart.

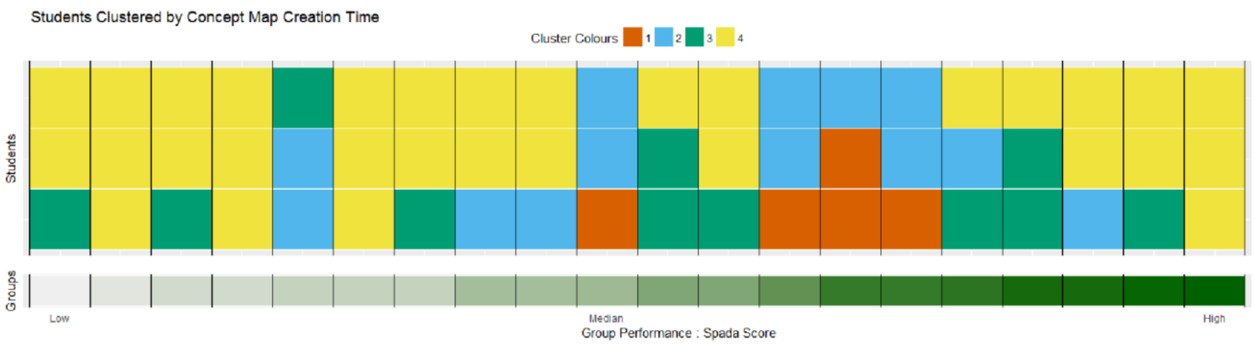

Figure 9: Students in their groups, coloured by their profiles and ordered by Spada score

Discussion and Conclusion

Collaborative learning raises multiple challenges for learning sciences and related fields. An important aspect of a successful collaborative learning experience is to get students grouped in a way that may foster, hopefully maximise, this learning experience. The way groups are formed in classrooms, blended or online environments requires a careful learning design process. Although there are some tools that automate the group formation phase, it is up to the teacher to choose the criteria for arranging which students should work together. This choice requires a deep understanding of the task, the students, and the desired outcome, which is not always the case because of lack of time, number of students and resources available.

Because of the above, understanding collaborative learning is a complex problem constrained by multiple variables, such as the number of students in the groups, time of collaboration, the nature of the task, and the environment in which the task is being executed. So far, the issue of group formation has been done either following social theories, or random or systematic processes. Our work aims to harness the data collected by collaborative educational technologies and empower teachers to explore all aspects of these collaborative learning processes so that they can make informed, data-driven decisions to support collaboration. This paper is a first step for understanding how different student profiles interact together when doing a collaborative work. Profiles were extracted from learning systems data and using clustering algorithms. Student interactions were measured by different group performance metrics. The charts presented are a first attempt to equip teachers with tools to explore what different profiles of students exist in their cohorts and how to link them to group performance.

The student profile clustering is an unsupervised attempt to find patterns within students' profiles in terms of their behaviour using the learning systems, their performance or demographics profiles. The boxplot chart intends to contrast the difference between these patterns so it can be easily perceived by the teacher. Similarly, the tile chart has the same purpose but targets the group patterns. The tile chart presents all the groups and their arrangements so it may give insights about why some groups performed better than others did. It also provides the ability to perform a novelty visual groupwise comparison, expanding more traditional comparisons made just individually between students (e.g. Verbert et al. (2014)).

As further investigations, our focus will be to evaluate the visualisation tools presented in this paper and to collect feedback from teachers. We will also consider improvements to the design of the interface, especially to represent larger cohorts of students. As a wider contribution, we will publicly release the code that generates the charts with its pertinent documentation, together with sample datasets to allow other researchers to propose different methods of analysis and visualisations for collaborative scenarios.

References

Beal, D. J., Cohen, R. R., Burke, M. J., & McLendon, C. L. (2003). Cohesion and performance in groups: a metaanalytic clarification of construct relations. *Journal of applied psychology, 88*(6), 989.

Bovo, A., Sanchez, S., Héguy, O., & Duthen, Y. (2013). *Analysis of students clustering results based on Moodle log data.* Paper presented at the 6th International Conference on Educational Data Mining-EDM 2013.

Carvalho, L., & Goodyear, P. (2014). *The architecture of productive learning networks*: Routledge.

Choi, H., Lee, J. E., Hong, W.-j., Lee, K., Recker, M., & Walker, A. (2016). *Exploring Learning Management System Interaction Data: Combining Data-driven and Theory-driven Approaches.* Paper presented at the Proceedings of the 9th International Conference on Educational Data Mining.

Cohen, E. G., Goodlad, J. I., Darling-Hammond, L., & Lotan, R. A. (2014). *Designing Groupwork : Strategies for the Heterogeneous Classroom, a New Edition* (Vol. Third edition). New York, NY: Teachers College Press.

Craig, M., Horton, D., & Pitt, F. (2010). *Forming reasonably optimal groups:(FROG).* Paper presented at the Proceedings of the 16th ACM international conference on Supporting group work.

Demetriadis, S., & Karakostas, A. (2008). *Adaptive collaboration scripting: A conceptual framework and a design case study.* Paper presented at the Complex, Intelligent and Software Intensive Systems, 2008. CISIS 2008. International Conference on.

Dillenbourg, P. (1999). What do you mean by collaborative learning? *Collaborative-learning: Cognitive and Computational Approaches.*, 1-19.

Gramoli, V., Charleston, M., Jeffries, B., Koprinska, I., McGrane, M., Radu, A., . . . Yacef, K. (2016). *Mining autograding data in computer science education.* Paper presented at the Proceedings of the Australasian Computer Science Week Multiconference.

Kardan, S., Roll, I., & Conati, C. (2014). *The usefulness of log based clustering in a complex simulation environment.* Paper presented at the International Conference on Intelligent Tutoring Systems.

Konert, J., Burlak, D., & Steinmetz, R. (2014). The Group Formation Problem: An Algorithmic Approach to Learning Group Formation *Open Learning and Teaching in Educational Communities* (pp. 221-234): Springer.

Koprinska, I., Stretton, J., & Yacef, K. (2015). *Students at risk: Detection and remediation.* Paper presented at the Proceedings of the 8th International Conference on Educational Data Mining.

Martinez-Maldonado, R., Dimitriadis, Y., Martinez-Monés, A., Kay, J., & Yacef, K. (2013). Capturing and analyzing verbal and physical collaborative learning interactions at an enriched interactive tabletop. *International Journal of Computer-Supported Collaborative Learning, 8*(4), 455-485.

Martinez, R., Kay, J., & Yacef, K. (2011). *Visualisations for longitudinal participation, contribution and progress of a collaborative task at the tabletop.* Paper presented at the Computer supported collaborative learning, CSCL.

McBroom, J., Jeffries, B., Koprinska, I., & Yacef, K. (2016). *Mining behaviours of students in autograding submission system logs.* Paper presented at the Proceedings of the 9th International Conference on Educational Data Mining.

Rojas, I. G., & García, R. M. C. (2012, 4-6 July 2012). *Towards Efficient Provision of Feedback Supported by Learning Analytics.* Paper presented at the 2012 IEEE 12th International Conference on Advanced Learning Technologies.

Siemens, G., & d Baker, R. S. (2012). *Learning analytics and educational data mining: towards communication and collaboration.* Paper presented at the Proceedings of the 2nd international conference on learning analytics and knowledge.

Sinha, T. (2014). *Together we stand, Together we fall, Together we win: Dynamic team formation in massive open online courses.* Paper presented at the Applications of Digital Information and Web Technologies (ICADIWT), 2014 Fifth International Conference on the.

Stahl, G. (2006). *Group Cognition: Computer Support for Building Collaborative Knowledge (Acting with Technology)*: The MIT Press.

Tukey, J. W. (1977). Exploratory data analysis.

Verbert, K., Govaerts, S., Duval, E., Santos, J. L., Van Assche, F., Parra, G., & Klerkx, J. (2014). Learning dashboards: an overview and future research opportunities. *Personal and Ubiquitous Computing, 18*(6), 1499-1514. doi:10.1007/s00779-013-0751-2

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Building academics' SoTL capacity through a course on blended learning

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This paper provides an outline of a course on blended learning which aims to build academics' scholarship of teaching and learning (SoTL) capacity as well as equipping them with knowledge and skills in designing and developing a prototype of a unit within a course. The paper also describes the underlying principles and frameworks in the conceptual model for designing the blended learning course, and how the various elements of the model relate to one another. Details on how the design of the course is being influenced by the model is also provided. The current progress of the project and possible studies in the future is also discussed at the end of the paper.

Keywords: Scholarship of teaching and learning (SoTL), academic development, learning design, blended learning.

Introduction

The last few years have been a growth in interest and development of blended learning courses at institutions of higher learning worldwide. Blended learning, according to Stein & Graham (2014), is defined as "a combination of face-to-face with online experiences to produce effective, efficient and flexible learning." Despite the popularity of blended learning, Mirriahi, Alonzo and Fox (2015) cited that blended learning in higher education are facing challenges in the following three areas, (a) low digital fluency among academics, (b) ill-defined definitions and views on blended learning, and (c) limited availability of tools to guide and evaluate blended learning course designs. At the same time, it is also observed that there has been a gradual shift in the awareness and emphasis on the importance of scholarship of teaching and learning (SoTL) among research-intensive institutions within the Asia region. This awareness on the importance of SoTL has resulted in the urgent need of building academics' SoTL capacity. This paper articulates how a course on blended learning for academics has been designed and developed based on a conceptual model that is built on the underlying principles of SoTL and constructive alignment. The course aims at both building academics' SoTL capacity as well as equipping them with the knowledge and skills to build their own courses in a blended learning mode through an evidence-based approach.

Conceptual model for the course on blended learning

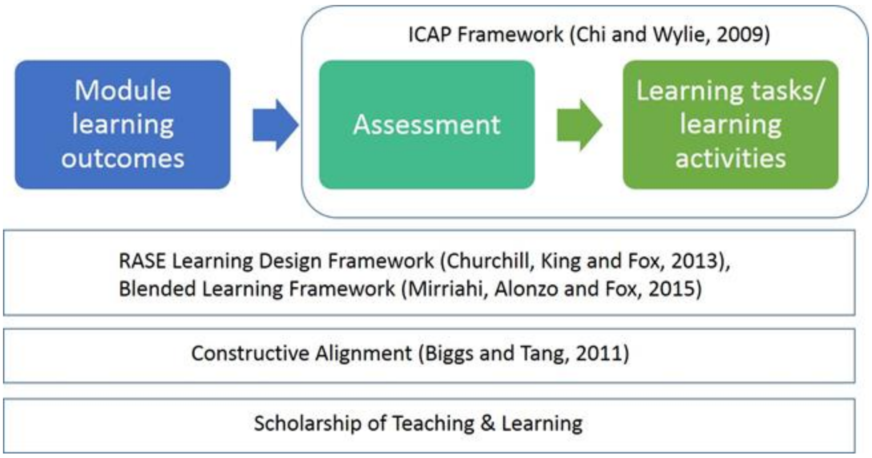

Figure 1: Conceptual model for the course on blended learning

The underlying principles in the current model for the course on blended learning (Figure 1) are the scholarship of teaching and learning (SoTL) and constructive alignment (Biggs & Tang, 2011).

SoTL and academic development

For this project, the scholarship of teaching and learning (SoTL) has been defined “as having a primary focus on improving the learning of the teachers’ students, while satisfying several key elements of scholarship: a scholarly inquiry leading to the production of a public artefact and the peer review of that outcome. This is in contrast to a definition that sees scholarly journal publications as the major outcome, with a primary focus on faculty career development and contributions to new knowledge that may (or may not) lead to improved teaching and learning generally.” (Trigwell, 2013). Geertsema (2015) argues that “SoTL can have a strong developmental function. Over time, finding ways to strengthen faculty members’ close engagement with the scholarship around learning and teaching—without undue and overhasty emphasis on publication in top journals but instead encouraging a more local way of making scholarly investigation public—will build institutional capacity in education that will, in the long run, help pave the way towards education research.” Geertsema further suggests that if the purpose of SoTL is to enhance learning and teaching, “it makes sense to orient SoTL inquiry towards a local institutional level” and “consequently have a higher local impact that if it were made public elsewhere.” This suggestion is supported by Mårtensson, Roxå and Olsson (2011) as it indicates that “in order to have an impact on a particular culture, teachers engaging in scholarship at a local level … are probably the most important category, in contrast to those operating on a global level (for instance by contributing publications in international educational journals)”.

In order to build academics’ SoTL capacity, teaching and learning centres in research-intensive institutions should explore ways of supporting academics in this area through a scholarly approach to academic development (Geertsema, 2015). Geertsema further elaborated that one of such approaches would be to “reimagine professional development programmes as opportunities to scaffold project-based scholarly investigations into academic practice.” There should also be opportunities for such works by academics to be shared with others in the institution, with the goal to impacting other colleagues especially those who are searching for possible solutions to issues they are experiencing in their teaching. Academic developers should also design and implement programmes which are relevant to academics’ needs “in being practice-based, in modelling active learning that can result in participants not merely receiving skills training but engaging in deep learning about learning, and in being anchored in scholarly reflection on learning and teaching” (Geertsema, 2015).

Blended learning framework

Built upon the foundations of SoTL and constructive alignment, the Blended Learning Framework developed by Mirriahi, Alonzo and Fox (2015) has been adopted into the model for two purposes (Figure 1). Firstly, it serves as a guide for “course design to ensure consistent high quality blended learning practice across an institution”. Secondly, “be used by academics as a self-assessment instrument to identify their strengths and weaknesses” in both current and subsequent levels of blended learning practice. The Blended Learning Framework (Mirriahi, et al., 2015) has a set of criteria and standards organized around the RASE learning design framework developed by Churchill, King and Fox (2013) which supports a student-centred, technology-rich environment suitable for blended learning. The RASE learning design framework emphasizes four components of a learning unit: Resources, Activity, Support and Evaluation. The list of the criteria and standards of the Blended Learning Framework is listed in Table 2 of the article by Mirriahi et al. (2015). Finally, we will use the ICAP framework for designing learning activities (Figure 1) and details are described in the following section.

ICAP framework: Designing learning activities to promote better learning outcomes

A simplified description of the flipped classroom learning model is where students are asked to view online lectures (pre-class) on their own time to prepare for learning activities that occur during scheduled face-to-face class time (in-class). Many proponents claim that this model encourages active learning as compared to the more passive learning found in traditional learning model consisting typically lecture cum tutorial sessions. Critics, however, argued that the success of the flipped classroom approach lies in the extent that active learning is being carried out, not the model (Jensen, Kummer, & Godoy, 2015).

Bonwell and Eison (1991) describes active learning as requiring students to do meaningful learning activities and think about what they are doing. Yet, teachers often faced with challenges to develop lessons that engage students cognitively and encourage meaningful learning. In particular, for the flipped classroom approach, it is often tricky for teachers to design active learning processes and strategies that can best integrate online and face-to-face settings to engage students effectively (Gerbic, 2011; Holley & Oliver, 2010).

To address these challenges, we incorporate the ICAP framework (Chi, 2009) to provide guidelines for teachers to optimize "active learning". The ICAP framework defines engagement in terms overt behaviours displayed or undertaken by students where teachers can observe. These overt engagement behaviours are differentiated into one of the four modes of engagement: passive, active, constructive, or interactive. Each mode of engagement predicts a different level of learning due to a different set of underlying knowledge-change process associated with the learning processes. The ICAP framework hypothesis assumes that activities designed as *I*nteractive are more likely to generate higher level of learning outcomes than *C*onstructive activities, which is superior than *A*ctive activities, which in turn is greater than *P*assive activities (I>C>A>P). Table 1 illustrates how ICAP framework can be used to guideline teachers to design online and face-to-face learning activities to engage students learning in the flipped classroom learning approach.

Table 1: Adaptation of Chi & Wylie (2014) taxonomy of four modes of activities and ICAP framework hypothesis of learning outcomes

Category	Passive	Active	Constructive	Interactive
Characteristics	Learners receiving information from instructional materials without overtly doing anything else	Learners exhibiting some form of overt motoric action or physical manipulation with instructional materials	Learners generating new ideas or products beyond what was provided in the lesson materials and instructions	Two or more learners contributing constructively through dialog or interacting
Knowledge-change process	Information is stored in an isolated manner	Integration of information with prior knowledge occurs	Inference process occurs where new knowledge is created	New knowledge and perspective can emerge from co-creating knowledge that neither partner knew
Learning Outcomes	Recall	Apply	Transfer	Co-create
Example online activities (non-exhaustive)	Watching an online video lecture without exploration	Manipulating the online video by pausing, playing, fast-forwarding, rewinding	Observing a tutorial dialogue-video with a worksheet provided for the students to response to the problems or to answer the questions.	Participating in videoconference to co-create a solution to an existing community challenge.
Example face-to-face activities (non-exhaustive)	Listening to an explanation or observing a demonstration without exploration	Copying solution from the board; highlight key points	Self-construction activities that leads to generation of new ideas or product (i.e. self-explaining; drawing concept maps, etc.)	Collaborative learning through discourse or dialoguing with partners that helps to generate new outputs or products

When designing a flipped learning course, the teacher needs to thoughtfully consider the joint connection of the online (pre-class) and face-to-face (in-class) learning activities to engage students, leading to better learning outcomes. The ICAP framework provides a form of scaffold, guiding the teacher design decisions to be more strategic in selecting appropriate learning activities that trigger certain modes of engagement. This can help to ensure better alignment between the learning environment the teacher created, the thinking approaches students used and the learning outcomes they achieved.

Design of the course on blended learning

Underpinned by SoTL, the 13-hour course is conducted through a blended learning mode and has been designed with the intended learning outcome of enabling academics to design and develop prototype (a unit within a course) in the flipped mode through an evidence-based approach. The course consists a series of six two-hour workshops and a one-hour presentation, spread across four months during the semester. Flipped mode is adopted for all sessions. Academics are required to carry out some preparatory work, either individually or in pairs, prior attending the face-to-face sessions. Learning tasks and resources assigned for online learning are provided through the learning management system.

For the first half of the course, academics would be introduced to constructive alignment, RASE and ICAP frameworks through readings, online and in-class discussions. Academics will have the opportunity to apply these frameworks as they are designing their lesson plans for the prototypes. The lesson plans would describe the learning tasks and assessments planned for both online and face-to-face sessions based on the intended learning outcomes for a unit of a course. Opportunities are also provided for academics to review each other's lesson plans and provide constructive feedback to one another. They are required to provide feedback on (a) the alignment of intended learning outcomes of the unit with teaching/learning activities and assessment planned, (b) learning scaffolds provided for students, both online and face-to-face environments, (c) levels of engagements based on the ICAP framework, (d) the 4 elements of the unit, namely resources, activities, support and assessment, based on the criteria and standards developed by Mirriahi et al (2015).

The second half of the course focuses on developing the prototype based on the lesson plan. Academics are guided to draft the storyboard of the multimedia resources they have planned, create short video clips and develop learning tasks and assessments for both online and in-class sessions. Towards the end of the second half of the course, academics are to provide peer feedback on the prototypes they have developed.

At the last session, academics will present their prototypes during a lunch cum gallery walk where all academics within the institution will be invited to attend. This session would provide an opportunity for academics to reflect, share and exchange ideas based on the prototypes presented. Academics are also encouraged to write their reflections on their learning at the end of the course.

Current progress and conclusion

At the time of writing the first offer of the course is being launched after approval was sought from the Director of the Centre for Development of Teaching and Learning to roll out the course. The first offer of the course is fully subscribed by academics within a week after it was publicised.

A study on the first offer will be conducted to find out the extent of how this course impacted on academics who attended the course. Such study would help to further fine-tune the curriculum, to better cater to the needs of academics within the institution. In addition, findings from such study would serve as reference for future evaluation studies on similar programmes which promotes teaching and learning inquiry.

This paper presented a model for a course on blended learning that is built upon SoTL and constructive alignment within a research-intensive institution located within Asia. The model aims to build the capacity of SoTL through an academic development programme. The model presented could also be adapted and used by other universities within the region, and be further researched. Findings from such studies would generate valuable knowledge in the field of scholarly approaches to teaching and learning, with the aim to enhance quality of teaching and learning in higher education.

References

Biggs, J. B., & Tang, C. (2011). *Teaching for Quality Learning at University* (4th ed.). Berkshire: Society for Research in Higher Education & Open University Press.

Chi, M. T. (2009). Active-constructive-interactive: a conceptual framework for differentiating learning activities. *Topics in Cognitive Science*, *1*(1), 73–105. doi: 10.1111/j.1756-8765.2008.01005.x

Chi, M. T., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, *49*(4), 219–243. doi: 10.1080/00461520.2014.965823

Churchill, D., M. King, and B. Fox (2013) Learning design for science education in the 21st century, *Journal of the Institute for Educational Research*, *45*(2), 404–421.

Geertsema, J. H. (2015) SoTL, academic practice, and academic development. *Asian Journal of the Scholarship of Teaching and Learning*, *5*(3), 138-149.

Gerbic, P. (2011). Teaching using a blended approach–what does the literature tell us? *Educational Media International*, *48*(3), 221–234. doi:10.1080/09523987.2011.615159

Holley, D., & Oliver, M. (2010). Student engagement and blended learning: Portraits of risk. *Computers & Education*, *54*(3), 693–700. doi: 10.1016/j.compedu.2009.08.035

Jensen, J. L., Kummer, T. A., & Godoy, P. D. d. M. (2015). Improvements from a flipped classroom may simply be the fruits of active learning. *CBE-Life Sciences Education*, *14*(1), ar5. doi: 10.1187/cbe.14-08-0129

Mårtensson, K., Roxå, T., & Olsson, T. (2011). Developing a quality culture through the Scholarship of Teaching and Learning. *Higher Education Research and Development 30*(1), 51-62. doi: 10.1080/07294360.2011.536972

Mirriahi, N., Alonzo, D., & Fox, B. (2015). A blended learning framework for curriculum design and professional development. *Research in Learning Technology*, *23*: 28451. doi: http://dx.doi.org/10.3402/rlt.v23.28451

Stein, J. & Graham, C.R. (2014). *Essentials for blended learning: A standards-based guide*. New York: Routledge.

Trigwell, K. (2013). Evidence of the impact of scholarship of teaching and learning purposes. *Teaching and Learning Inquiry*, *1*(1), 95-105. doi: http://dx.doi.org/10.20343/teachlearninqu.1.1.95

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Mining video data: tracking learners for orchestration and design

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Learning spaces influence how we act, however there is a lack of systemic research addressing the impact of environments on teaching and learning. In this paper, we introduce a hybrid tracking technique in which a colour model is combined with algorithms to identify human positions, and applied to video data. The aim of identifying patterns of movement that could be used to indicate successful collaboration in open plan learning spaces. We apply the method to a previously analyzed dataset, to demonstrate how multiple analytic techniques can be used to build a complex understanding of learner movement in relation to collaboration and learning. We conclude with suggestions of the ways in which the results could be used by instructors to inform orchestration of complex learning environments, as well as directions for future research.

Keywords: learning analytics, learner tracking, learning spaces

Introduction

Learning spaces influence how we act, in ways we may not notice (Amedeo, Golledge & Stimson, 2009). Given the substantial investment by universities in the design and construction of new learning spaces, it seems reasonable to expect changes in the ways learners are considered, designed for, and facilitated. However, there is a lack of systemic research addressing the impact of environments on teaching and learning (Brooks, Walker & Baepler, 2014). Many new learning spaces adopt an open-plan configuration. To understand how learners use these types of spaces, we need to know what it means for learning, and in turn, for teaching. With growth in the use of ‘big data’ (e.g. Macfadyen & Dawson, 2010), which can be broad, or deep, new methods are being developed to do just that. In this paper, we present an investigation of learners’ movements in an open-plan space as they complete a complex learning task, using a hybrid tracking technique in which a colour model is combined with algorithms to identify human positions, and applied to video data. We present background to the methodological approach and the context in which this analysis takes place. The methods developed for tracking learners are described and the results presented. We discuss the results in relation to the findings of previous analyses of the same dataset, and suggest ways in which the results could be used by instructors to inform orchestration of complex learning environments, as well as directions for future research.

Background

In this paper, we argue that in order to understand, design for, and teach in new learning spaces, we need to work in the intersection of several core methodological and theoretical approaches to understanding learning and teaching. A body of work that examines the facilitation of such learning environments is *orchestration* (Prieto, Dlab, Gutiérrez, Abdulwahed, & Balid, 2011). Orchestration is used to describe a teacher's management of a classroom in which students have access to a range of technological devices (Dillenbourg, Javela & Fischer, 2009). There is growing interest in the study of learning and teaching in spaces that include digital and non-digital tools and the development of automated or semi-automated methods (learning analytics, multimodal learning analytics) to understand activities in these environments (see e.g. Martinez-Maldonado, Goodyear, Kay, Thompson & Carvalho, 2016; Thompson, Ashe, Carvalho, Goodyear, Kelly & Parisio, 2013). To study complex learning environments, such as new university open-plan learning spaces, multiple measures of learner activity are needed. In multimodal learning analytics (Blikstein, 2013), multiple modes of activity – gesture, gaze, as well as discourse, movement and the creation of artefacts are considered, and a more systemic view of a learning situation is adopted as the results of the analyses are recombined in order to develop a model of understanding (Thompson, 2013). Recent work is developing the relationship between using real-time learning analytics for orchestration of learning across physical and digital spaces (Martinez-Maldonado, 2016). *Actionable science,* from recent work in ecology, encourages scientists to work directly with policy makers, so that science has a better chance of influencing policies (Beardsley, 2011). The ability of learning analytics techniques to be actionable relies on core interaction between researchers and instructors in order to develop tools that meet the needs of learners, and can be integrated into practice (Martinez-Maldonado, Pardo, Mirriahi, Yacef, Kay & Clayphan, 2016).

There is ongoing discussion about appropriate ways for universities to design for, and assess, graduate attributes such as teamwork, interpersonal communication, problem solving, critical thinking and creativity (Frawley, Dyson, Tyler & Wakefield, 2015). Computer-supported collaborative learning is a common activity in many higher education learning situations. Identifying indicators of successful and unsuccessful collaboration using learning analytic approaches is more common where there is a digital component to the learning environments, where the evidence of student activity, such as eportfolios (Aguiar, Ambrose, Chawla, Goodrich & Brockman, 2014), or online discussions (e.g. Wise, Zhao & Hausknecht, 2014) are digital and can be collected and analyzed. Yet, we know very little about identifying productivity, when groups use a combination of physical and digital tools in a learning space (Goodyear, Jones & Thompson, 2013). Typically, the application of learning analytics to physical spaces has focused on gaze (e.g. Schneider & Pea, 2015) or attention (Raca & Dillenbourg, 2015). In these studies, however, students remain at desks, and it is their response to the teacher, or other students in a fixed group that is analyzed (e.g. Raca, Tormey & Dillenbourg, 2013). Open-plan learning spaces are potentially more complex than this. Across many studies an important aspect of collaboration has been *convergence*, whether there is a particular physical location of gaze (e.g. Schneider & Pea, 2015; Raca & Dillenbourg, 2015) or a concept in dialogue (Jeong & Chi, 2007). We argue that by being able to track learners in their movement in an open-plan learning space, that their physical location could also be used as an indicator of the productivity of their collaboration, and indicate to teachers whether intervention is needed. A learner tracking tool was developed to help us to gain a birds-eye-view of patterns of movement around a room, in order to be used in combination with other measures of learning and assessment.

Methods

Human tracking has been investigated in many settings in the last decade. For instance, the tracking techniques have been applied to areas such as public surveillance, gaming, human-computer interactions and robotics. As a high-level computer vision task, the aim of human tracking is to establish the coherent relations of human beings, given consecutive video streaming frames. For major computer-vision based applications, accurate tracking is the fundamental work enabling identification of activity and behavior. Previous work reported on in learning analytics has focused on the use of heatmaps to achieve an understanding of the patterns of users around technology (Martinez-Maldonado et al., 2016).

This dataset has been reported on previously (see Thompson et al., 2013 for further detail). Masters students were given a design task to be completed in a 5-week period. The group analyzed collaborated on this task in online and a face-to-face environment. The group consisted of four students (Damien, Eileen, Gabrielle, and Lavina, pseudonyms), and met online (Skype) four times and face-to-face three times (these were recorded as well as their work in Google Drive). One segment of their first meeting was analyzed in this analysis, although all face-to-face sessions have been analyzed previously (Thompson et al., 2013). The students' grades in this group were comparable to the rest of the class for the individual components. However, this group received the highest grade in the class for the collaborative component, which led us to identify the collaboration in this group as successful. The physical environment (Figure 3) contained writeable walls, onto which computers could be projected. The furniture could be moved to suit the needs of the learners in the room. The task required students to work in groups of four to discuss and collaboratively design educational design patterns and a pattern language. In the previous analysis, automated discourse analysis was used to examine the ways in which learners used the tools, interpreted the assignment brief, and designed their own roles for this task. Changes in the use of keywords from the assignment brief, and contained in the final assignment were used to show the shift in focus in this group, and to identify who was responsible for saying them. The gaze was also recorded, and used to identify the focus of attention within the group and compare this between the first fifteen minutes of the first session and the middle of the final session. The first excerpt is also the focus of our proof of concept below. In what follows, we describe the development of the algorithms for learning tracking and the application to this data. Many algorithms have been developed for human tracking. Figure 1 shows the main features of three core models adopted in human tracking.

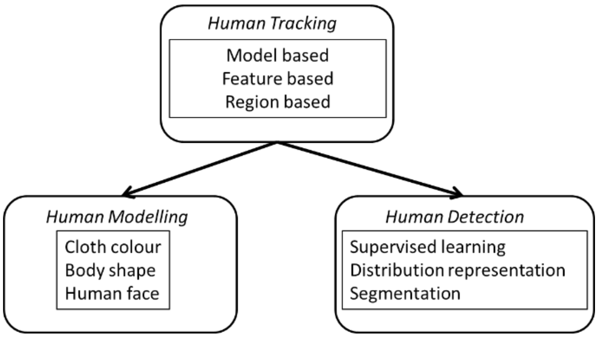

Figure 1. Functional diagram for human tracking.

As observed from Figure 1, human tracking is traditionally presented using a top-down approach, which consists of three modules. *Human modelling* module characterizes a group of people (or individual people) of interest. Firstly, the target objects (human beings) need to be represented in a specific format; then the module applies different features to characterize the objects, such as cloth color, body shape, or even the faces (Rincon, Makris, Urunuela, & Nebel, 2011, Feng, Guan, Xu & Tan, 2009, Ramanan, Forsyth & Zisserman, 2007). *Human detection* module involves the identification of the human beings in the given video frames. The identification module can either be provided in the initialization stage only or be integrated into the tracking algorithm. A variety of algorithms can be employed for identification, such as, supervised learning, distribution representation and segmentation (Yang, Bouzerdoum, & Phung 2010). *Human Tracking* module brings human modeling and human representation together to look for the target object of interest. According to the target representations, existing human tracking techniques can be classified as model-based, feature-based, and region-based tracking. Model-based tracking generally detects the human model in a video sequence. The commonly-used models are human body and face. Feature-based tracking employs various features, such as skin color, texture, and edge. Finally, region-based methods track the moving target in the forms of blobs, or body parts. We refer the readers to (Hu, Tan, Wang & Maybank, 2004) for a more comprehensive survey on human object tracking.

The performance of the tracking method using only one type of target representation is easily influenced by environmental noise including illumination changes, image blur, or camera movements. To improve the tracking performance, in this paper, a hybrid tracking technique is employed by combing the Hue Saturation Value (HSV) color feature, Mean Shift algorithm (Cheng, 1995) and Kalman filter (Kulkarni & Vargantwar, 2014). More precisely, the HSV color feature is employed to describe colors in terms of their shade and brightness. Then we apply the Mean Shift algorithm on the HSV feature to identify the exact human positions in the current frame. Next the Kalman filter is further employed to search for human in the next frame. The employed tracking technique is also illustrated in Figure 2.

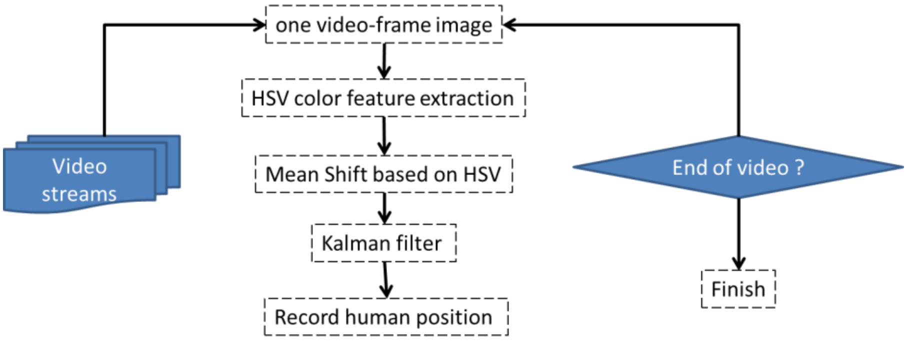

Figure 2. The employed human tracking technique

Results and discussion

The previous analysis of this group focused on the roles that emerged within the group (leader, synthesizer, online tool specialist, and coordinator), with evidence from the discourse as well as gaze of how these roles developed over the five weeks (Thompson et al., 2013). The current results demonstrate movement of the students in their very first encounter (see Figure 3). The student represented by the red line (at the laptop) becomes the online tool specialist. The student represented by the green line becomes the coordinator. The student represented by the blue line becomes the group leader, and the student sitting at the keyboard who does move during this segment becomes the synthesizer. In this first segment, the previous analysis showed that the students represented by the green and blue lines were the focus of other team members' attention, but were not in control of the tools that drew the others' gaze, so we assumed that this was due to their verbal contribution. When we examined patterns in their gaze in the original analysis, it was clear that the learners were focused on different objects, with little convergence. This is consistent with their movement, with different patterns of movement also clear in Figure 3.

These results indicate four distinctly different patterns of movement in the learning space indicative of the group's collaborative process. Of the four students, two have clearly wider-ranging patterns of movement, while the other two were more stationary (one responsible for the displays on the whitewalls, the other a focus of attention due to verbal contributions). Such patterns of movement have implications for the types of resources introduced by teachers into the learning environment. For example, the sitting student has not moved because of the nature of their task. This may be a function of the keyboard they are using and placement of other surfaces they can use to work. If they are stationary, it is possible that their contribution to the discussion is limited. An awareness of movements, in relation to tasks and roles performed by students may have implications for the effectiveness of learning designs, group roles, how teachers frame group tasks and configure the learning space. Understanding how the space was used, its relation to other information we have about the group, such as how roles and social interactions change over time, informs teachers' knowledge of how to effectively configure and facilitate groups in new learning spaces. What we can see from this is that at this early stage in their teamwork, the students were not collaborating around a shared representation physically. They were not gathered around the table, or the whitewall. From the beginning, their movement was separate, their movements were dispersed throughout the space and the roles that they adopted in the group reflected these behaviours. A similar representation of their final face-to-face meeting would indicate very little movement, with all gathered around the far whitewall, stationary on chairs as they focused on their individual roles in creating the shared assignment.

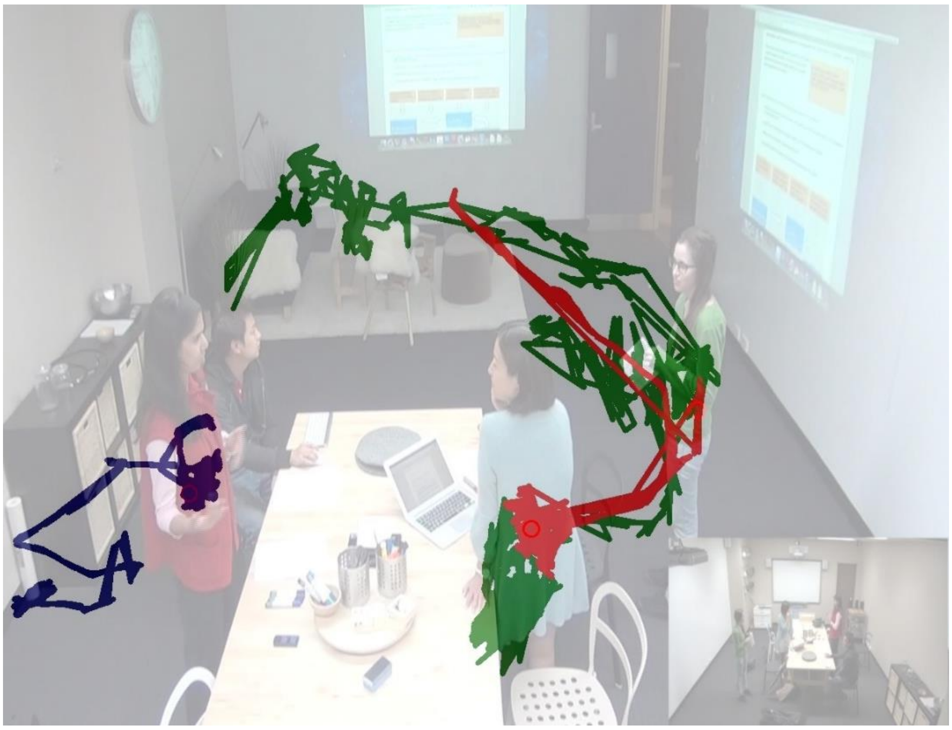

Figure 3: results of the application of the learning tracking algorithm

Future work will better represent these changes over time, and will include more complex learning spaces. Here we have presented analysis of a single group, to test our approach. However, the classroom is a much more complex and dynamic space. Our methods will need to be further developed to handle multiple groups and a teacher. As we examine different groups and in a variety of contexts, we will be able to identify patterns of movement and use that can be firstly used to prompt further and deeper investigation, and secondly used to be able to identify patterns of behaviour to help with orchestration in such spaces. To support better learning designs, fine-tune and provide feedback to students in real-time, it is necessary to start to develop findings and methods in a predictive fashion.

We introduced this paper with reference to the recent investment by universities in new learning spaces, as well as the importance of graduate attributes, such as teamwork, interpersonal skills, and creativity. These findings, while preliminary, suggest that the motion of learners could be indicative of roles and progress through a task in a way useful to orchestration by a teacher. They point to students' dispersed behaviour patterns, guided by their task and role, which is made possible by the open-learning space. In a more traditional classroom, students would be situated in relation to the work, likely including table and/or digital device. The more traditional space is where teachers would have experience and would frame their learning designs. Identifying behaviours and patterns that may influence or relate to learning in new spaces can inform and support teachers' new learning designs, guide decisions on resources to include in these spaces and expectations for student's roles and collaborations.

References

Aguiar, E., Ambrose, G. A., Chawla, N. V., Goodrich, V., & Brockman, J. (2014). Engagement vs Performance: Using electronic portfolios to predict first semester engineering student persistence. *Journal of Learning Analytics*, 1(3), 7-33.

Amedeo, D., R. G. Golledge, and R. J. Stimson. 2009. Person Environment Behavior Research: Investigating Activities and Experiences in Spaces and Environments. New York, NY: Guilford.

Brooks, Walker & Baepler, 2014. Overview. New Directions for teaching and learning

Cheng, Y (1995). "Mean shift, mode seeking, and clustering", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 17(8): 790-799.

del Rincon, J. M., Makris, D., Urunuela, C. O. & Nebel, J. C. (2011). Tracking human position and lower body parts using Kalman and particle filters constrained by human biomechanics. *IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics*, 41(1):26–37.

Dillenbourg, P., Jarvela, S., & Fischer, F. (2009). The evolution of research on computer-supported collaborative learning: From design to orchestration. In N. Balacheff, S. Ludvigsen, T. Jong, A. Lazonder, & S. Barnes (Eds), *Technology-enhanced learning,* pp. 3-19. New York: Springer.

Feng, S., Guan, Q., Xu, S. & Tan, F. (2009). Human tracking based on mean shift and Kalman filter. *In Proceedings of International Conference on Artificial Intelligence and Computational Intelligence*, volume 3, pages 518–522.

Frawley, J. K., Dyson, L. E., Tyler, J. & Wakefield, J. (2015). Building graduate attributes using student-generated screencasts. In *Australasian Society for Computers in Learning and Tertiary Education*, pp. 100-111, Perth, Australia.

Goodyear, P., Jones, C., Thompson, K. (2014). Computer-supported collaborative learning: Instructional approaches, group processes and educational designs. In J. M. Spector, M. D. Merrill, J. Elen, M. J. Bishop (Eds.), Handbook of research on educational communications and technology, (pp. 439-451). New York: Springer.

Hu, W., Tan, T., Wang, L. & Maybank, S. (2004). A survey on visual surveillance of object motion and behaviors. *IEEE Transactions on Systems, Man, and Cybernetics, Part C: Applications and Reviews*, 34(3):334–352.

Jeong, H. & Chi, M. T. H. (2007). Knowledge convergence and collaborative learning. *Instructional Science*, 35, 287-315.

Kulkarni, A., Vargantwar, M. (2014) Video Based Tracking with Mean-Shift and Kalman Filter, *International Journal of Engineering Research & Technology* (IJERT), 3(5): 1271-1274.

Macfadyen, L., & Dawson, S. (2010). Mining LMS data to develop an "early warning system" for educators: A proof of concept. Computers and Education, 54, 588-599.

Martinez-Maldonado, R., Goodyear, P., J.Kay, Thompson, K., and Carvalho (2016) An Actionable Approach to Understand Group Experience in Complex, Multi-surface Spaces. *SIGCHI Conference: Human Factors in Computing Systems, CHI 2016, 2062-2074.*

Martinez-Maldonado, R., (2016). Seeing Learning Analytics Tools as Orchestration Technologies for Learning Activities Across Physical and Digital Spaces. In *International Conference on Learning Analytics and Knowledge, (LAK 2016)*, Edinburgh, UK. 2016, pages 70-73.

Prieto, L. P., Dlab, M. H., Gutierrez, I., Abdulwahed, M., & Balid, W. (2011). Orchestrating technology enhanced learning: A literature review and a conceptual framework. *International Journal of Technology Enhanced Learning,* 3(6), pp. 583-598.

Raca, M. & Dillenbourg, P. (2014). Classroom social signal analysis, *Journal of Learning Analytics,* 1(3), 176-178.

Raca, M., Tormey, R. & Dillenbourg, P. (2013). Student motion and its potential as a classroom performance metric. *3rd International Workshop on Teaching Analytics (IWTA).*

Ramanan, D., Forsyth, D. A. & Zisserman, A. (2007). Tracking people by learning their appearance. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 29(1):65–81.

Schneider, B. & Pea, R. (2015). Does seeing one another's gaze affect group dialogue? A computational approach. *Journal of Learning Analytics,* 2(2), 107-133.

Thompson, K. (2013). Using micro-patterns of speech to predict the correctness of answers to mathematics problems: An exercise in multimodal learning analytics. International Conference on Multimodal Interaction, ICMI 2013, New York City, New York: ACM Digital Library

Thompson, K., Ashe, D., Carvalho, L., Goodyear, P., Kelly, N., Parisio, M. (2013). Processing and Visualizing Data in Complex Learning Environments. American Behavioral Scientist, 57(10), 1401-1420.

Wise, A. F., Zhao, Y., & Hausknecht, S. N. (2014) Learning analytics for online discussions: Embedded and extracted approaches. *Journal of learning analytics,* 1(2), 48-71.

Yang, J., Bouzerdoum, A., Phung, S. L. (2010). Dimensionality reduction using compressed sensing and its application to a large-scale visual recognition task, *International Joint Conference on Neural Networks* (IJCNN 2010), 1-8.

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Designing and Analysing STEM Studios for preservice teacher education

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There is a need for approaches to understand the teaching and learning of STEM and STEAM in schools in order to prepare preservice teachers for innovative classroom practice. In this paper we use a combined design approach to examine the activity of school students, preservice teachers and graduate STEAM students in two STEM Studios at a University in Queensland. We present our revised conceptual model based on earlier iterations as part of an OLT funded project. Multimodal learning analytics approaches will be applied in order to understand the integration of knowledge processes, epistemic cognition, collaboration and tool use.

Keywords: STEM Studio, preservice teacher education, learning analytics, design based research

Introduction

STEM Studios or makerspaces provide interested students and community members with space, resources and expertise to create technology-based solutions. In STEM Studios, coding and programming are authentically linked to robotics, electronics, and more complex creative work. In parallel with, and to support, the integration of the Australian Curriculum in Technologies (ACARA, 2016), makerspaces have the potential to support interdisciplinary, creative, collaborative problem solving for school students and teachers. In order to prepare primary and secondary preservice teachers for this challenge, we need to understand STEM Studios as complex learning environments, where multiple knowledge building processes, social interactions and specialist tool use need to interact in order to complete an open-ended, evolving task. We invited school students from local schools to work on projects for a STEM competition at two STEM Studios located on Queensland University campuses, outside normal school hours, one afternoon a week, for eight weeks. In order to understand the relationship between design, learner activity, and learning outcomes, we are taking a combined design approach (Thompson, Gouvea & Habron, 2016). This combined design approach draws on Sandoval's (2014) conjecture mapping to guide the design based research, and Carvalho & Goodyear's (2014) activity centred analysis and design (ACAD) framework to guide the analysis of the design in relation to activity and learning outcomes. In the context discussed in this paper, learners include *school students* (using a STEM Studio as an after school club), *preservice teachers* (volunteering at the STEM Studio), as well as *graduate students* (volunteering from science, engineering and the arts).

Multiple sources of data including video, audio, screen capture, as well as physical artefacts, and questionnaires and interviews (Thompson, Ashe, Carvalho, Goodyear, Kelly & Parisio, 2013) will be collected. Data will be extracted to examine gaze (e.g. Worsley & Blikstein, 2015), movement (e.g. Raca & Dillenbourg, 2014; Raca, Tormey & Dillenbourg, 2013), discourse (e.g. Thompson, 2013), and artefact creation (e.g. Oviatt & Cohen, 2014) in order to understand the integration of knowledge processes, epistemic cognition, collaboration, and tool use. The ultimate aim of the research is to understand a) the complex nature of school students' learning in such spaces; b) implications for preservice teacher practice; c) scientists' appreciation of communication of STEAM practices and concepts; and d) to refine the STEM studio model for its inclusion as a formal course for preservice education students. In this paper, we present our initial conceptual model of the project, based on research from previous iterations of the STEM Studio project.

The STEM Studio approach builds on recent research (Brandt, Cennamo, Douglas, Vernon, McGrath & Reimer, 2013; Gershenfeld, 2005; Blikstein, 2013) as well as ongoing work by members of the project team as part of the OLT funded STEP-UP project (www.stepup.edu.au). Makerspaces (Rosenfeld Halverson, & Sheridan, 2014), FabLabs (Gershenfeld, 2005; Blikstein, 2013), and STEM Studios (Brandt et al., 2013) are informal spaces, for community members, or after-school clubs (Evans, Lopez, Maddox, Drape, & Duke, 2014), that provide opportunities for students to learn through the creation of innovative solutions. It is an effective learning environment in informal (e.g. Brandt et al., 2013; Evans et al., 2014), and formal contexts (e.g., Blikstein, 2013;

Loristen Girls School, 2016), however the role of the teacher and the complex nature of the learning in these contexts have not been investigated.

In this STEM Studio approach, we encourage preservice teachers to consider an interdisciplinary approach to problem solving (Pennington, 2016). This interdisciplinary approach to teaching encourages a wide variety of knowledge and skills drawn from the Sciences (technology, maths, engineering) and the Arts (literacies, design, humanities) (Brady, 2014; Wintermann & Malacinski, 2015). We need to understand how teachers negotiate these relationships, and how they, and their students, can best be supported in the STEM Studio and outside it. The potential of STEM Studios lies in the intersection of the pedagogical approach, access to resources, and the collaborative nature of the learning. In order to solve a problem, students must integrate the specialised methods of multiple disciplines, negotiate social interactions, and apply this to creative work using new tools. If teachers are to scaffold students through these complex real world dilemmas, we need to understand what productive work in STEM Studios looks like.

Previous iterations of this STEM Studio approach focused on the role of self-efficacy in the practice of preservice teachers. Bandura (1977) defines self-efficacy as one's belief in their own ability to achieve a task. Based on work within social cognitive theory (Bandura, 1997) it acknowledges an interactive dynamic between beliefs, attitudes and opinions (our cognition) and our performance on a task (our behaviour). Whilst the impact of students' self-efficacy has been shown to be predictive of study behaviour (Zimmerman, Bandura & Martinez-Pons, 1992) as well as academic outcomes (Multon, Brown & Lent, 1991), a focus on teacher self-efficacy in the literature has been a more recent phenomenon (e.g., Fives, Hamman & Olivarez, 2007; Martin, Sass & Schmitt, 2012; Wheatley, 2005). Measurements of teacher self-efficacy are also suitable for the current study of pre-service teachers as direct measurements of the ability to teach in authentic contexts cannot be observed and previous studies (Albion, 1999) have shown self-efficacy ratings are a reliable predictor of future performance. The Norwegian Teacher self-efficacy scale (Skaalvik & Skaalvik, 2010) was chosen as the validated instrument to measure pre-services teacher self-efficacy pre- and post-intervention.

Methods

In this iteration of the STEM Studio approach, there are two informal learning environments, each on one of two university campuses at a Queensland University. School students can work on STEAM (Science, Technology, Engineering, Arts and Mathematics) projects outside normal school hours with the help of preservice teacher education students, graduate science and arts students, and researchers. Our research focuses on (1) *school students*, aged between 12-16 years, who wish to enter projects into a STEM competition; (2) *preservice teacher* volunteers; and (3) STEAM *graduate student* volunteers.

Multiple sources of data (video, audio, screen capture, as well as physical artefacts, and questionnaires and interviews) will be collected to examine gaze, movement, discourse, and artefact creation (e.g., coding, drawing). We aim to use these analyses to understand the integration of knowledge processes, epistemic cognition, collaboration, and tool use. This work will build on research in the application of automated and semi-automated methods to understand learner and instructor activity in complex learning environments (e.g. Martinez-Maldonado, Goodyear, Kay, Thompson & Carvalho, 2016; Thompson, Ashe, Carvalho, Goodyear, Kelly & Parisio, 2013; Raca & Dillenbourg, 2013; Worsley & Blikstein, 2015). In multimodal learning analytics (Blikstein, 2013), multiple modes of activity are considered, and a more systemic view of a learning situation is adopted as the results of the analyses are recombined in order to develop a model of understanding (Thompson, 2013). This research aims to be *actionable*, developed in combination with practitioners, with the aim of being able to use it to make decisions (Beardsley, 2011).

Results and Discussion

The STEM Studio project was first conducted in 2015 as one of three approaches under an OLT funded project to improve STEM Teacher Education. In the first iteration, training was provided in inquiry approaches, and in the tools used for communication between participants outside of face-to-face meetings. This first iteration focused only on preservice teachers, and relied on measuring changes in teaching self-efficacy. A comparison of preservice teacher teaching self-efficacy using the Norwegian Teacher Self Efficacy scale (Skaalvik & Skaalvik, 2010), pre- and post-intervention showed significant differences in three scales: (1) perceived ability to adapt instruction to individual needs; (2) maintain discipline; and (3) cope with change, all with medium effect sizes (Cohen, 1988). Researcher observations from the other STEM Studio approaches indicated that the inclusion of graduate students and other academics as STEM experts was successful. Based on these findings, as well as the need to better understand the activity of learners and preservice teachers that occurred during the STEM Studio sessions, the design of the research was modified for the 2016 iteration of the project.

We present the new design using the combined design approach (Thompson, Gouvea & Habron, 2016) in Figure 1 below. There are four key changes to the design of the research. First, we expanded our definition of "learners" beyond preservice teachers to include the graduate students, and school students. Broadening this definition means that design elements now include training for preservice teachers and graduate students in all inquiry approaches, as well as in the tools for collaboration. Second, we consider constructionism (Papert, 1980) and elements of interdisciplinary problem solving (Pennington et al., 2016) to be core to the processes of knowledge construction. Third, we expanded the physical and digital learning environment to include tools for technology and engineering (more commonly aligned with 'makerspaces' (Rosenfeld-Halverson & Sheridan, 2014)). Finally, we expanded our analysis to include the activity of all learners.

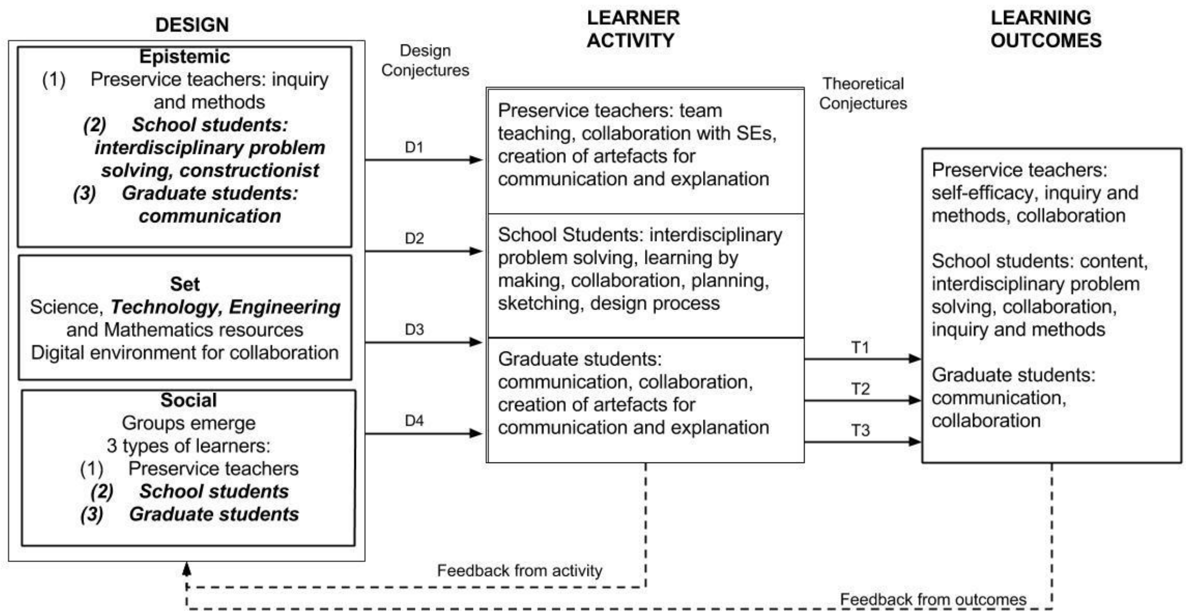

Figure 1: Iteration 2 of STEAM Room

In Figure 1, design (D1-D4) and theoretical (T1-T3) conjectures are identified relating to the role of school students, preservice teachers, and graduate students. The design conjectures are that:

> (D1) Graduate students will collaborate with other learners to help identify appropriate methods of inquiry;
> (D2) Preservice teachers will collaborate with graduate students to help communicate concepts and methods of inquiry to school students;
> (D3) The expanded physical environment will provide opportunities for new ways of explaining; and
> (D4) The interdisciplinary approach will facilitate collaboration between learners.

The theoretical conjectures are that:

> (T1) Training and its application will improve self-efficacy for preservice teachers;
> (T2) The interdisciplinary approach will improve preservice teachers' collaboration skills; and
> (T3) Graduate students' mentoring skills, communication skills, and collaboration skills will improve.

We also expect to be able to describe the interactions between school students, preservice teachers, and graduate students using the multimodal learning analytics described earlier. Previous work has focused on the analysis of discourse to identify patterns of idea generation (Thompson, Ashe, Yeoman & Parisio, 2013), and problem solving (Thompson, 2013). We aim to add to this by examining the role of the creation of mediating artefacts in the creation of STEM solutions. We also aim to investigate STEM and STEAM as a process of interdisciplinary problem solving, and the role of the integration of different perspectives in the creation of solutions.

Conclusions

There is a need for approaches to understand and design for the teaching of STEM and STEAM in schools in authentic and integrated ways. Investigating the detail of how a studio approach to learning and teaching STEM in an informal context has the potential to give us insights into how and what to integrate into classroom practice. By using the combined design approach, we aim to conduct ongoing, design-based research into the relationships between design, learner activity and learning outcomes. In addition, the use of multimodal learning analytics techniques will build on work that aims to apply a synthetic, systems approach to understanding complex learning environments. This will have implications for the opportunities for learning that we provide for our preservice teachers, to best equip them for innovative classroom practice.

References

ACARA (2016). Technologies Curriculum, F-10. http://www.australiancurriculum.edu.au/technologies/introduction, accessed 8th August, 2016.

Albion, P. (1999). Self-efficacy beliefs as an indicator of teachers' preparedness for teaching with technology. Presented at, the 10th International Conference of the Society of Information Technology and Teacher Education, 28 February - 4 March, 1999, San Antonio, TX, USA.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review*, 84, 191-215.

Beardsley, T. M. (2011). Pulling at a tangled web. *BioScience*, 61(11), p. 843.

Blikstein, P. (2013). Digital Fabrication and 'Making' in Education: The Democratization of Invention. In J. Walter-Herrmann & C. Büching (Eds.), *FabLabs: Of Machines, Makers and Inventors.* Bielefeld: Transcript Publishers.

Bilkstein, P. (2013). Multimodal Learning Analytics. *LAK 2013*, pp. 102-106.

Brady, J. (2014) STEM is incredibly valuable, but if we want the best innovators then we must teach the arts. *Innovation*, 5, pp. 1-5.

Brandt, C. B., Cennamo, K., Douglas, S., Vernon, M., McGrath, M. & Reimer, Y. (2013). A theoretical framework for the studio as a learning environment. *International Journal of Technology Design Education*, 23, pp. 329-348.

Brouwers, A., & Tomic, W. (2000). A longitudinal study of teacher burnout and perceived self-efficacy in classroom management. *Teaching and Teacher Education*, 16(2), 239-253.

Carvalho, L., & Goodyear, P. (2014). *The architecture of productive learning networks.* New York, NY: Routledge.

Cohen, J. W. (1988). *Statistical Power Analysis for the Behavioural Sciences (2nd Ed)*, Hilldale, NJ: Lawrence Erlaum Associates.

Evans, M. A., Lopez, M., Maddox, D., Drape, T., & Duke, R. (2014). Interest-driven learning among middle school youth in an out-of-school STEM Studio. *Journal of Science Education and Technology*, 23, pp. 624-640.

Fives, J., Hamman, D., & Olivarez, A. (2007). Dos burnout begin with student-teaching? Analysing efficacy, burnout, and support during the student-teaching semester. Teaching and Teacher Education, 23, 916-934.

Gershenfeld, N. (2005). *Fab: The coming revolution on your desktop—From personal computers to personal fabrication.* New York: Basic Books.

Lauriston Girls School (2016). *The pioneer of the FabLab@School program is coming to Lauriston.* https://www.lauriston.vic.edu.au/about/lauristons-fablab-school (accessed 25/05/2016).

Martin, N. K., Sass, D. A., Schmitt, T. A. (2012). Teacher efficacy in student engagement, instructional management, student stressors, and burnout: A theoretical model using in-class variables to predict teachers' intent-to-leave. Teaching and Teacher Education, 28, 546-559.

Martinez-Maldonado, R., Goodyear, P., Kay, J., Carvalho, L. & Thompson, K. (2016). An Actionable Approach to Understand Group Experience in Complex, Multi-surface Spaces. *CHI'16*, May 07-12, 2016, San Jose, CA, USA.

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. Journal of Counselling Psychology, 38(1), 30-38.

Oviatt, S. & Cohen, A. (2014). Written activity, representations and fluency as predictors of domain expertise in mathematics. *Proceedings of the 16th International Conference on Multimodal Interaction*, pp. 10-17.

Pennington, D., Bammer, G., Danielson, A., Gosselin, D. C., Gouvea, J., Habron, G., Hawthorne, D., Parnell, R. A., Thompson, K., Vincent, S., & Wei, C. (2015) The EMBeRS project: Employing model-based reasoning in socio-environmental synthesis. *Journal of Environmental Studies and Sciences*, October

Raca, M. & Dillenbourg, P. (2014). Classroom social signal analysis, *Journal of Learning Analytics*, 1(3), 176-178.

Raca, M., Tormey, R. & Dillenbourg, P. (2013). Student motion and its potential as a classroom performance metric. *3rd International Workshop on Teaching Analytics (IWTA).*Rosenfeld Halverson, E. & Sheridan, K. M. (2014). The maker movement in education. *Harvard Educational Review*, 84(4), pp. 495-504.

Sandoval WA (2014) Conjecture mapping: An approach to systematic educational design research. *Journal of the Learning Sciences, 23,* 18–36.

Skaalvik, E. M. & Skaalvik, S. (2010). Teacher self-efficacy and teacher burnout: A study of relations. *Teaching and Teacher Education*, 26, 1059-1069.

Thompson, K. (2013). Using micro-patterns of speech to predict the correctness of answers to mathematics problems: An exercise in multimodal learning analytics. International Conference on Multimodal Interaction, ICMI 2013, New York City, New York: ACM Digital Library

Thompson, K., Ashe, D., Carvalho, L., Goodyear, P., Kelly, N., Parisio, M. (2013). Processing and Visualizing Data in Complex Learning Environments. American Behavioral Scientist, 57(10), 1401-1420.

Thompson, K., Ashe, D., Yeoman, P., & Parisio, M. (2013). Phases of design: Following idea development and patterns of collaborative discussion in a learning by design project. The 10th Int'l conference on Computer Supported Collaborative Learning, Madison, Wisconsin, pp. 494-501.

Thompson, K., Gouvea, J., & Habron, G. (2016). A design approach to understanding the activity of learners in interdisciplinary settings: Environment and Diversity. *To be presented at the International Conference of the Learning Sciences, June 19-24, Singapore, 2016.*

Wintermann, B. & Malacinski, G. (2015) Teaching evidence-based innovation as a transdisciplinary professional skill in an undergraduate biology writing workshop. *International Journal of the Arts and Science*, 8(2) p. 423.

Worsely, M. & Blikstein, P. (2015) Leveraging multimodal learning analytics to differentiate student learning strategies. *Proceedings of the Fifth international conference on learning analytics and knowledge,* pp. 360-367.

Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. American Educational Research Journal, 29(3), 663-676.

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Learners Multitasking (Task Switching) during a Virtual Classroom session. Should teachers be concerned?

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The use of virtual classrooms (VC) in the Vocational Education and Training (VET) sector is becoming increasingly popular due to the ability for learners from any location to access education online in real time with a teacher, and to participate in an environment that simulates a face to face classroom. However, a major area of concern that has emerged is the tendency for learners to multitask (task switch) rather than remain attentive and focused on the content being delivered. This paper reports on findings from a study which investigated whether learners are task switching while participating in a VC and whether this affects the teaching and learning that occurs.

Keywords: Virtual classrooms, multitasking, task switching, learner engagement, Vocational Education and Training (VET).

Introduction to Task Switching

Helping learners to "pay attention" has always been a major focus for educators. The ability to focus the mind is a prerequisite to learning and a basic element in classroom motivation and management. However, one important feature that is becoming more prominent in education is the prevalence of learners to do two things at once. This is a particular issue with today's youth, who have grown up with the internet and are media task switchers who switch between watching television, texting, making a posting on their Facebook page and studying.

There is much debate about the definition of multitasking and even whether human multitasking is possible. Rosen (2008) a fellow at the US Ethics and Public Policy Centre claimed that "when we talk about multitasking we are really talking about attention: the art of paying attention, the ability to shift our attention and more broadly to exercise judgment about what objects are worthy of our attention" (2008, p. 109).

Gasser and Palfrey (2009) conducted research as part of the Digital Natives project conducted at Harvard University. They contended there are two types of multitasking:

- Parallel processing – this is defined as doing two things at once; however, one task is usually automatic for example reading a book while listening to music
- Task switching (divided attention) – this is defined as the process of rapidly changing from one task to another for example reading a book and responding instantly to a text message (Gasser & Palfrey, 2009).

This article will focus on the area of task switching or the issue of dividing attention as this is the area that concerns learners using the VC.

General Literature on Task Switching

The last decade of research has discovered that learners are often task switching. Research conducted by McMahon and Pospisil (2005) found that 'multitasking' was evident, with two thirds of the learners reporting that they task switch and have lots of things "on the go" at once. A more recent Australian study by Judd (2014) investigated 3372 computer session logs of 1279 university learners. Judd found that 70% of sessions involved some 'multitasking'.

While it is becoming clear that current learners are task switching there is also mounting evidence that task switching has an effect on learners' ability to accomplish tasks effectively, with studies recording a reduction in performance levels and/or an increase in errors (Ralph et al., 2014; Kirschner & van Merriënboer, 2013; Junco & Cotten, 2011; Lin et al., 2009; Ophir et al., 2009; Strayer, 2001) and a reduction in knowledge retention (Levitin, 2015; Risko et al., 2013). There is also evidence that task switching may have a negative effect on the time taken to complete a task (Bowman et al., 2010; Judd, 2014; Gasser & Palfrey, 2008; Rubinstein et al., 2001).

Reduction in performance levels and increase in errors

Research by Strayer (2001) confirmed that talking on the phone while driving a car is as dangerous as driving while intoxicated. Findings included decreased attention and increased reaction time so that drivers missed half the things they would normally see, like billboards or pedestrians. This study has convinced many countries, including Australia, that using a mobile phone while driving is dangerous and many have subsequently made it illegal. This is a strong argument that task switching has a negative effect on performance.

A Stanford University study conducted by Ophir, Naas and Wagner (2009) put 100 learners through a series of three tests to investigate what happens to people who 'multitask'. The research found that people who are regularly bombarded with several streams of electronic information do not pay attention, control their memory or switch from one job to another as effectively as those who prefer to complete one task at a time.

Lin et al. (2009) studied media 'multitasking' capabilities by comparing novice and expert reading skills in both 'multitasking' and monotasking conditions. Findings confirmed that all participants performed worse in the test 'multitasking' condition. These findings are supported by a study by Junco and Cotten (2011) who examined the effects of learners 'multitasking' while doing their schoolwork on their grade point average (GPA). This study found that learners who task switched (for example Facebooking and/or texting while doing schoolwork) did achieve a lower GPA and argued that regular task switching can have a negative impact on academic performance.

Kirschner and van Merriënboer (2013) argued that people are not capable of 'multitasking' and can at best switch from one activity to another. They claimed that switching requires a person to juggle her or his limited cognitive resources to accomplish the different tasks successfully. This juggling leads to greater inefficiency in performing each individual task, namely, that more mistakes are made and it takes significantly longer as compared to sequential work (2013, p. 172). A further study by Ralph et al. (2014) found that media 'multitasking' leads to an increase in attention related errors.

Reduction in knowledge retention

A more recent research into learners task switching in education is that of Risko, Buchanan, Medimorec & Kingstone (2013) who researched learners engaging in media non-lecture related activities while participating in a lecture. Sixty- four United States university learners were observed, and results demonstrated that engaging in these activities takes attention away from the lecture and this impairs retention of lecture material. They argued that "one of the greatest challenges is to better understand, given our knowledge of the demands of dual tasking, how the distraction posed by this technology influences educational outcomes" (2013, p. 2).

Levitin (2015) argued that task switching comes at a neurobiological cost. It depletes essential neuro-resources that are needed for actually doing things and thinking things. He explained that if children text message and study at the same time, the information from their schoolwork goes into the striatum, a brain region that stores new procedures and skills, rather than facts and ideas. If there is no distraction, however, the information goes into the hippocampus, where it is catalogued in a variety of ways, making it easier to retrieve.

Increase in time taken to complete tasks
Rubinstein, Meyer and Evans (2001) conducted extensive research which involved participants alternating between different tasks or performing the same task repeatedly. The findings revealed that participants lost time or made errors when they had to switch from one task to another. Gasser and Palfrey (2008) argued that task switching increases the amount of time needed to finish a task. They further argued that it may be impossible to prevent learners task switching. Rather, they believed educators should help learners take control of their learning by educating them about the negative effects of task switching. Judd (2015) supported this argument about the importance of educating learners and suggested learners should be given guidance and tips on how to influence their study habits and better manage their study time.

Bowman et al. (2010) examined the effects of learners using instant messaging while in a classroom. The results indicated that while learners think they are accomplishing more when task switching, findings suggest that they will actually need more time to achieve the same level of performance on an academic task. Judd (2014) found that all evidence indicates that 'multitasking' is more likely to negatively, rather than positively, impact on learning. He argued that "more time and effort will be required to result in the same level of memory encoding, and learning, during a 'multitasking' session than a focused or sequential one" (2014, p. 366).

Virtual Classroom Research on Task switching

The above research clearly shows that the tendency by learners to task switch can impede their learning. One of the first studies of learner task switching in VCs was conducted by the eLearning Guild (2005) in a report focusing on the current trends in e-learning. The Guild surveyed 4200 respondents asking if they task switched (term used in the question was 'multitasking') during a VC session and only 13% said "rarely" or "never" while exactly half (50%) said "always" or "often". The survey also polled the respondents if they thought this task switching (term used in the question was 'multitasking') interfered with their learning, with 14% reporting it did "always" or "often", 52% reporting sometimes and only 31% reporting that it "rarely" or "never" interferes.

In 2011 a United Kingdom research study into virtual learning (Towards Maturity, 2011) asked respondents what they believed were major barriers to adoption of the VCs and 28% listed the issue of users 'multitasking' in training. (Towards Maturity 2011, p. 14). While no other statistics could be found about task switching, many VC practitioners discuss the importance of discouraging learners from task switching. Clark and Kwinn (2007) argued that the main frustration with the virtual classroom environment is 'multitasking'. No matter how engaging you are as an instructor, you must still battle the learner's constant temptation to check emails and multitask (2007, p. 5). Courville (2010) argued that "the reality is that today's audience is 'multitasking' during your presentation, perhaps even twittering about it in real time. Assume they're 'multitasking' (2010, p. 149). Clay (2012) argued that you "must engage learners repeatedly to keep them from 'multitasking' (2012, p. 3).

The Research Study - Encouraging Learner Interaction, Engagement and Attention in the Virtual Classroom (an investigation into the phenomenon of multitasking)

There is very limited research literature about the issue of learners multitasking while participating in a VC and no research available on this issue in the VET sector. This paper reports on a doctoral study which aimed to add to this body of research by investigating the phenomena of VET learner's task switching in virtual classrooms sessions and if this did affect the teaching and learning that occurred.

The study was conducted at the Canberra Institute of Technology (CIT). At the time of the study, CIT was a large multi-campus institute comprising five teaching colleges situated across six campus locations in the Australian Capital Territory in Australia. CIT is a part of Australia's Vocational Education and Training system (VET) and delivers qualifications ranging from Certificate 1 to Bachelor degrees under the Australian Skills Quality Authority (ASQA). It is a registered training organization (RTO). Twelve individual case studies were analysed, each comprising one teacher and their learner cohort in their use of the Virtual classroom (Wimba was the platform used). Note – complete data was collected from only 6 of the case studies. A design based methodology involving two iterations was conducted, with the first being held in semester 2, 2011 and the second in semester 1, 2012. A mixed methodology was selected to ensure the richness of the data. Instruments for data collection included an entry and exit survey for teachers and learners, an end of session poll from the learners, a blog journal from the teachers, an e-diary from the researcher, a Wimba analytic tracking log, a detailed session observation tool and interviews from support staff.

The first section of the Task Switching research investigated the following:
- Are learners task switching in virtual classroom sessions and if so how much?
- What task did the learners switch to while attending a VC session?
- Which part of the session were the learners least engaged?

The second section of the study explored methods and strategies teachers can employ to focus learner attention on the relevant learning activity and limit their tendency to engage in distracting activities.

Findings

Are Learners Task Switching and if so how much?

The following Table 1 records the level of task switching the learners reported during the VC sessions.

Table 1: Learner task switching frequency.

Case study	Results of learner end of session poll	Results of learner exit survey	Average numbers of task switchers
1	43%	100%	71.5%
2	40%	75%	57.5%
7	100%	50%	75%
8	87%	100%	93.5%
9	64%	71.5%	67.7%
10	88%	NA	88%

N/A = not applicable

- The above results indicate that learner's task switched with an average percentage of 75.5% across all case studies (the above data was collected from six teachers, 72 responses from the end of session poll from the learners and 27 learners completing the exit survey). Therefore, the answer to this question is yes, approximately 75% of all learners task switched while participating in a VC session.

What task did the learners switch to while attending a VC?

The following Table 2 displays the tasks learners switched to while attending a VC.

Table 2: Tasks performed by learners during a VC session.

Case Study	Results from teacher exit survey	Results from learner end of VC poll	Results from learner exit survey (multiple responses allowed)
1	e, fb	**tp** 33%, **w** 25% **e** 17%, **cri** 17%, **o** 8%	**tp** 50%, **e** 50%
2	e	**w** 60%, **d** 20%, **c** 20%	**e** 50%, **tp** 25% **nts** 50%
7	nts	**fb** and **tp** 100%	**tp** 50%, **e** 50%
8	tp, fb	**tp** 60%, **w** 26%, **tv** 7% **o** 7%	**tp** 25%, e 25%, **fb and tp** 25%, **e and fb** 12.5%, **e, fb, tp and o** 12.5%, **two of the following fb, tp, e)** 25%
9	N/A	**tp** 65%, **w** 21%, **o** 14%	**tp** 20%, **fb** 40%, **e** 20%, **two of the following (fb, tp, e**) 20%
10	tp, fb	**tp** 50%, **w** 20%, **e** 10%, **tv** 10%, **o** 10%	N/A

e = email, fb = Facebook, cri = course related information, o = other, w = included all websites (Facebook, YouTube etc.), tp = text and phone, c = children, tv = television, nts = no task switching, N/A = not applicable

- The most common task listed was the text/phone with the second being email, followed by the websites (including the use of Facebook and YouTube). Other tasks listed including looking after children, having dinner and watching television.

There were issues with correlating these data. When this study commenced, Facebook was still gaining in popularity and therefore the tasks listed in iteration one were different from the tasks listed in iteration two with survey questions changing in iteration two to include Facebook. The questions were also changed from learners able to provide open answers to having to select specific tasks.

The amount of task switching increased from iteration one where the learners recorded an average 64.5% task switching compared to iteration two at 81.05%. This increase in the amount of task switching may have been due to the increase in the use of smart phones and the increase in the use of social media during this time. The researcher suspects if this survey was completed now the use of social media would be the most common task and would include the use of Facebook, Twitter and Instagram. The role of social media should be investigated in further research on task switching.

Which part of the session were the learners least engaged.
Table 3 displays the results from learners and teachers of when they felt they learners were the least engaged.

Table 3: Learner engagement measure.

Case no.	**Results of learner end of poll**	**Results of learner exit survey**	**Marked decline in engagement by learners**			**Results of teacher exit survey**
			Session 1	**Session 2**	**Session 3**	
1	end	middle	NA	1 start, 5 middle 9 end (11 LT)	0 start, 0 middle 5 end (5 LT)	start
2	start	start and end	0 start, 2 middle, 1 end (5 LT)	0 start, 2 middle 3 end (3 LT)	NA	start
7	end	end	0 start, 5 middle 2 end (8 LT)	0 start, 4 middle 0 end (10 LT)	NA	end
8	end	middle and end	1start 2 middle, 6 end (14 LT)	1start 3 middle 2 end (7 LT)	0 start, 3 middle 1 end (7 LT)	middle
9	start	end	1 start, 1 middle 5 end (10 LT)	N/A	N/A	N/A
10	middle	NA	0 start, 1 middle 0 end (2 LT)	2 start, 0 middle 0 end (3 LT)	1 start, 0 middle 0 end (3 LT)	end

LT = learners in total, N/A = not applicable

Case study one learners listed either the end or middle as being the least engaging, and the teacher stating it was the beginning. However, in the two sessions there was a marked decline in participation at the end of the sessions. The teacher changed her delivery methodology for the last session as previously she had encouraged a great deal of interaction with the use of emoticons, chat or group activities on the whiteboard. However, in the last sections of both sessions the delivery methodology was straight lecture slides. This would allude to the importance of encouraging regular interactions to maintain the attention of the learners. The teacher stated that she suspected they were task switching in these last sections but she could not be sure.

Case study two results were more consistent with both learners and teachers listing the beginning as least engaging. However, there was a decline in participation in the middle of one session and the end of the other. The teacher predominantly used a webcam as her main engagement tool rather than slides. This worked well as she was very positive and enthusiastic. However, the researcher suspects if the teacher was less confident or enthusiastic the sessions would not have been so successful. The teacher encouraged participation by inviting learners to use the whiteboard tools and by asking many questions. However, there were times during the session where the teacher called on learners by name and they did not respond. The teacher commented "were they task switching or just trying to work out how to use the tools – hard to tell?" The teacher could have encouraged more attention by regularly using emoticons to ensure the learners were paying attention. The teacher also did not use PowerPoint slides to post information or questions and instead typed on the whiteboard. While she was doing this the learners could easily have switched to another task. The teacher commented that there was "lots of quiet time which can lose the learners [attention] – so should have set time limits, and issue of typing over should have set PPT, or quickly put in lines, or just used chat". She included PowerPoint slides in the second session and this session ran more smoothly than the first.

Case study seven results were also consistent with learners and teachers listing the end as least engaging, although the results show there was a reduction in participation in the middle of both sessions. It was straight after multiple lecture slides in a row with no interactivity that there was a major delay in responses from the learners. One learner started to type text on the slides when not prompted and demonstrated that they were bored. When the teacher asked individuals or the group for responses there were delays at the end of these lecture slides, but there did not seem to be delays at other times. One learner also put up the "speed up" emoticon, which demonstrated that he was becoming bored. There was also a four minute delay while the teacher had to reload slides and directly after this silence one of the learners stated that they had to leave. This may have been due to the delay. All these issues could have been dealt with by asking for emoticons or a tick-yes/cross-no at the end of each slide to ensure the learners remained attentive. The teacher realised after the delay in responses in session one that she needed to make her session more interactive and varied, and for the second session she included more interactivity and a video.

The results from case study eight showed similar perceptions with the learners and teacher as they both listed the middle as least engaging. In sessions two and three there was a very small decline in participation in the middle. The teacher maintained the attention of the learners throughout the session. She was one of the only teachers who believed that learners always task switched and this may have helped the engagement of the sessions as she designed the session to include a great deal of interaction with multiple tools. She regularly called learners by name throughout the session so all learners knew they could be called on at any time. If she sensed they were bored she addressed this by telling them how long there was left to go or what was coming next. She also asked them to use the emoticons and chat. She continuously encouraged the learners when they participated with the tools. This worked well with the international learners, who were hesitant to use tools at the commencement of the sessions, but by the end of the sessions, were interacting with all tools regularly. One learner was disruptive and typed without invitation on a slide and the teacher brought the learner back on task by encouraging him to be active in the lesson by posting up a web link.

Case study nine results had a mix of perceptions with the learners listing the middle as least engaging, the teacher the end, and the data indicating the end of the session. This decline was due to the teacher displaying the webcam and therefore no interaction was required by the learners so these statistics may not be accurate. However, the teacher could have asked for a tick-yes/cross-no to ensure they could view an image correctly and to maintain attention. There was a delay in the session while the teacher was trying to get the USB microscope images working, although, as all learners were aware that this was new innovative technology, they all remained focused on the room. However, they became restless and started using the drawing tools on the displayed whiteboard screen. If this delay occurred regularly the learners could be tempted to task switch.

Results from case study ten once again presented a mix of perceptions, with learners listing the middle as least engaging, the teacher the end and the data marked the middle of one session and the beginning of the other two sessions. These lessons were designed to be lecture based. The teacher maintained attention by adding text regularly to the screen. He asked questions and if no response was given he added a hint, but there were silences while he waited for responses and the learners could have lost focus. He adjusted this for the second and third session and asked individual learners to answer questions. In the second session one learner was called to answer a question and when she did not reply the teacher called on her a second and third time. She then responded with "was on the phone but still listening." The fact she did not hear the teacher calling her name three times could mean she was distracted from the content. During the first session there was a significant delay when the teacher typed text on the screen. This could have allowed learners to task switch. However, the teacher resolved this by writing text one line at a time. The teacher also realised after the first session he required more interactivity to keep the learners focused and did start asking the learners to use the emoticons. He did comment that "one possibility I might try in the future is allow learners to use the whiteboard as well. Just to make the lesson more interactive for them. At the moment, the experience for the learners is pretty passive".

There were issues with the collection of these data. The first was the difference in an exact definition of what constituted the beginning, middle and end of each session. This was not specified to either the teachers or the learners and this may have resulted in incorrect responses. From the researcher's perspective the sessions were equally divided into three sections based on the length of the session. However, this discrepancy may have skewed the results. For example, a section towards the end of the beginning section may have been analysed as the beginning from the perspective of the researcher but may be been seen as the middle from the learners. With the issues in data collection the above statistics cannot conclusively answer the question of when the learners were the least engaged. However, it does suggest that a teacher's perspective can be very different from a learner's perspective.

Summary of Findings

The findings from the data indicated that learners definitely task switched, with 75% of the learners reporting that they did. The most common task listed was texting/using the phone, the second was using email and the third using websites including Facebook and YouTube. This study showed that the section of the session that the learner's task switched varied depending on the teachers, learners and sessions. So the exact time frame could not be conclusively answered. However, the above discussion suggests that the learners appeared to task switch when there was limited interactivity.

The above data suggests that learners were doing other tasks and were therefore not actively participating in and absorbing the content being delivered by the teacher or participating in the discussions. This was highlighted by the learner in case study ten who when called on to participate in the discussion did not hear the teacher ask her the question initially and then admitted she was on the phone. Learners task switching and not paying attention caused a delay in content delivery of the sessions as in some cases the teachers were waiting for responses from these learners.

Solutions - methods and strategies teachers can employ to focus learner attention on the relevant learning activity

- The following solutions were proposed according to the issues that were raised in this study.

Designing for Regular Interactions

- It is critical that teachers design their sessions to include regular interactivity with the learners to maintain attention. This could be as simple as asking for a tick-yes/cross-no, asking the learners to post a comment in the chat or encouraging active participation through a group whiteboard drawing tool activity. From the results of this study CIT now encourage all teachers to have no more than four slides without interaction, e.g. tick or cross, emoticons etc. In addition, teachers are advised that they should not have a slide displayed for longer than four minutes. Another method to gain regular interaction is to call leaners by their names, to avoid delays and to ensure all learners remain attentive when asking questions.

The Importance of Instruction Design
A teacher must recognise the importance of good instructional design when developing a VC session. Particular importance must be placed on the planning of all aspects of the session, including having a session that is well structured and includes clear guidelines and ground rules and uses a variety of delivery methods. Slide design must also be considered and should include frequent slide changes, use of relevant graphic images with limited text, slides that encourage interactivity by the learners, and if possible provide group activities and regular movement on the slides by using tools such as the pointer tool or the drawing tool. A teacher should avoid wherever possible displaying consecutive heavy text lecture slides.

Using additional Platform Plugins

Current virtual classrooms platforms such as Adobe Connect are constantly improving, evolving and incorporating new and additional tools and plugins. Additional Adobe Connect tools currently available to assist engaging learner attention include the 'randomiser'. This tool collects all learner names from an attendee lists and uses a randomised spinner that selects a name. This encourages learners to remain engaged at all times as they cannot anticipate when their names will be called. Adobe Connect also has a tool available at an additional cost called the 'engagement metre'. This tool is a quick way for teachers to view how engaged their learners are during the session.

Use of Nanny Software

- Learners could be encouraged to use "nanny" software. This software can allow the learners to set time restrictions that block web access to certain sites, for example Facebook or email. The learners could set this to block access to these sites during the time they are participating in the VC. Common nanny software programs include K9 Web Protection and Self-Control.

Educating Teachers and Learners about the negative impacts of Task Switching

- The teacher in case study eight commented that she believed the learner's task switched always and therefore made sure she designed for interaction. This highlights the importance of educating teachers that their learners will be task switching and that this task switching can affect the learning experience. It is equally important that learners are also educated on task switching and how it affects their retention of knowledge in these sessions.

Conclusion

- This study concluded that learners are task switching while using VCs. Findings from the studies discussed in the literature review and this study suggest task switching has a negative effect on the teaching and learning that occurs. This paper provided some possible solutions, however it is hoped these findings will lead to additional discussion and research on the use of VCs; and in particular the issue of how to retain the attention of learners while they are participating in a VC session.

References

Bowman, L., Levine, L., Waite, B., & Gendron, M. (2010). Can students really multitask? An experimental study of instant messaging while reading. *Computers & Education 54*, 927-931.

Clark, R., & Kwinn, A. (2007). *The New Virtual Classroom.* San Francisco: Pfeiffer.

Clay, C. (2012). *From Chalkboard to Keyboard. Transitioning to the Virtual Classroom*. Seattle, US: Netspeed Learning Solutions.

Courville, R. (2010). *The Virtual Presenter's Handbook.* 1080 Group Publication

Gasser, U., & Palfrey, J. (2008). Mastering Multitasking. *Association for Supervision and Curriculum Development, 66*, 14-19. Retrieved March 15, 2010, from http://www.ascd.org/publications/educational-leadership/mar09/vol66/num06/Mastering-Multitasking.aspx

Judd, T. (2014). Making Sense of Multitasking: The Role of Facebook. Computers and Education. *Computers & Education, 63*, 358-367. doi:10.1016/j.compedu.2013.08.013

Junco, R., & Cotten, S. (2011, September). *A Decade of Distraction? How Multitasking Affects Student Outcomes*. Paper presented at the 2011 A Decade in Internet Time Symposium on the Dynamics of the Internet and Society, Oxford, UK. Retrieved September 10, 2010, from http://ssrn.com/abstract=1927049

Kirschner, P., & van Merriënboer, J. (2013). Do Learners Really Know Best? Urban Legends in Education. *Educational Psychologist, 48*(3), 169-183. doi:10.1080/00461520.2013.804395

Lin, L., Robertson, T., & Lee, J. (2009). Human multitasking abilities: Learning tasks vs. performance tasks. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference 2009* (pp. 2589-2592). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Levitin, D. (2015). *The organized mind: Thinking straight in the age of information overload.* London, UK: Penguin.

McMahon, M., & Pospisil, R. (2005). Laptops for a digital lifestyle: Millennial students and wireless mobile technologies. *Proceedings of Ascilite 2005 Conference: Balance, fidelity, mobility: Maintaining the momentum?* (pp. 421-431). Brisbane, Australia: Queensland University of Technology, Department of Teaching and Learning Support Services.

Ralph, B. C., Thomson, D. R., Cheyne, J. A., & Smilek, D. (2014). Media multitasking and failures of attention in everyday life. *Psychological Research, 78(5), 661-669.*

Rosen, C. (2008). The Myth of Multitasking. *The New Atlantis*, 105-110.

Ophir, E., Nass, C., & Wagner, A. (2009). Cognitive control in media multitaskers. *Proceedings of National Academy of Sciences of the United States of America, (106)*37, 15583-15587. Retrieved May 19, 2010, from

http://www.pnas.org/content/early/2009/08/21/0903620106.full.pdf+html
Risko, E., Buchanan, D., Medimorec, S., & Kingston, A. (2013). Everyday attention: Mind wandering and computer use during lectures. *Computers & Education*, *68*, 275-283.
Rubinstein, J., Meyer, D., & Evans, E. (2001). Executive Control of Cognitive Processes in Task Switching. *Journal of Experimental Psychology-Human Perception and Performance*, *27*(4), 763-797.
Strayer, D. (2001). Driven to Distraction: Dual-Task Studies of Simulated Driving and Conversing on a Cellular Telephone. *Psychological Science*, *12*, 462-466.
The Elearning Guild. (2005). *Current Trends in e-Learning Research Report.* Santa Rosa: The eLearning Guild.
Towards Maturity. (2011). *Harnessing live online learning*. *UK's first research study into virtual learning. Towards Maturity Benchmark Report supported by Commelius Solutions 2011*.)
Trabinger, K. (2016). *Engaging Learner Interaction, Engagement and Attention in the Virtual classroom (an investigation into the phenomenon of multitasking)*. (Doctoral Dissertation, University of Southern Queensland). Retrieved from https://eprints.usq.edu.au/29694/1/Trabinger_2016_whole.pdf

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Note: All published papers are refereed, having undergone a double-blind peer-review process.

Technology Advances in Virtual Classrooms (and how this affects learner engagement).

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As technology evolves and devices become more affordable there are many exciting possibilities for the use of innovative technology in virtual classrooms. However, while some of these innovations can encourage learner attention others afford learners more opportunities to multitask (task switch).

Keywords: virtual classroom, multitask, technology, learner engagement

Virtual Platform Improvements

Current virtual classroom platforms such as Adobe Connect are constantly improving, evolving and incorporating new and additional tools and plugins. Additional Adobe Connect tools currently available to assist engaging learner attention include the ‘randomiser’ (see Figure 1). This tool collects learner names from an attendee list and uses a randomised spinner to select one name. This encourages learners to remain engaged at all times as they are unable to anticipate when their names will be called. Adobe Connect also has a plug in tool available at an additional cost called the ‘engagement metre’ (see Figure 2). This tool is a quick way for teachers to view how engaged their learners are during the session.

Figure 1: Adobe Connect Randomise.

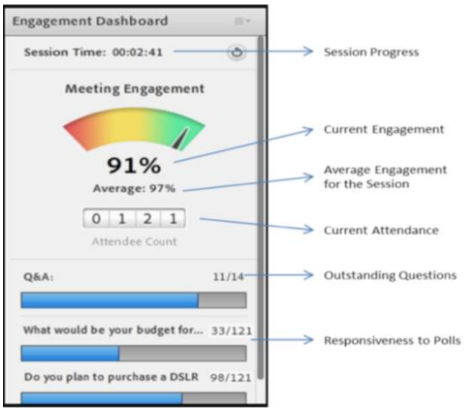

Figure 2: Adobe Connect Engagement metre © Webqem 2014

Virtual Classrooms with Virtual Worlds

Some companies have developed a combination of virtual worlds and virtual classrooms. One such company is 3D Immersive Collaboration Consulting (3D ICC). This combination called 'Terf' includes the use of Adobe Connect and allows users to interact through video and audio in 3D Immersive environments with the use of avatars. See Figure 3.

Figure 3: Example of the use of 3D ICC ©2011-2016, 3D Immersive Collaboration Consulting.

Other Devices

Many virtual classroom platforms now afford teachers and learners the ability to participate on devices like smartphones and tablets. At the present time there is limited functionality available but this may increase in the future with advances in technology. A more recent mobile device is the Smart Watch. The Apple Smart Watch currently interacts with the WebEx platform but at this stage allows only very minimal interaction. Other possibilities for future use include learners' participation in a virtual classroom through smart televisions, fridge Wi-Fi LCD screens and even iPad Touch glass kitchen splashbacks.

Future Possibilities

Microsoft is exploring mood sensing advertisements using mood-recognition technology and claims the technology would be:

> a computer-implemented method to determine emotional states of users that receive advertisements on client devices, the method comprising: monitoring a user's online activity during the time period; receiving an indication of the user's reaction to the content; and assigning an emotional state to the user based on the tone of the content and the indication of the user's reaction to the content (Cavalli, 2011, p.1)

This application could be adapted to assist teachers in a virtual classroom understand if a learner is engaged and focused. The same applies to improvements in facial recognition software.

There are also many wearable cameras including Point of View glasses (POV) which are increasing in popularity as the costs reduce. The Canberra Institute of Technology teachers have used a USB microscope to display images using the webcam and it would be interesting to explore the use of these POV glasses in a virtual classroom.

Summary

While many of the above technologies can assist in focusing learner attention including plugins such as the randomiser and tools such as the engagement metre; mood gauges and facial recognition, other technology may afford learners more opportunities to multitask (task switch). For example, connecting through a mobile device could be detrimental as there is limited participation available on these devices. This also applies to learners participating via their smart watch, televisions, fridges or kitchen splashbacks. With the kitchen splashback, the very reason this device was created was to allow the use of this device while cooking and hence if a student was trying to participate in a virtual classroom session they would have to task switch between focusing on the content in the virtual classroom session and focusing on cooking. Similarly, with smart televisions many of these devices allow users to split displays and therefore afford the opportunity for learners to watch a television show or movie on one display while trying to participate in a virtual classroom on the other. This presentation will discuss the implications for teaching and learning in the virtual classroom of the future including tips for designing and delivering sessions that encourage learner attention and discourage multitasking (task switching).

References

Cavalli, E. (2011). Kinect-based mood analysis could bolster Microsoft's advertising efforts. *Digital Trends.* http://www.digitaltrends.com/cool-tech/kinect-based-mood-analysis-could-bolster-microsofts-advertising-efforts/

3D Immersive Collaboration Consulting. (2016). Terf Feature Summary. http://www.3dicc.com/product-details/

Trabinger, K. (2016). *Engaging Learner Interaction, Engagement and Attention in the Virtual classroom (an investigation into the phenomenon of multitasking)*. (Doctoral Dissertation, University of Southern Queensland). Retrieved from https://eprints.usq.edu.au/29694/1/Trabinger_2016_whole.pdf

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Using mobile technology for workplace learning: Fostering students' agency

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Students' agency is an important enabler of productive learning in complex, unpredictable workplace environments. In the study presented here, we explored how mobile technology can help students enhance their workplace learning experiences and develop their capacity to act as learners and future practitioners. We collected survey and interview data from 312 participants, which informed the development of Mobile Technology Capacity Building Framework that comprises thematic resources for students, academics and workplace educators. Its development draws on two sets of theoretical ideas: the importance of agentic learning that enables students to develop their practice capabilities; and the use of activity-centred learning design to distinguish between what can be designed ahead of time and what should be left to students' agency. This study and Framework contribute to understanding how the productive use of technologies can foster students' agency and development of deliberate professionals with a high sense of adaptive expertise.

Keywords: Workplace learning, Mobile technology, Student agency, University education

Introduction

In current liquid times, the rapid technological changes and disruption to traditional work roles and practices have led to increased insecurity and uncertainty (Bauman & Haugaard, 2008). Australian universities have responded to these changes by shifting how they prepare students for their future work, including promoting workplace learning (WPL) and online learning (Johnson *et al.* 2012; Orrell 2011). WPL is supervised student learning that occurs in authentic workplaces as part of a university course. Online learning (including e-learning and mobile learning) at university can be seen as the new mode of program delivery that best fits students' busy and digitally-enhanced lives. It is also presented as essential in preparing students for the digital age (El-Hussein & Cronje, 2010; Al-Okaily, 2013).

To better help students prepare for these liquid times, there might be a need for universities to deliver programs that appeal to today's fast and flexible ways of living, but, more importantly, there is a need to help students develop their capacity to learn and work in unpredictable, complex environments. This requires greater reflexivity (e.g. critical thinking) and autonomy (e.g. deliberate and thoughtful action) so that students, as future practitioners, can learn from the consequences of their actions in an ever-changing context (Trede & McEwen, 2016).

In this paper, we argue that embedding students' use of mobile technology during WPL can develop their understanding of how environmental factors shape professional practices and their capacity to find innovative solutions to future practice problems. We suggest that this is the case because both mobile technology and WPL provide opportunities to learn across learning and work environments, they are grounded in social, discursive and collaborative learning practices, and they provide opportunities to develop self-directed learning skills and students' capacities to respond to unplanned experiences. We present a Mobile Technology Capacity Building Framework (Framework) designed to help students make the most of their personal mobile devices (PMDs) for WPL. We discuss the ways in which the Framework can help students enhance their WPL experiences as well as strengthen their reflexivity, their autonomy and adaptability as current learners and future practitioners.

Mobile technology and workplace learning

Apart from giving access to information, mobile technology can address students' sense of isolation during WPL and enhance their connection to professional practitioners, academic staff and peers. This type of connectivity can enable collaborative networked learning across settings (Mettiäinen, 2015), reduce students' reliance on workplace educators (WPEs) for their learning and help them process a challenging, interesting or confusing situation in order to transform it into a powerful discursive and reflective experience (Sharples *et al.*, 2005). For instance, students can ask and receive feedback from others online and engage in collective reflection and look for solutions to problems encountered; or they can ask sensitive questions they might find difficult to ask their WPE or teacher. It can also help students develop new professional and digital competencies, such as understanding of safe and ethical online conduct, appropriate networking and communicating online, filtering and critiquing information. As such, students' use of mobile technology in WPL has the potential to develop and enhance their learning agency and change the student-supervisor dynamics.

We are careful not to suggest, however, that the use of mobile technology for WPL is risk-free or always conducive to learning. WPL, as learning in situated practice environments, requires thoughtful moderation of activities and so does the integration of PMDs in this context. This is for several reasons. At times, the use of PMDs is not appropriate because being present cannot necessarily be replaced by being connected with mobile technology across settings. Sometimes it is crucial to be present to observe or perform a task. Also, the acceptance and integration of mobile devices vary widely across contexts for individuals, organisations and disciplines. Ertmer, *et al.* (2012) found two types of barriers to the use of technology for learning in the workplace: external barriers (e.g. access, support and culture) and internal (e.g. personal beliefs and attitudes, and misconduct). These types of barriers also apply to the uptake and implementation of mobile technology for WPL. It is important that these cultural issues and barriers are addressed early and with students, WPEs and academic teachers.

Case study

To explore the entangled relationship between learning, work and technology, we successfully sought funding from the Australian Commonwealth Government Office for Learning and Teaching. Through a two-year funded project, we researched the use of PMDs in bridging learning at university and in the workplace for students enrolled in education and healthcare courses – with a long lasting tradition of WPL -, and their academics and WPEs, across four metropolitan and regional Australian universities. Using participatory research processes, we sought to understand the range of use of mobile technology for WPL and associated benefits and barriers. This led to the development of a set of resources, for which we gathered reiterative feedback. The set of resources is part of the Framework designed to help students, academics and WPE make better use of PMDs to connect learning and work.

Theoretical concepts

For this exploratory project into technology-enhanced learning and teaching practices, we drew on two sets of theoretical ideas: 1) the importance of agentic learning that enables students to develop their professional identity, practice capabilities and professional network (Billett, 2011); and 2) the use of activity-centred learning design to distinguish between what can be designed ahead of time and what should be left to students' agency, and the use of design patterns to capture and share reusable design experiences (Goodyear & Markauskaite, 2012).

Billett (2011) shows how the intended curriculum in WPL can be made to support students in becoming active and agentic learners. To enhance students' learning in and from placement experiences, preparation needs to articulate requirements for active students' participation on placement and shared expectations about purpose and role. During placements, students need to actively engage and respond to the rich workplace environment, seek support, as much as possible, through interactions with academics and establish and maintain professional learning relationships with placement staff. After placements, WPL experiences need to be debriefed, shared and critically appraised. To promote inclusiveness, pedagogical approaches need to go beyond focusing exclusively on knowledge and skill and teacher control to aligning socio-cultural, emotional, cognitive and technical aspects of WPL.

We drew inspiration from Goodyear and Markauskaite's (2012) design-led approach, which places students' activity at the centre of learning and structures learning designs around what is designable - ahead of time - and what must be left to emerge and be self-managed. Much of what students do, in workplaces and elsewhere, is a contingent response to local events and circumstances. At best, teachers and others can set things in place (e.g. suggested tasks, useful tools and resources) in ways that enable students to benefit from them if/when they are relevant to a particular context or situation. This indirect approach to facilitating learning through design offers a realistic way of conceiving of the scope and limits of teachers' agency, especially when teachers' work is expressed through preparatory resources.

Method

The development of the Framework was informed by empirical data derived from 312 participants across two stages. Stage 1 gathered data from 78 participants – through pre- and post-placement surveys with students; a one-off survey with WPEs; and in-depth interviews with academics and WPEs – about their use of mobile technology in WPL. The analysis of this data informed the development of a series of resources. During Stage 2, reiterative feedback on these resources was gathered, through surveys, workshops, webinars, interviews and focus groups from 234 participants. Stage 2 data provided valuable comments and ideas for improving the resources as well as highlighted the importance of considering workplace cultures and issues of time and place. Data from Stage 1 and 2 was brought together in the Framework that was developed at the end of Stage 2.

Findings and development of the Mobile Technology Capacity Building Framework

PMDs in WPL practices

Stage 1 data showed that among our participants there was a high use of mobile devices (93% of students and 85% of WPEs used a range of devices including smartphones, laptops, tablets and eBook readers) and high confidence (92% of students and 54% of WPEs stated that they felt 'very confident' or 'confident') in using them. In addition to that, data identified many opportunities to use mobile devices, and positive impact on connection and learning. Data also, however, highlighted that there was a need for better preparation and training (61% of students and 77% of WPEs had no access to internal resources, support or training to use mobile technology for learning in the workplace*)*, implementation of policies and guidelines (46% of students and WPEs stated that there were no policies or guidelines or were not aware of their existence), more reliable internet access, broader integration and a greater focus on people and pedagogy (Trede, *et al.*, 2016).

Though students' use of PMDs for WPL has the capacity to enhance their level of agency, our findings showed that they used PMDs in WPL primarily for communicating with peers and friends (78% use 1-5 times a day), more so than for reflecting (10% 1-5 times a day) and being assessed (17% use 1-5 times a day). Our findings identified a range of factors that can explain the underuse of PMDs for learning, including workplace bans on social media, unreliable internet access, the cost of data download and streaming, and the lack of understanding by students, academics and WPEs of how to use PMDs advantageously for learning or work (Trede, *et al.*, 2016). For example, whereas some WPEs emphasised the need for students to abide by their workplace's social media policies, others welcomed students' use of PMDs and enjoyed learning from them. Some academics were concerned that students' use of PMDs while on placement might lead to their disengagement with others in their environment, and/or unprofessional conduct. This concern was often influenced by academics' own level of digital literacy and personal preference. Other academics discussed how best to integrate PMDs as a peripherally enhancing rather than a central tool in WPL.

Key dimensions of learning

This data, combined with a review of the literature on mobile learning and students' agency, helped us identify core dimensions of learning with PMDs for WPL that were used as pivotal elements of the Framework. These dimensions are: purposeful planning, awareness raising, deliberate engagement and action and critical sensemaking.

Purposeful planning
One of the benefits of using PMDs for WPL relates to the management of time and activities as evidenced by the following quote: "Having my smartphone makes life a lot easier as I receive emails to notify me when the university site has had any changes."; or the capacity to stay connected: "I used my smartphone to keep in contact with family and friends. Things would have been very difficult without them!". One student enjoyed the use of PMDs because "It is a good change from looking up books etc while on placement". This is

commensurate with Gikas and Grant's (2013) findings around rapid access, the variety of ways to learn and flexible access that allows control over when and how often to learn.

Awareness raising

Students reported that their use of PMDs for WPL had raised their awareness of the complex entanglement between organisational, professional and individual practices and preferences. Students were aware of the possible impact the visible use of PMDs in professional practice had on their relationships with WPEs, colleagues and clients. Though this awareness pertained to a realisation of how certain WPEs rejected PMDs as an inappropriate tool for work and/or learning on placement, this resulted in students having to reappraise and explain their practices and that of their WPEs as this quote highlighted: "Other members of staff believe I wasn't interested in my job because I was studying [using a PMD] while on placement during times when there were no patients. I had to explain that I didn't like sitting around and doing nothing and that by studying during breaks between patients I was learning something valuable".

Deliberate engagement and action

Mobile technology can help students to deliberately engage with others: "I think as an old person and working with young students, who just love their devices, it is great when they can show me things and teach me things. This leads to great interaction between us because they then know that I am human". This point is also highlighted in Williams *et al.*'s (2014) study on undergraduate students' perception of technology at a large Midwestern research institution in the USA. Citing Wankel and Blessinger, the authors argued that the use of technology had the capacity to encourage students "to positively express their individuality and build student-to student, and student-to-educator relationships".

Critical sense-making

Our study showed that academic interviewees believed that PMDs enable students to locate quality information for a rapid response while on placement, record themselves in practice for later recall and reflection, and to use apps for patient education to be a benefit and encouraged students. The potential flow on benefit of using mobile devices to access information on-time and to receive immediate feedback and interaction is the capacity to connect different elements together, question the way things are done and hence foster students' self-regulated learning.

The resources and Framework

From the analysis of Stage 1 data and the dimensions of learning with PMDs for WPL, seven themes were retained to help students make appropriate use of their PMDs on placement: staying professional and safe, considering issues of time and place, planning learning activities, initiating dialogue, networking, creating your own learning opportunities on the go and deepening reflection. These themes are at the heart of the resources and the Framework developed in Stage 2 of the project. Each resource consists of two components: a thematic discussion and an accompanying pedagogical artefact. The thematic discussion is a narrative intended to be used as a discussion starter to help academics understand what students most need to inform the process of customising the accompanying artefact for their specific contexts. Four of the thematic resources (initiating dialogue, networking, creating learning opportunities on the go and deepening reflection) specifically foster the aspects of student's agency discussed above. The artefacts are concrete repurposable tools (e.g. a series of tasks and prompting questions) designed to build educators and students' capacities to make the best use of mobile technology for WPL.

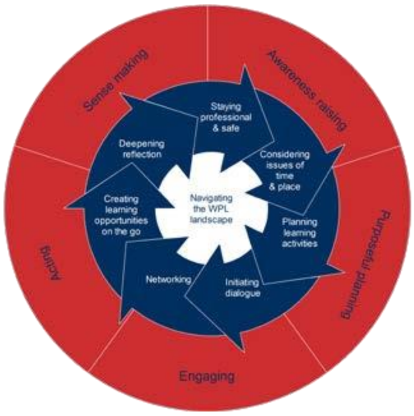

Figure 1: The Mobile Technology Capacity Building Framework for WPL

The GPS for WPL is another concrete resource specifically designed for students to make sense of the different opportunities for learning using PMDs before, during and after placement. This resource includes bite-size information, activities, and further reading on the seven themes organised around how to communicate, reflect, share, organise their studies, access relevant information, be assessed, receive feedback and/or relax using a PMD while on placement, as well as around the difference between formal and informal spaces and how to use them appropriately. It is important to note that the GPS for WPL was not designed as a standalone preparation resource for WPL. Also, because digital technology is rapidly changing, this resource neither focuses on providing a list of apps nor is it solely about enhancing digital literacies. Ultimately, the GPS for WPL was designed to enhance students' professional, ethical and purposeful use of PMDs for learning and work.

To show the interconnection between the dimensions of learning and the resources, the Framework has been conceptualised as a wheel (see Figure 1). The outer ring of the wheel represents the five key dimensions of agentic learning. These broadly align with seven thematic resources represented in the middle ring. The concrete resource for students (the GPS for WPL) is located in the centre of the Framework.

Conclusion

Our findings indicated that there is a need to focus on assisting students, academics and WPEs to see the potential of PMDs in enhancing WPL and to develop our understanding of effective pedagogies for the use of PMDs. The use of PMDs in WPL has the potential to increase students' agency and professional identity development for future practice that is uncertain and complex. However, for students to knowledgeably harness opportunities afforded by PMDs in WPL requires a concerted effort from students, academics and WPEs. It is essential that they adopt a critical and deliberative perspective that helps develop a shared understanding of how to connect and bridge different learning spaces appropriate for professional and/or workplace context. This will assist students in becoming agentive learners, deliberate professionals and adaptive experts. The next step is to validate the Framework by surveying its implementation in relation to the learning elements of the Framework, for example.

These findings contribute to existing knowledge about challenges in mobile learning. The common ground between WPL and mobile learning provides a worthwhile terrain to develop a better understanding of the ways in which mobile technology combined with WPL can be used purposefully for learning and work as well as help students develop agency.

References

Al-Okaily, R. (2013). Mobile learning and BYOD: implementations in an intensive English program. *Learning and Teaching in Higher Education: Gulf Perspectives*, *10*(2).

Bauman, Z., & Haugaard, M. (2008). Liquid modernity and power: A dialogue with Zygmunt Bauman. *Journal of Power, 1*(2), 111-130.

Billett, S. (2011). Integrating experiences in workplace and university settings: A conceptual perspective. In Billett, S. & Henderson, A. (Eds.) *Developing learning professionals*. Dordrecht, Springer.

El-Hussein, M. O. M., & Cronje, J. C. (2010). Defining Mobile Learning in the Higher Education Landscape. *Educational Technology & Society, 13*(3), 12-21.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E. & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education, 59*, 423-435.

Gikas, J., Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones and social media. *The Internet and Higher Education*, *19*, 18-26.

Goodyear, P. & Markauskaite, L. (2012). Pedagogic designs, technology and practice-based education. In Higgs, J., Barnett, R., Billett, S., Hutchings, M. & Trede, F. (Eds.) *Practice-based education: Perspectives and strategies*. Rotterdam, Sense Publishers.

Johnson, L., Adams, S., & Cummins, M. (2012) *The NMC Horizon Report: 2012 Education Edition* Austin, Texas: The New Media Consortium.

Mettiäinen, S. (2015). Electronic Assessment and Feedback Tool in Supervision of Nursing Students During Clinical Training. *Electronic Journal of e-Learning*, *13*(1).

Orrell, J. (2011) *Good Practice Report: Work-integrated learning*. Sydney: The Australian Learning and Teaching Council.

Sharples, M., Taylor, J., & Vavoula, G. (2005). Towards a theory of mobile learning. Paper presented at the *mLearn 2005 - 4th World conference on mLearning: Mobile technology: The future of learning in your hands*, Cape Town, South Africa.

Trede, F., Goodyear, P., Macfarlane, S., Markauskaite, L., McEwen, C., & Tayebjee, F. (2016). Enhancing Workplace Learning through Mobile Technology: Barriers and Opportunities to the Use of Mobile Devices on Placement in the Healthcare and Education Fields. Paper presented at the *mLearn 2016: Mobile learning futures: Sustaining quality research and practice in mobile learning, Sydney,*

Trede, F. & McEwen, C. (2016). Carving out the territory for educating the deliberate professional. In F. Trede & McEwen, C. *Educating the deliberate professional: Preparing for future practices*, (pp. 15-28). Dodrecht: Springer.

Williams, R. D., Lee, A., Link, A., & Ernst, D. (2014). Minding the Gaps: Mobile Technologies and Student Perceptions of Technology, *HETL*.

Please cite as: Trede, F., Macfarlane, S., Markauskaite, L., Goodyear, P., McEwen, C. & Tayebjee, F. (2016). Using mobile technology for workplace learning: Fostering students' agency. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 583-588).

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Designing a toolkit to support the development of copyright literacy

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The Open Education Licensing (OEL) project team surveyed teaching and other staff in the Australian higher education sector. The surveys informed the design of a Toolkit web application, which would provide tailored information to users by presenting relevant questions and guidance in a decision tree format.

The decision tree provides pathways to guidance regarding the licensing of teaching resources for Australian higher education. The software was developed iteratively, allowing subject matter experts (SME) to feed in their content whilst the data system and interface were designed and implemented. A user-centred methodology was employed to maximise usability. The Toolkit used open source technologies and is itself openly licensed.

This poster communicates the process of design, development and testing of the Toolkit web application. The lessons learned through this process may help inform the design of other innovative systems that aim to emulate the support provided by SME.

Keywords: OER OEP toolkit copyright literacy user-centred usability decision-tree web-application software

Problem

Copyright literacy is defined as “acquiring and demonstrating the appropriate knowledge, skills and behaviours to enable the ethical creation and use of copyright material,” (UK Copyright Literacy, n.d.). One challenge regarding the effective application of Open Educational Practices (OEP) in Australia is academics’ perceived lack of understanding of copyright and licensing (Bossu, Brown, & Bull, 2014). The Open Education Licensing project team surveyed 166 teaching and other staff from 35 Australian universities to identify these gaps in understanding. The survey revealed that 65% of respondents considered OEP to be an important or somewhat important part of their institutions’ activities while 70% indicated that their institutions currently offered some free educational content, and 43% of respondents revealed that their institution did not have strategic plans that included Open Educational Resources (OER) or OEP (Wright, Bossu, Padgett & Whitehead, 2016). This suggests that there are impediments to accessing relevant supporting resources in the context of higher education in Australia.

Solution

The surveys informed the design of a Toolkit web application. The development team determined that the most appropriate format for a copyright and licensing Toolkit was a decision tree, whereby users could follow a path of questions to guidance determined by their responses. This contextual guidance provides links to openly available support resources to assist copyright officers, academics and librarians. The project team mapped the survey data with the questions and answer options, and defined the pathways to the guidance.

As an example, a particular case might involve a user who is seeking general information about using an existing resource but does not have any specific questions in mind. Using the Toolkit, the user indicates that they will use this resource in the course of their employment at the University of Tasmania. This generates guidance about intellectual property and copyright ownership at the university, with links to relevant information, including policies on the university's website. The user then indicates that the resource is already licensed under a Creative Commons BY no derivatives licence (CC BY-ND), and this generates guidance about that licence with links to relevant information. The user then indicates that they do not intend to change the resource. This triggers guidance about moral rights, and avoids presenting irrelevant guidance about modifying the resource and potential licence conflicts. The user finishes by indicating that the resource will be shared on YouTube. Guidance is available about the use of YouTube, including a link to terms of use and a recommendation that the user consults their institution's Copyright Officer. As the user provides each answer, the guidance snippet(s) can be previewed. On completion of the pathway, all guidance snippets are available within a 'Guidance Summary', which can be exported to save or print for future reference.

Design and development

Content

The decision tree was modelled using a flowchart diagram. The data for describing the questions and answers in the flowchart were then modelled in a way appropriate for storing in a relational database. This process of structuring the data – the normalisation process – is required so that the data may be flexibly used. By defining how each piece of data is related to each other (e.g. which questions have which answer options), the development team could eliminate duplications and query the data in many ways.

System

The team developed an innovative approach to managing the ongoing refinement of the decision tree content separate from the development of the user interface. The team provided a spreadsheet to subject matter experts (SME) for creating or modifying the questions, answers and guidance content. By enabling the concurrent development of both content and system, the project timeline could be abbreviated.

The user interface was designed first by producing wireframes, which specified the general layout of the decision tree page elements without concerning styling, such as colour and typography. Design decisions at this stage focused on presenting users with one question per view, and enabling the user to navigate back and forth through their pathway. Prototyping the intended design in this quick and easily changed format had a number of benefits: it enabled feedback early in the design, and initiated early production of content, data systems, and visual design. The wireframes allowed design decisions to be made before any implementation effort.

The wireframe design demonstrated that the decision tree can lead users only to those materials that are relevant when relevant. Once the core functionality and layout was established, wireframes were followed with mockups to design the visual elements. These graphical elements were then implemented in the web application to enhance the usability, navigability and recognisability of the web application.

The development process followed a user-centred methodology. A set of functions and features were chosen to release after each development iteration. The latest version was tested at workshops, where participants – who had never before seen the application – were asked to achieve set goals without explicit instructions. Their interactions with the application were observed, and their opinions and commentary noted either informally or with surveys. The feedback was analysed by the development team, and solutions to the problems were implemented in subsequent iterations. Accessibility, too, was a central focus in the design of the interface, and the site is designed to meet WCAG 2.0 AA guidelines.

The Toolkit was developed with open principles in mind. It was implemented using open source technologies (e.g. PHP and MySQL), and the Toolkit software itself is openly licensed so that it can be reused and adapted. Many of the materials linked to within the guidance are existing OER, saving effort in re-creating content.

The result

The Toolkit will be publically available on the project website. With the software licensed with an open source licence, the Toolkit can be reused and adapted to solve similar problems in other domains, rather than singularly the domain of copyright literacy. For example, this decision tree system could be used to support students with their administrative queries so that they know which department can attend to their concern, or the system might be applied to the troubleshooting of technical problems for users of particular software or hardware.

References

Bossu, C., Brown, M., & Bull, D. (2014). *Adoption, use and management of Open Educational Resources to enhance teaching and learning in Australia.* Retrieved from http://www.olt.gov.au/system/files/resources/CG10_1687_Bossu_Report_2014.pdf

UK Copyright Literacy. (n.d.). *Home.* https://copyrightliteracy.org/ [viewed 5 Oct 2016].

Wright, R., Bossu, C., Padgett, L., & Whitehead, D. (2016). *Open Education Licensing: Copyright tools for education in the 21st century*. Poster presented at Higher Education Research and Development Society of Australasia Inc. – The shape of higher education, Fremantle, Australia, 4-7 July 2016.

Please cite as: van der Veer, B., Carew, T. & Padgett, L. (2016). Halt and Catch Fire: Towards a Critical Theory of Post-Print Reading. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 589-591).

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Applications of Automatic Writing Evaluation to Guide the Understanding of Learning and Teaching

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This paper provides an overview of tools and approaches to Automated Writing Evaluation (AWE). It provides a summary of the two emerging disciplines in learning analytics then outlines two approaches used in text analytics. A number of tools currently available for AWE are discussed and the issues of validity and reliability of AWE tools examined. We then provide details of three areas where the future direction for AWE look promising and have been identified in the literature. These areas include opportunities for large-scale marking, their use in MOOCs and in formative feedback for students. We introduce a fourth opportunity previously not widely canvased; where learning analytics can be used to guide teachers' insights to provide assistance to students based on an analysis of the assignment corpus and to support moderation between markers. We conclude with brief details of a project exploring these insights being undertaken at an Australian institution.

Keywords: Learning systems, feedback, student writing, assignment scoring, large class management

Background

Innovative analytical tools are providing educational designers and teachers opportunities to understand student performance in much greater detail than ever before. Tools such as text analytics, information retrieval, machine learning, natural language processing and learning analytics form part of the suite of big data analytics that have the potential to provide evaluative feedback on students' work (Shermis & Burstein 2013).

Automated analysis and evaluation of written text, or automated writing evaluation (AWE), is being used in a variety of contexts, from formative feedback in writing instruction (from primary through tertiary education), to summative assessment (e.g. grading essays or short answer responses with or without a second human grader). The increased use of large-scale exams, (e.g. NAPLAN in Australia, and exams based on the Common Core State Standards Initiative in the US), along with the rise in popularity of Massive Open Online Courses (MOOCS) is generating a plethora of writing to be evaluated and assessed, and demanding ever more sophisticated text analysis tools.

However there is also a realisation that such tools provide wider scope and application than simple writing evaluation. Recently, systems like WriteLab and Turnitin's Revision Assistant have focussed on the iterative nature of writing and on providing formative feedback, rather than marks or grades, in order to encourage students to revise and rewrite their work in advance of final submission deadlines, allowing them to offer targeted instruction based on identifiable skills gaps.

In this paper we provide a brief review of some key concepts underlying the technology being applied in AWE drawing on insights from computer science, linguistics, writing research, cognitive psychology, educational data mining (EDM) and learning analytics (LA). We then provide a synopsis of a number of AWE tools and discuss their validity and reliability and the features and limitations of the most widely-used AWE engines. We then describe three opportunities emerging from the literature before outlining a previously unreported fourth area – Teacher Insights – which has potential for academics and teachers to evaluate the performance of text based assignments. We conclude with an outline of a current prototype utilizing Teacher Insights being developed at an Australian University.

Tools for Automated Writing Evaluation

Educational Data Mining and Learning Analytics

The Educational Data Mining (EDM) community website describes EDM as "an emerging discipline, concerned with developing methods for exploring the unique and increasingly large-scale data that come from educational settings, and using those methods to better understand students, and the settings which they learn in" (International Educational Data Mining Society 2015). In the first issue of the Journal of Educational Data Mining, Baker and Yacef (2009, p.6), highlight some key areas of interest for EDM: "individual learning from educational software, computer supported collaborative learning, computer-adaptive testing (and testing more broadly), and the factors that are associated with student failure or non-retention in courses." With the advent of MOOCs and publicly available data, such as the Pittsburgh Science of Learning Center DataShop, EDM research has accelerated in recent years.

Learning Analytics (LA) was defined in the first international Learning Analytics and Knowledge conference as "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs" (Siemens 2011). It draws on the increasing range of data available from digital learning tools and environments. LA is distinguished from Academic Analytics, in that LA is more specific in focusing exclusively on the learning process (Long & Siemens 2011). Long and Siemens (2011) present an optimistic role for LA: "Analytics in education must be transformative, altering existing teaching, learning, and assessment processes, academic work, and administration," and it is "essential for penetrating the fog that has settled over much of higher education."

Siemens and Baker (2012) promote a closer collaboration between the EDM and LA communities, as the two groups share the goals of improving both educational research and practice through the analysis of large-scale educational data. Nevertheless, they suggest that there are some important distinctions. Firstly, EDM focuses more on automated discovery, while LA "leverages human judgement" more. Secondly, EDM research is applied more in automated adaptation such as intelligent tutoring system (ITS), whereas "LAK [Learning Analytics and Knowledge] models are more often designed to inform and empower instructors and learners." Thirdly, LAK's holistic approach contrasts with EDM's reductionist paradigm (Siemens & Baker 2012, p. 253).

One interesting development from EDM/LA that is relevant to AWE is Lárusson and White's 'point of originality' tool. This is designed to help instructors in large university courses, such as first year gateway courses, to monitor students' understanding of key concepts. The system uses WordNet, a large lexical database of English words (https://wordnet.princeton.edu/), to "track how a student's written language migrates from mere paraphrase to mastery, isolating the moment when the student's understanding of core concepts best demonstrates an ability to place that concept into his or her own words, a moment we've chosen to call the 'Point of Originality'" (White & Lárusson 2010, p. 158). This works on the assumption that when students recast the course's key concepts in their own words, they are demonstrating higher-order thinking. In one study (Lárusson and White 2012), the tool was used to assess undergraduate students' originality in written blog posts throughout the semester. The authors concluded, "As students' blog post originality scores increased, their final paper grades covering the same topics increased as well. In other words, as their blogging activity became more original, the students wrote better papers" (Lárusson and White 2012, p. 218).

Natural Language Processing (NLP)

Put simply, natural language processing (NLP) is "an area of research and application that explores how computers can be used to understand and manipulate natural language text or speech to do useful things" (Chowdhury 2003, p. 51). Some of these useful things include machine translation, speech recognition, information retrieval and extraction, summarisation, and relevant to AWE, text processing. Liddy (2001) points out that NLP can operate at various levels of linguistic analysis, including phonology, morphology, lexical, syntactic, semantic, discourse and pragmatic.

For text or speech analysis, NLP uses both *statistical* and *rule-based* methods. *Statistical* methods include supervised and unsupervised modeling approaches. *Supervised* approaches require human annotated data (for example, scores of essays from human raters), while *unsupervised* learning does not use annotated data, but rather, "language features are automatically generated that are often statistically-based, such as bigram frequencies (proportional number of occurrences of two word sequences in a corpus)" (Burstein et al. 2013, p. 56). A model is then created from these language features which can predict certain characteristics in language. In *rule-based* methods, "specific rules are designed, such as syntactic patterns, to guide the identification of language structures" (Burstein et al. 2013, p. 56).

Another interesting application of NLP is in sentiment analysis systems. Such systems "use NLP to identify if a text contains opinion statements, and further, to categorize these statements by polarity, specifically, determining if they contain positive or negative sentiment, or both" (Burstein et al. 2013, p. 57).

Latent Semantic Analysis (LSA)

Latent Semantic Analysis (LSA, also referred to as Latent Semantic Indexing) examines large corpora to approximate human understanding of the similarity of meanings between words. It does this using "a high-dimensional linear associative model that embodies no human knowledge beyond its general learning mechanism" (Landauer & Dumais 1997, p. 211). In other words, it does not use human constructed dictionaries or grammars, but simply analyses words, sentences and paragraphs using a mathematical model to compare the text with others. LSA is described as "a theory and method for extracting and representing the contextual-usage meaning of words by statistical computations applied to a large corpus of text" (Landauer et al. 1998, p. 260). LSA is able to analyse how "vast numbers of weak interrelations" (Landauer & Dumais 1997, p. 211) are connected in a text in order to assess, for example, how much content knowledge an author has acquired.

To give a concrete example, Landauer and Dumais (1997) created an LSA model, which they claimed "acquired knowledge about the full vocabulary of English at a comparable rate to schoolchildren" (p. 211). This was achieved by training their model on a large set of entries from an encyclopaedia, after which the model was able to perform on a vocabulary test (the *Test of English as a Foreign Language – TOEFL),* at a level comparable to moderately proficient non-native English speakers. In order to test their model and "simulate real world learning" Landauer and Dumais (1997) used LSA to analyse text taken from Grolier's *Academic American Encyclopedia,* which is aimed at young adults. From this they took the first roughly one paragraph of text from 30,473 articles forming approximately 4.6 million words. They seek to show that "two words that appear in the same window of discourse – a phrase, a sentence, a paragraph, or what have you – tend to come from nearby locations in semantic space" (Landauer & Dumais 1997, p. 215). The first stage of input for LSA is a matrix with rows representing unitary event types (in this case 60,768 rows each representing a unique word which occurred in at least two paragraphs) and columns representing contexts in which instances of the event types occur (i.e. the 30,473 paragraphs). This matrix is then analysed by a statistical technique called singular value decomposition (SVD). While LSA can quickly obtain results using SVD, its accuracy is not considered as good as LDA methods that use a generative probabilities model. As processing technology improves, LDA is becoming a more popular method as greater accuracy is obtained without penalising speed.

This technology forms the basis of the *Intelligent Essay Assessor (IEA)* software developed by Knowledge Analysis Technologies, and later acquired by Pearson Knowledge Technologies. It is on this basis that Pearson (2010) makes the claim the *IEA* can assess content knowledge in a range of disciplines. LSA is also used in many other applications, such as Internet search, intelligent tutoring systems and studies of collaborative communication and problem solving. It has even been successful in passing textbook-based final exams when trained on domain corpora from the test's reading material (Foltz et al. 2013, p. 79).

Automated writing evaluation and scoring

AWE systems can be classified as either simulation-based assessments or response-type systems (Williamson et al. 2012). The former present computerised simulations of real-life scenarios, and are usually specific to a certain test (such as the United States Medical Licensing examination). The latter are more generalisable in that they score a typical type of response such as mathematical equations, short written responses, spoken responses, or essays. Essay scoring has been a particular focus for many automated systems and numerous essay evaluation systems are now used in formative feedback as well as high-stakes testing. In these tests the automated assessor acts either as a second rater to assist human scorers (e.g. in ETS' TOEFL test - ETS 2015), or as the sole rater (e.g. the Pearson Test of academic English (PTE Academic) uses automated scoring for writing and speaking (Pearson 2012). The following section provides a synopsis of a number of available tools.

Currently available tools

E-rater and Criterion by ETS
Educational Testing Service's (ETS) E-rater® was designed to predict a holistic essay score from a human rater, based on a given rubric, using statistical and rule-based NLP methods (Burstein et al. 2013). More recent development, according to Burstein et al. (2013, p. 55), "has deliberately focused on the development of a greater variety of features to more comprehensively address the writing construct." These features include detecting errors in grammar, word form, writing mechanics (e.g. spelling), prepositions and collocations, identifying essay-based discourse elements and their development, highlighting weaknesses in style, and analysing vocabulary, including topical and differential word usage, and sophistication and register of words (Burstein et al. 2013). In order to build a scoring model, these linguistic features are analysed in a minimum of 250 human-scored essays and "using a regression modeling approach...the values from this training sample are used to determine an appropriate weight for each feature" (Burstein et al. 2013, p. 61). After this training sample has been analysed, the system can start to assess the test papers in terms of the linguistic features desired. The system "converts the features to a vector (list) of values on a numerical scale. These values are then multiplied by the weights associated with each feature, and a sum of the weighted feature values is then computed to predict the final score" (Burstein et al. 2013, p. 61).

Criterion® is ETS' platform for providing automated formative feedback on writing. Feedback from *Criterion®* includes a grade as well as feedback about technical quality (e.g. grammar and spelling errors), and organization and development (Burstein et al. 2013, p. 64). The types of error comments that *Criterion®* provides cover grammar, word usage, mechanical mistakes, style and organisation. A small-scale study of English as a Second Language (ESL) students in a pre-university writing course at Iowa State University found that nearly half of the feedback provided by *Criterion®* was disregarded by students, perhaps due to inaccuracies in some of the feedback, such as highlighting proper nouns as spelling errors, or correct sentences as fragments or run-ons (Chapelle et al. 2015). Nevertheless, Chapelle et al. (2015, p. 391) concluded: "Given that the proportion of successful revision is over 70%, *Criterion®* feedback can be considered as positively influencing the revision process, even if substantial room for improvement exists."

Intelligent Essay Assessor and WriteToLearn™ by PKT
The Intelligent Essay Assessor (IAE) was launched in 1998 by Knowledge Analysis Technologies and later acquired by Pearson Knowledge Technologies (PKT) (Foltz et al. 2013). In their marketing material, Pearson (2010) makes the ambitious claim that IAE "evaluates the meaning of text, not just grammar, style and mechanics" and that "IEA can 'understand' the meaning of text much the same as a human reader". They claim this for both essays and short constructed responses, and in a range of subject areas. Although potentially overstated, these claims are based on the fact that IAE uses Latent Semantic Analysis (LSA). As Foltz et al. (2013, p. 69) state, "approximately 60 variables have the potential to contribute to an overall essay score, as well as trait scores such as organization or conventions."

The IAE engine forms the basis for PKT's WriteToLearn system, which is a web-based platform "that provides exercises to write responses to narrative, expository, descriptive, and persuasive prompts as well as to read and write summaries of texts in order to build reading comprehension. Feedback is provided via overall and trait scores including 'ideas, organization, conventions, word choice, and sentence fluency' " (Foltz & Rosenstein 2015). Grammar and spelling errors are also noted and students can receive automated feedback as well as teacher feedback through the platform and revise and resubmit their essays. The WriteToLearn platform is designed as a formative tool that provides continuous assessment of student writing. As Foltz et al. (2013, p. 69) claim, "Recognizing that writing is a contact sport that can be better played with technology, leads to students who markedly improve their writing skills."

IntelliMetric™ and MY Access!™ by Vantage Learning
The initial version of IntelliMetric was one of the first scoring engines to be released after an early grading system was conceived in the 1960's and included the first electronic portfolio – MY Access! - providing writing aids, word processing capabilities and teacher analytics (Shermis & Burstein 2013, p. 9). IntelliMetric takes papers scored by human raters for a particular question prompt (Schutlz 2013 suggests a minimum of 300 of these training papers for the best accuracy) and 'learns' to evaluate these to provide a holistic score. According to Schultz (2013, p. 90), IntelliMetric analyses "400 semantic-, syntactic-, and discourse-level features to form a composite sense of meaning." The scoring takes into account content features such as breadth of support and cohesion, plus structural features including grammar, punctuation and sentence complexity (Schultz 2013).

MY Access! is Vantage Learning's formative assessment tool. It provides scores as well as feedback on Focus and Meaning, Content and Development, Organization, Language Use Voice and Style, and Mechanics and Conventions (http://www.vantagelearning.com/products/my-access-school-edition/). Feedback can be provided in various languages for English language learners. In a small classroom-based study of English Language learners at a university in Taiwan, Chen and Cheng (2008) analysed how MY Access! was received by students and instructors in three different classes. They found that instructors' attitudes to the software and the way it was used greatly impacted students' perceptions. When scores and feedback from MY Access! were combined with teacher and peer feedback, and when the AWE engine was used formatively, rather than summatively, students' attitudes were more positive towards it.

LightSide and Revision Assistant by LightSide Labs / Turnitin

The recent release of the Revision Assistant program by Turnitin brings a new focus on formative assessment and the rewriting process. The program is based on technology originally developed by LightSide Labs. LightSide was founded as an open source machine learning platform with the aim of helping non-expert users to create a text analysis tool for specific tasks. LightSide uses a workflow, where sets of scored texts are used to train a model, which can be applied to a variety of machine learning tasks (Mayfield & Rosé 2013). An important part of this workflow is the error analysis step, which uses a confusion matrix to highlight any discrepancies between labels humans assigned to the training input (such as essay grades) and labels applied by the model. This makes the individual features causing labelling errors visible, and allows for the improvement of the model (Mayfield & Rosé 2013).

Turnitin acquired LightSide labs in 2014 in order to integrate LightSide and Turnitin for formative and summative assessment, including automated feedback and grading, originality check and peer review. LightSide's LightBox corporate product has become the Turnitin Scoring Engine, which allows institutions to automatically score essays or short answer responses after training the engine for specified prompts, while Revision Assistant has become their formative feedback tool.

Rather than scores, Revision Assistant gives students "Signal Checks" in areas such as ideas, focus, language and evidence, as well as formative feedback through in-line comments. In the first half of 2015, Turnitin ran a pilot study on their Revision Assistant system with 18 middle and high schools in the United States (Turnitin 2015). In this study, 94% of students revised their work at least once. The authors compared this with an earlier study of the ETS' *Criterion*® system, where 29% of students revised their work. Another positive outcome from the study was that average word counts of students' work gradually increased with each revision. In addition, students' grades (as assessed by the system) increased after rewriting their work. Middle school students increased their score by 0.97 on a 4 point scale, and high school students by 0.73. While more rigorous studies of the system are required, this indicates a positive first implementation of the software.

WriteLab

WriteLab sets itself apart from the large-scale automated essay scoring engines, by focusing on formative feedback throughout the writing process, with the end goal being presenting work to a human reader such as a teacher or peer. CCCC committee chair Beth Hewitt, wrote a cautiously optimistic review of the software, suggesting that, despite legitimate concerns about machine graders designed to replace human readers, "WriteLab's current configuration and stated goals should not be ethically troublesome for writing center educators" (Hewitt, 2016). Speaking with the Hechinger Report, CEO of WriteLab, Matthew Ramirez stated: "It's important to say that this program is meant to supplement teacher feedback, not replace it…It enables students to turn in prose that's much more refined but not by any means finished" (Berdik 2016). Currently, WriteLab offers suggestions about different areas of writing, including Clarity, Logic, Concision, and Grammar.

Unlike Revision Assistant, WriteLab allows students or teachers to write or upload text based on any topic, without the need for specific prompts. In the first rollout of the program, WriteLab used a Socratic method of asking the writer questions, rather than marking a word or phrase as wrong. However, some students, particularly high-school students, preferred direct instruction in grammar and usage (Berdik 2016). As a result, the system now allows users to set preferences for more or less prescriptive comments (http://home.writelab.com/blog//product-update).

Validity and reliability

Already by 1995, Page and Petersen were claiming that for the very first time a computer had been able to simulate the judgements of a group of humans on a brand new set of essays, using a blind test. Page was an early researcher of AWE starting Program Essay Grade (PEG) in the 1960's and established an important distinction between what he called *trins* and *proxes:* "*Trins* are intrinsic variables of interest, such as diction, fluency, grammar, and countless others. Having no direct measures of these, PEG began with *proxes*, approximations or possible correlates of the *trins*. Human judges evaluated various *trins* as they read essays, but computers could work only with *proxes*" (Page & Peterson 1995, p. 546). This concept that the job of a scoring engine is to predict the scores of a human rater has been central to the development and validity claims of most scoring engines, with human raters' scores considered the "gold standard" (Williamson et al. 2012, p. 7). Specifically, the agreement of human and machine scores is generally evaluated on the basis of quadratic-weighted kappa and Pearson correlations (Fleiss & Cohen 1973).

In terms of inter-rater reliability, a number of studies (often funded by the proprietors of AES software) have shown that AES systems' grades are mostly equivalent to human raters (Shermis and Burstein 2013; Shermis 2014). One exception, however, comes from a study by Wang and Brown (2007), who found that in grading essays from 107 tertiary students, the IntelliMetric™ system gave significantly higher grades than two trained faculty members. While the human scorers failed 27.1% of students, IntelliMetric™ only failed 2.8%. Wang and Brown propose that this may be because students in the study had different linguistic and cultural backgrounds to the students whose essays were used for training data. They suggest that IntelliMetric™ and other AES systems may not be effective tools for scoring placement tests, as students may be placed at a level where they cannot perform successfully.

However, if AES systems can validly be used in large-scale scoring, this provides a great number of benefits, as Elliot and Williamson (2013, p. 4) summarise: "quality improvements over human scoring; consistency, tractability, specificity, detail-orientation; speed of scoring and score reporting; reduced need for recruitment/training overhead; provision of annotated feedback on performance; and cost savings." Nevertheless, in order to develop this kind of system, there needs to be a set of guidelines for the validity and impact of the system, and Williamson et al. (2012) provide this in their 'Framework for Evaluation and Use of Automated Scoring.' Drawing on this framework and Kane's four areas of validity arguments, Elliot and Williamson (2013) summarised the questions that need to be asked of an AES system to test its validity. Their table covered the four broad areas of scoring, generalisation, extrapolation and implication and listed nine associated research questions.

One common argument against the validity of automated scoring engines is that they can be gamed. For example, Les Perelman, together with students from MIT and Harvard, created a gibberish-generating engine he called Babel (Basic Automatic B.S. Essay Language Generator). Babel generates essays based on up to three keywords, which are nonsensical to the human reader, but which he has shown receive high scores from a number of AWE systems (Kolowich 2014). However, this issue of gaming may be overcome by implementing the framework that Higgins and Heilman (2014) have developed. The EDM field may also offer insights into how to avoid gaming the system. For example, Baker et al. (2004) describe an early machine-learned Latent Response Model that identified if students are gaming intelligent tutoring systems. They claim that students who game these systems learn only two thirds as much as students who interact with the system in the intended way.

Another common complaint about AEW is that in writing to a machine, students lose the social purpose of writing. As the Conference on College Composition and Communication puts it, "If a student's first writing-experience at an institution is writing to a machine…this sends a message: writing at this institution is not valued as human communication – and this in turn reduces the validity of the assessment" (CCCC 2003). As Herrington and Moran (2001) point out, the goals of a writer can change if writing for a machine, where the writer is aiming to "beat the machine" and score a high grade, rather than trying to transfer meaning to a human reader.

Current and future directions

Large-scale testing

Large-scale testing is gaining traction in many countries, and motivating the development of new automated scoring technologies. For example, in Australia, the Australian Curriculum, Assessment and Reporting Authority has undertaken testing of four automated scoring systems for NAPLAN persuasive essay and found that the automated scoring solutions were "capable of handling marking rubrics containing 10 different criteria" (ACARA, 2015).

In the US, the Common Core State Standards Initiative (CCSSI) has been adopted in most US states (approximately 85%) for K-12 education (http://www.corestandards.org/). The CCSSI lists standards in English language arts and literacy for students at each grade, with the aim to "ensure that all students are college and career ready in literacy no later than the end of high school" (CCSSI 2010). This is important for the development of AWE technology, as it means more assessed writing. As Shermis (2014, p. 54) points out, with the introduction of the CCSSI, "The sheer number of written responses for high-stakes summative assessments across the grade levels makes it challenging and cost-ineffective to have human raters exclusively score these assessments." Also, the evaluation of writing under the CCSSI includes linguistic features such as quality of argumentation and use of precise, domain-specific vocabulary, and is therefore aligned with NLP research and applications (Burstein et al. 2013). The CCSSI have already influenced the direction of development of AES technology and it is likely this will continue. As Burstein et al. (2013, p. 65) argue, "It is essential that we continue to develop capabilities that capture as many as possible of the features of writing that are explicitly valued in contemporary writing assessments." Foltz et al (2013, p. 69) claim that their Intelligent Essay Assessor and its underlying LSA technology are particularly suited to the CCSSI's emphasis on content as an indicator of mastery and higher order thinking skills: "PKT's shibboleth that substance matters more than form is now front and center of American curriculum reform."

Shermis (2014) reported on an automated essay scoring competition that saw a number of services being consistently good and even exceeding human rating performance. He concludes: "Automated essay scoring appears to have developed to the point where it can consistently replicate the resolved scores of human raters in high-stakes assessment." (p.75). However, Perelman (2014) disagrees with this interpretation, arguing, "These claims are not supported by the data in the study, while the study's raw data provide clear and irrefutable evidence that Automated Essay Scoring engines grossly and consistently over-privilege essay length in computing student writing scores." He contends that the "State-of-the-art" that Shermis considers in his article, is "largely, simply counting words."

MOOCs

Massive Open Online Courses (MOOCs) represent another interesting area of AWE development, with large-scale enrolments requiring new methods of essay or short answer evaluation. Various MOOCs have taken different approaches to this challenge, including edX's use of automated essay scoring, and Coursera's peer review. edX, the MOOC platform founded by MIT and Harvard announced inclusion of automated grading of essays using their Enhanced AI Scoring Engine in 2012. Like edX, the EASE platform is open source. There is little published about EASE at this stage, but according to Kolowich's (2014) article in *The Higher Education Chronicle,* "Rather than simply scoring essays according to a standard rubric, the EASE software can mimic the grading styles of particular professors. A professor scores a series of essays according to her own criteria. Then the software scans the marked-up essays for patterns and assimilates them". However, this is probably an inflated claim.

Some other MOOC platforms use peer review for essay scoring, such as Coursera's "calibrated peer review", where students are trained on a scoring rubric for a particular assignment before they begin reviewing their peers' work (Balfour 2013). Balfour suggests that one good approach may be to combine the use of AES and CPR, where an AES system is used on multiple rounds of drafts in order to improve the quality of essays, while the final evaluation is made using a form of CPR. He also notes that MOOCs may provide a new source of data for testing AES technologies that has hitherto been dominated by the large-scale testing organisations due to their access to large numbers of essays. He believes this may refine or change the state of the literature available about AES.

Formative assessment

The importance of timely formative feedback is well recognised in educational research within the assessment for learning field (Black & William 1998). In Hattie's (2008) large meta-analysis of influences on student achievement, feedback fell in the top 5 to 10 highest influences, with an average effect size of 0.79 (twice the average). Wiggins (2012) points out the differences between advice, evaluation, grades and feedback and suggests seven keys to effective feedback: that feedback should be goal-referenced, tangible and transparent, actionable, user-friendly, timely, ongoing and consistent.

Although AWE technology largely began as a way to assign scores to essays, facilitating this kind of formative feedback has increasingly been the goal of AWE systems. Deane (2013a, 2013b) outlines the implications for "Cognitively Based Assessment of, for, and as Learning," (CBAL) for AWE, and points out a number weaknesses in current AWE systems. Firstly, he argues, most systems focus on the final written product, rather than the writing process. Secondly, an AWE system assesses the quality of one particular text at a particular time, rather than the quality of the writing skill of the writer, even though writers may produce high quality texts in one context and not in others. Thirdly, the development of the technology so far has focussed on one particular use case: to imitate a human rater's holistic (or trait) score for a piece of writing based on a particular rubric. However, as he notes, other use cases could be imagined, such as giving differentiated feedback during the writing process, or supporting peer review or collaboration.

Future developments in AWE technology may be able to assess more of the writing construct. Dean (2013b, p. 310) argues that "It would be a mistake to focus AES research entirely within the space circumscribed by the holistic scoring rubric, or by traditional school essay grading. Future research may make it possible to cover a much larger portion of the writing construct." On a similar note, Elijah Mayfield, co-founder of Turnitin's Revision Assistant, wrote for EdSurge in 2014: "Scoring essays for high-stakes exams is a reliable but utilitarian use of machine learning. It is functional, not innovative. Automated scoring alone, as a summative teacher support, is adequate – but incomplete. Teachers deserve a more thoughtful reinvention of the tools used to teach writing."

One way in which Deane (2013b) suggests this might be achieved is adding new sub-constructs, such as conceptual or social elements of writing to the scoring system, (although, as he admits, this would require much further development in NLP than is currently available). He also notes that the additions made would need to be specific to a genre being evaluated (e.g. quality of argumentation would only be relevant for certain writing prompts). Deane suggests a second way to extend AWE systems is by adding new sources of evidence. For example, keystroke logs could capture the time that writers pause longer within words. Thirdly, advances in NLP methods could improve the AWE systems and allow them to measure more of the features identified by the CBAL literacy framework.

The Role of Learning Analytics for Teacher Insights

A considerable amount of work being undertaken in the name of Learning Analytics is focused on understanding the actions and behaviours of students in learning situations. For example there are numerous studies reporting on student's LMS activity and logs, engagement with learning resources or the interrogation of enterprise-wide systems. Aspects of motivation, engagement, and participation all provide insights into why a student may undertake learning, however AWE also provides the opportunity to understand where and what students are learning, or not and to inform learning design (Lockyer et al 2013). It can provide teachers with summaries of various metrics through dashboards (Verbert et al., 2013) and an understanding of concepts that are not covered in assignments, the sophistication of expression, level of research undertaken and extent of critical thinking applied in the assignment.

The Next Generation Rubric project has been established at an Australian University as a collaboration between a small number of academics and a recently appointed business analytics team. The project is supported by an internal Learning and Teaching grant and has sought to develop a proof of concept for a tool to provide students and academics information on the performance of students' text based assignments.

The starting point for the development of the tool was a marking rubric, as these underpin many standardised marking schemes at Universities. While it is acknowledged that rubrics have come to have a range meanings to various people (Dawson, 2015), we have relied on Popham's (1997) definition; "a scoring guide used to evaluate the quality of students' constructed responses" and consists of an evaluative criteria, and guidance on expectations for associated scores or marks (Popham, 1997).

The project has analysed assignments from two subjects, an introductory marketing management subject in a Masters course and a first year subject in the Bachelor of Arts. The marking criteria for both assignments included the elements of structure (including spelling, grammar and punctuation), evidence of research and correct referencing, critical analysis and identification of issues and recommendations based on relevant theories. Using the marking criteria as the basis for analysis a program was developed that would provide feedback on students' performance. By examining the results from the analysis a greater understanding of the computer's ability to assess student performance can be evaluated, and the results have been compared to the human issued marks for each assignment. The project is continuing and has already provided useful insights into student's writing performance and tutor grading.

Conclusion

Further research is needed into AWE's ability to help students develop their writing skills but also in how it can provide feedback to teachers on areas where students can be guided in understanding topics and concepts. As analytics tools improve and become more widely available there is considerable scope for teachers to have a far greater insight into their students' learning and understanding of discipline material, which can then inform improvements to student instruction, feedback and learning design.

References

ACARA, (2015). *An evaluation of automated scoring of NAPLAN persuasive writing.* Australian Curriculum, Assessment and Reporting Authority. Available from: http://www.nap.edu.au/_resources/20151130_ACARA_research_paper_on_online_automated_scoring.pdf

Balfour, S. P. (2013). Assessing writing in MOOCs: automated essay scoring and calibrated peer review. *Research & Practice in Assessment*, 8 (1), 40-48.

Baker, R. S., Corbett, A. T., & Koedinger, K. R. (2004). Detecting student misuse of intelligent tutoring systems. *Intelligent Tutoring Systems,* 531-540.

Baker, R. S., & Yacef, K. (2009). The state of educational data mining in 2009: A review and future visions. *JEDM-Journal of Educational Data Mining, 1*(1), 3-17.

Berdik, C. (2016). Can a curious computer improve student writing? Available from http://www.slate.com/articles/technology/future_tense/2016/01/writelab_a_roboreader_that_helps_students_improve_their_writing.html

Black, P., & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappa, October.*

Burstein, J., Tetreault, J., & Madnani, N. (2013). The e-rater automated essay scoring system. *Handbook of automated essay evaluation,current applications and new directions* (pp. 55-67) Routledge.

CCCC Executive Committee. (2003). CCCC position statement on teaching, learning, and assessing writing in digital environments. Retrieved from http://www.ncte.org/cccc/resources/positions/digitalenvironments

CCCC Executive Committee. (2009). Writing assessment: A position statement. Retrieved from http://www.ncte.org/cccc/resources/positions/writingassessment

CCSSI. (2010). Common core state standards for English language arts & literacy in History/Social studies, science and technical subjects. Retrieved from http://www.corestandards.org/wp-content/uploads/ELA_Standards.pdf

Chapelle, C. A., Cotos, E., & Lee, J. (2015). Validity arguments for diagnostic assessment using automated writing evaluation. *Language Testing*, 0265532214565386.

Chen, C. E., & Cheng, W. E. (2008). Beyond the design of automated writing evaluation: Pedagogical practices and perceived learning effectiveness in EFL writing classes. *Language Learning & Technology, 12*(2), 94-112.

Chowdhury, G. G. (2003). Natural language processing. *Annual Review of Information Science and Technology, 37*(1), 51-89.

Dawson, P. (2015). "Assessment rubrics: towards clearer and more replicable design, research and practice". *Assessment & Evaluation in Higher Education*. doi:10.1080/02602938.2015.1111294.

Deane, P. (2013a). On the relation between automated essay scoring and modern views of the writing construct. *Assessing Writing, 18*(1), 7-24.

Dean, P. (2013b). Covering the construct. *Handbook of automated essay evaluation, current applications and new directions* (pp. 298-312) Routledge.

ETS (Educational Testing Service) (2015). Scores: How to evaluate English-language tests. Retrieved from https://www.ets.org/toefl/institutions/scores

Elliot, N., & Williamson, D. M. (2013). Assessing writing special issue: Assessing writing with automated scoring systems. *Assessing Writing, 18*(1), 1-6.

Fleiss, J. L., & Cohen, J. (1973). The equivalence of weighted kappa and the intraclass correlation coefficient as measures of reliability. *Educational and Psychological Measurement,*

Foltz, P. W., & Rosenstein, M. (2015). Analysis of a large-scale formative writing assessment system with automated feedback. *Proceedings of the Second (2015) ACM Conference on Learning@ Scale,* 339-342.

Foltz, P., Streeter, L., Lochbaum, K., & Landauer, T. (2013). Implementation and applications of the intelligent essay assessor. *Handbook of automated essay evaluation, current applications and new directions* (pp. 68-88) Routledge.

Hattie, J.A.C. (2009). Visible Learning: A synthesis of over 800 meta-analyses relating to achievement. London, UK: Routledge.

Herrington, A., & Moran, C. (2001). What happens when machines read our students' writing? *College English,* 480-499.

Higgins, D., & Heilman, M. (2014). Managing what we can measure: Quantifying the susceptibility of automated scoring systems to gaming behavior. *Educational Measurement: Issues and Practice, 33*(3), 36-46.

International Educational Data Mining Society. (2015). Homepage. Retrieved from http://www.educationaldatamining.org/

Kolowich, S. (2014). Writing instructor, skeptical of automated grading, pits machine vs. machine. *The Chronical of Higher Education,* April 28.

Landauer, T. K., & Dumais, S. T. (1997). A solution to Plato's problem: The latent semantic analysis theory of acquisition, induction, and representation of knowledge. *Psychological Review, 104*(2), 211.

Landauer, T. K., Foltz, P. W., & Laham, D. (1998). An introduction to latent semantic analysis. *Discourse Processes, 25*(2-3), 259-284.
Lárusson, J. A., & White, B. (2012). Monitoring student progress through their written point of originality. *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge,* 212-221.
Liddy, E. D. (2001). Natural language processing.
LightSide Labs. (2015). Our products. Retrieved from http://lightsidelabs.com/how
Lockyer, L., Heathcote, E. & Dawson, S. (2013). "Informing pedagogical action: aligning learning analytics with learning design" *American Behavioral Scientist* XX(X). 1-22.
Long & Siemens, G., (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE Review, 46*(5), 30.
Mayfield, E. (2014). Where does automated essay scoring belong in K-12 education? *EdSurge Newsletter*. Retrieved from: https://www.edsurge.com/news/2014-09-22-where-does-automated-essay-scoring-belong-in-k-12-education
Mayfield, E., & Rosé, C. P. (2013). LightSIDE: Open source machine learning for text accessible to non-experts. *Handbook of automated essay evaluation,current applications and new directions* (pp. 124-135) Routledge.
Page, E. B. (1966). The imminence of... grading essays by computer. *Phi Delta Kappan,* , 238-243.
Page, E. B., & Petersen, N. S. (1995). The computer moves into essay grading: Updating the ancient test. *Phi Delta Kappan, 76*(7), 561.
Pearson. (2010). Intelligent essay assessor (IEA) fact sheet. Retrieved from http://kt.pearsonassessments.com/download/IEA-FactSheet-20100401.pdf
Pearson. (2012). Objective fact sheet. Retrieved from http://pearsonpte.com/wp-content/uploads/2014/07/ObjectiveFactsheet.pdf
Perelman, L. (2014). When "the state of the art" is counting words. *Assessing Writing, 21*, 104-111.
Popham, J. (1997). "What's Wrong - and What's Right - with Rubrics". Educational Leadership 55 (2): 72–75.
Schultz, M. T. (2013). The IntelliMetric automated essay scoring Engine—A review and an application to chinese essay scoring. *Handbook of automated essay evaluation: Current applications and new dir* (pp. 89-98) Routledge.
Shermis, M. D. (2014). State-of-the-art automated essay scoring: Competition, results, and future directions from a United States demonstration. *Assessing Writing, 20*, 53-76.
Shermis, M. D., & Burstein, J. (2013). *Handbook of automated essay evaluation: Current applications and new directions* Routledge.
Siemens, G. (2011). LAK '11: 1st International Conference on Learning Analytics and Knowledge. Retrieved from https://tekri.athabascau.ca/analytics/
Siemens, G., & Baker, R. S. (2012). Learning analytics and educational data mining: Towards communication and collaboration. *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge,* 252-254.
Turnitin. (2015). Turnitin revision assistant results from the classroom: Pilot study review. Retrieved from http://go.turnitin.com/ra-pilot-study
Verbert, K., Duval, E., Klerkx, J., Govaerts, S. & Santos, J. (2013). Learning Analytics Dashboard Applications. *American Behavioral Scientist* XX(X) 1-10.
Wang, J., & Brown, M. S. (2007). Automated essay scoring versus human scoring: A comparative study. *The Journal of Technology, Learning and Assessment, 6*(2)
White, B., & Larusson, J. A. (2010). Detecting the point of originality in student writing. *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries,* 817-820.
Wiggins, G. (2012). Seven keys to effective feedback. *Feedback, 70*(1)
Williamson, D. M., Xi, X., & Breyer, F. J. (2012). A framework for evaluation and use of automated scoring. *Educational Measurement: Issues and Practice, 31*(1), 2-13.

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Facilitating Summative Peer Review of Teaching: a software based on academic values

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This paper reports on a summative peer review of teaching process implemented in a university. Software was developed to facilitate the peer review process, demonstrate principles of transparency, fairness and equity and support the academic values of collegiality, confidentiality and communication.

Keywords: summative peer review of teaching, software

Introduction

Peer review of teaching is a valuable feature of academic culture that facilitates and encourages improvement in teaching practice. The importance of peer review in higher education teaching is internationally recognised (Blackmore, 2005) and several national peer review projects have been funded in Australia (McKenzie et al., 2011; Sachs et al., 2014; Crisp et al., 2009) including a web-based peer review project (Wood, 2008). However, the focus remains largely on formative feedback for improving teaching practice (Bell, 2012) while academics are reluctant to accept summative peer review of teaching (SPRT) as an indicator of teaching effectiveness (Iqbal, 2013). Many academics are concerned about transparency, fairness and equity in the SPRT process, particularly if applied to performance management or promotion. In December 2014 the senior management group at UniSA approved the development of software to facilitate and enhance the SPRT process and address these concerns.

SPRT at UniSA

The process of SPRT at UniSA is initiated by the Head of School (HoS), who nominates staff for formal peer review at the commencement of each calendar year. Two trained reviewers observe a teaching activity/artefact, review curriculum materials including assessment items and course assessment profiles and develop a final report that merges their reviews. Where the observations and recommendations from the reviewers markedly differ and consensus cannot be reached a third reviewer may be requested by the HoS. The reviewers submit the final report and notification of completion of the peer review process is sent to HoS. The staff member under review has the option of writing a reflective response (rejoinder) regarding the feedback. A final report is included as part of a staff member’s full suite of evidence of quality teaching for performance management or promotion purposes.

A new software system was developed to facilitate SPRT and enhance the following values within the process:

- *Equity/fairness* - The software supports equity/fairness by enabling the peer reviewee to see all stages of the peer review process: initiation, organisation, observation and report. They can also participate in the selection of their reviewers; make a rejoinder to the reviewers’ report; request another review on the basis of extenuating circumstances with the support of the Head of School (HoS) or request a third reviewer when reviewers disagreed about their respective observations. A reviewer is also given the opportunity to reject an invitation to review a colleague.
- *Collegiality* - The software facilitates opportunities for reviewee and reviewers to meet and discuss selected review criteria and organise the observation activity. It also enables the reviewee to respond to reviewers’ comments via the rejoinder and allows reviewers to reflect on and collaborate on their judgements about a colleague’s teaching and then to collaboratively write the final report.
- *Confidentiality* - Confidentiality in the system is enhanced when the HoS can initiate a peer review and view (but not modify) the peer review report. The software also allows reviewers to complete parts of the peer review form, enter observations and write a report however they are not able to see the reviewee’s rejoinder. All review data is stored in a secure database.
- *Communication* - Pre-review meetings are held between reviewers and reviewees to discuss and agree on dimensions and their indicators. These are then entered into the SPRT software.

- *Consistency* - The software provides a consistent framework for SPRT processes across the University and includes an up-to-date list of trained reviewers from across the University who can participate in reviews. Templates encourage reviewees to reflect on their teaching objectives, methods and feedback and choose the criteria on which their teaching or teaching materials will be judged.

The software includes the following roles.

Table 1: Software Roles

System Administrator	Review Manager	Reviewer	Reviewee
This role has access to all components within the system except for the populated review form and covers.	This role is granted to the Head of School (HoS) or Associate Head of School and is restricted to a specific School.	This role can move across Schools.	This role is restricted to a specific School.
• View status (only) of all reviews across system • Configure the system and manage passwords • Manually assign people to specific roles • Edit School information • Modify dimensions and template.	• Initiate a peer review process • Assign a third Reviewer in the case of a disagreement between reviewers • Deactivate a review (in the case of extenuating circumstances).	• Organise and observe a peer review process • Consolidate findings and create a final report.	• Participate in pre-review meeting • Submit a rejoinder based on the final report completed by Reviewers

Outcomes

The SPRT software was trialled at the start of the 2016 promotion process (March 2016) with very limited functionality (the ability for Review Managers to enter a reviewee's details and the selection of two reviewers). A total of 67 reviews were completed and a great deal of positive feedback was received:

- Reviewers valued the discussion of teaching environments and review criteria and the development of a shared understanding of the review process. Many were excited to learn new or different teaching techniques that they could then experiment with in their own teaching, reflecting Bell's (2012) claim that peer review of teaching results in academic development. The training of a pool of peer reviewers has established the beginnings of a 'teaching community' referred to by Shulman (1993)
- Reviewees valued the opportunity to engage equally in the meetings prior to the observation of their teaching. They also indicated that they benefited from the constructive feedback received along with the evidence-based judgements of their teaching
- Heads of School valued the ability to become more aware of the quality of their colleagues' teaching.

As a result of the trial a range of enhancements to the software have been identified for future development:

- Allowing reviewers to nominate the periods they are available for peer review which will cut down on unnecessary email communication being triggered by requests for peer review
- Relaxing the need for one reviewer from the School and one from without the School once a School's reviewers have met their quota
- Linking to profiles of the pool of trained reviewers
- Developing agreements with other universities to access external peer reviewers.

References

Bell, M (2012) Peer Observation Partnerships in Higher Education 2nd Edition Higher Educational Research and development Society of Australasia Milperra

Blackmore, J. A. (2005). A critical evaluation of peer review via teaching observation within higher education. The International Journal of Educational Management, 19(2), 218-232.

Crisp,G., Sadler, R., Krause, K., Buckridge, M., Wills, S., Brown, C., McLean, J., Dalton, H., Le Lievre, K., & Brougham, B. (2009). Peer review of teaching for promotion purposes: A project to develop and implement a pilot program of peer review of teaching at four Australian universities. Sydney, NSW: Office for Learning and Teaching. http://www.olt.gov.au/resource-peer-review-teachingadelaide-2009

Iqbal, I (2013) Academics resistance to summative peer review of teaching: questionable rewards and the importance of student evaluations. Teaching in Higher Education, 18, 557-569

McKenzie, J, & Parker, N. (2011). Peer review in online and blended learning environments. Sydney, NSW: Australian Learning and Teaching Council. http://www.uts.edu.au/sites/default/files/final-report.pdf

Sach, J., & Parsell, M. (2014) Introduction: The place of peer review in learning and teaching. In J. Sachs & M. Parsell (Eds), Peer review in learning and teaching in higher education: International perspectives. Springer, Dordrecht. p.1-12.

Shulman, L. (1993). Teaching as community property: Putting an end to pedagogical solitude. Change: The Magazine of Higher Learning, 25,(6), 6-7.

Wood, D. & Friedel, M. (2008) Peer review of online learning and teaching: New technologies, new challenges. In: Hello! Where are you in the landscape of educational technology? 1126-1135, Proceedings ascilite Melbourne 2008. http://www.ascilite.org.au/conferences/melbourne08/procs/wood-1.pdf

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From Flipped to Flopped to Flexible classrooms in Higher Education? – Critical Reflections from Australia

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There is currently much hype about the blended learning model of the 'flipped classroom' in higher education in Australia. Many courses at Universities are being transformed into fully or partially flipped classrooms where students prepare for face-to-face classes beforehand so that inclass time is used for active and collaborative learning. We provide six risks related to the flipped classroom based on our critical reflections from designing and teaching a fully flipped classroom. We argue that students' satisfaction and engagement with the flipped classroom model is increasingly eroded by the number of 'flipped' courses and the rising time demands for students and teachers. Other factors that risk the flipped classrooms becoming 'flopped classrooms' are the lack of prior training of students for self-motivated learning; and the dependence on skilled teachers to create inspiring and course content relevant pre-class activities and to run effective collaborative exercises in the class room.

Keywords: flipped classroom; active learning, flexible learning, higher education

Introduction

There is much hype about the 'flipped classroom' and 'flipped learning' in higher education around the world, including Australia, because it is seen as an 'innovative pedagogy' which in the next 2-5 years has a potential 'high impact' on student engagement and learning at Universities (Sharples et al., 2014). As stated in Faculty Focus (2015, 2), "perhaps no other word has been as popular in higher education during the past few years as the term 'flipped'." The flipped classroom, which is also called the inverted classroom, is a pedagogical model in which students prepare for the face-to-face classroom through online material and activities, such as watching recorded lectures, doing web quests or online quizzes. The flipped classroom is thus a blended learning strategy as it involves a combination of face-to-face and online components in the same course. The traditional lecture, often seen as ineffective for student engagement and learning, is replaced with online material and the face-to face classroom is used for active learning, such as problem solving, group work, discussion and analysis (EDUCAUSE, 2012; Faculty Focus 2014; 2015).

Fully or partially flipped classrooms have been increasing as the preferred model of delivery in higher education (Faculty Focus, 2015). The University of Adelaide's Vice-Chancellor, has even declared that the traditional lectures are obsolete and "are never coming back" (Dawson, 2014), and is promoting more use of blended and online learning for courses. Despite its increasing popularity as an instructional model, there is still limited evidence of its effectiveness for improving student learning outcomes (Sharples et. al., 2014, p. 15; McNally et al., 2016). This is slowly changing with more and more studies emerging about the benefits of the flipped classroom, in particular for increasing student engagement and interactive collaborative learning, but also for improved learning outcomes (Wanner & Palmer, 2015; Flores, 2016; Foldnes, 2016; Koo et al., 2016).

In this conceptual paper, we provide our critical reflections about the flipped classroom based on our experiences. Student surveys and evaluations of flipped courses and also perspectives of teachers about the flipped classroom are also utilized for our discussion. Our main argument is that there is a growing danger that flipped classrooms will turn into 'flopped classrooms' because students – and also teachers – may become increasing disillusioned and resistant to this model of delivery. We argue that the increasing number of flipped classrooms, which are implemented with varying success, could undermine the basic premises and objectives of flipped learning, such as more learner and learning-centred approaches to teaching, more flexibility in delivery and assessment, and increasing student involvement as partners in their independent learning journeys. We identify six risks about the flipped classroom which require future research.

The Flipped Classroom: blended and active learning

The current trend of more and more blended learning and online learning, for example the rise of the Massive Open Online Courses (MOOCs) around the world, is increasingly challenging and replacing the traditional forms of teaching and learning at universities. This trend is partly driven by student demands for more flexibility in course delivery and partly by universities transforming to new situations of global learning, internationalisation of education and limited public funding for universities (Allen & Seaman, 2013). Blended learning is ultimately "a fundamental redesign that transforms the structure of, and approach to, teaching and learning" (Garrison & Vaughan, 2011, p. 5). The flipped classroom is a result of these trends as it provides more flexibility for student learning. The responsibility of learning in the flipped classroom model shifts from the teacher to a more student and learning centred approach. The flipped classroom is a 'flexible pedagogy' and "offers the benefits of being a more student-focused approach to teaching and learning" (Gordon, 2014, p. 10). The teacher is, however, still central to the flipped classroom model, as she/he is the one who provides the online course content for the students to go through before class, and also generally develops the active learning activities in the face-to-face classroom. The success of flipped learning depends on how the interactive classroom element is constructed" (Sharples et al., 2014, p. 15) and is thus very much teacher-centred. This is a contradiction and limitation, in our view, of the flipped classroom model, as we discuss below. However, there can be no doubt that the flipped classroom and blended learning provides the opportunity for teachers to rethink their pedagogies and teaching practices, and put the learners more at the centre of teaching and learning (Faculty Focus, 2014; 2015).

As a study by the authors (Wanner & Palmer, 2015) showed, students in one social science class mostly enjoyed the fully flipped classroom, delivered in 2014, as it provided them with a more personalised approach to learning through more flexibility in their learning and with assessment. This study supported other studies that the flipped classroom increased student engagement with course content, the teacher and with their peers, and that students prefer a blended learning environment over solely online. Students like interactive, collaborative, and well-designed learning activities in a face-to-face classroom. This corroborates other studies, such as a 'good practice' report about blended and technology enhanced learning (Partridge et al., 2011) and a literature review that active learning works for student engagement and learning (Prince, 2005). Although there are clear benefits of blended and flipped learning, such as more flexibility for students and more student engagement, there are also many challenges, such as student expectations that these modes of learning mean less work for them, the lack of students' self-responsibility for their learning, and the increased time commitment for teachers (Partridge et al., 2011). The many institutional, pedagogical, and personal challenges to design and run successful flipped classrooms (see Wells & Holland, 2016) make the model very vulnerable to turn into a 'flop'. The success of the model depends, in our view, too much on presumed teacher and student ability to make flipped classrooms work consistently across the sector, not to forget the role of the institutions to provide all required technologies and flexible learning spaces. These issues are discussed more in the next section.

From Flipped to Flopped Classrooms? - Six risks

The fully flipped classroom of one of the authors, on which the study in 2014 was based, was run again in Semester 1 in 2016 (the course is only offered every second year). In 2014, there were 109 students enrolled in the course, with 17 international students (mainly from Brazil), and the gender distribution was 81 female and 28 male students. In 2016, the number of enrolled students was 71 with 48 female and 28 male students and 8 international students (all from Europe). The teacher observed a marked difference in the enthusiasm and engagement with the course material, both online and face-to-face, by the students. No formal study was done for the course in 2016, but the student evaluations of the course showed that the percentage of broad agreement declined for important criteria from 2014 to 2016: *Has clearly identified learning outcomes* (83.87% in 2014 to 77% in 2016); *Uses appropriate strategies to engage me in my learning* (87.10% in 2014 to 80% in 2016); *Overall, I am satisfied with the quality of this course* (80.65% in 2014 to 67% in 2016). The low student evaluations in 2016 prompted us to reflect and to rethink the flipped classroom model of teaching and learning. We suggest six risks about current developments of the flipped classrooms, and the dangers of becoming flopped classrooms based on our own reflections and observations.

***Risk 1:* Many students do not have the time for flipped classrooms in all of their learning**
With increasing number of flipped classrooms students have less and less time to prepare adequately or perhaps at all for the face-to-face classrooms. The flipped classroom model bases its success on the in-class activities, which in turn rely on the pre-class student preparation, but students are likely with more and more time demands to have decreasing intrinsic motivation to do the many required preparatory tasks; they are more likely to be driven by extrinsic motivation (what is assessed) in their learning (Abeysekera & Dawson, 2015). In our study (Wanner & Palmer, 2015), students did suggest that if all of their classes followed a flipped model, it would actually be very hard to prepare for tutorials due to the clashes that they experience in their own timetables and the likelihood that they would end up with tutorials close together in time with insufficient time to prepare for each of them correctly.

The average time spent by each student on the Learning Management System where the online learning modules for preparation were provided declined in our fully flipped course (offered for the first time in 2014 and second time in 2016) from 45.42 hours per course (12 weeks) in 2014 to only 8.88 hours in 2016. This might show decreasing interest and motivation with the flipped classroom model of instruction or it might show that students have learned how to adjust to succeed in the many flipped classrooms they are participating with the minimal amount of time and effort (Risk 4). It is definitely worth noting that despite entreaties over the years from lecturers, students have rarely come prepared to tutorials and lectures. This mentality is one of the biggest hurdles towards a flipped classroom being a consistent success.

***Risk 2:* Many students do not have the required skills for flipped learning**
The flipped classroom and flipped learning depends on self-regulated, highly self-motivated students who have the time management, organisational, analytical and critical thinking from the provided pre-class information and the interactive in-class activities (Partridge et al., 2011, p. 5). Students in our study (Wanner & Palmer, 2015) were concerned about self-motivation, remembering to do course tasks and technical issues as well as potential lack of direction and additional workload. In addition, the flipped learning environment through more group work and collaborative learning in the classroom “seem to favour the extrovert” who have the skills to lead group discussion or being active in role plays and so on, but “are we missing valuable contributions from students who don’t speak up and thrive in these highly interactive situations?” (Faculty Focus, 2014, p. 18). There is usually no specific training for students to develop the skills needed for flipped learning; it is assumed that student can do the preparatory work but “self-regulated learning is neither easy nor automatic” and depends on already existing levels of self-efficacy (that is positive judgements about own academic capabilities) (Pintrich, 1999, p. 467). Students continue to use the same learning strategies they have used in the traditional learning environment (eg. traditional face-to-face lectures) without learning effective self-regulated learning strategies and skills required in flipped learning (Koo et al., 2016; p. 7). Student “require assistance transitioning from instructor-centred to learning-centred environments” (McLaughlin et al., 2016, p. 33). It could be that students are already disengaged with the material during pre-class preparation because they lack the required skills. This potentially further demotivates the students and may increase their resistance to the flipped classroom. The face-to-face classroom would then be less effective in achieving student learning, because of students’ internal resistance and having ‘de-linked’ from the flipped classroom process before they even arrive in class.

***Risk 3*: Students are becoming increasingly resistant to flipped classrooms and learning**
McNally et al. (2016) have shown that resistance to student-centred learning in the flipped classroom occurs not just because of the novelty of this approach, but also because the high level of demand for active learning in the class and for preparation relates to lower student acceptance and less favourable student perceptions of flipped classrooms. They distinguish between ‘flip endorsers’ – those who display positive attitudes towards the pre-and in class course activities and are more engaged with the content and the peers – and ‘flip resisters’ – those students who resist the amount and type of pre and in class activities. Interestingly, “flip endorsers were found to be older and more likely to be female” McNally et al. (2016: no page assigned yet). This links to Risk 2 that there are different learning styles and student skills which need to be more researched and taken into account for effective flipped classrooms. There is also the issue of cognitive load or overload that with too many tasks and assignments across various flipped classrooms students will become demotivated and resistant to flipped learning (Abeyesekera & Dawson, 2015). It needs further research to discover at what level and why students become resistant to flipped learning, and also whether there are gender or other culturally determined factors of student resistance. Our study has shown (Wanner & Palmer, 2015) that students want a balance of teacher guidance and of self-control in their learning and assessment but finding this balance is likely to be very complex.

***Risk 4:* Students become more strategic in being successful in flipped classrooms without going through the flipped learning process**

With more and more uptake of fully or partially flipped classrooms, students are becoming increasingly more strategic in how they are using their time to do the many different tasks for pre-class preparation and for assessment. In the flipped classroom, assessment continues to play a crucial role in student learning. Extrinsic motivation by students – that their efforts lead to measurable outcomes in forms of grades – is the norm for students in higher education and also in flipped classrooms (Abeyesekera & Dawson, 2015). However, extrinsic motivation is in a way counter-productive to developing self-regulated and self-motivated (by intrinsic motivation), life-longer learners. As argued by Abeyesekera & Dawson (2015, p. 7), the flipped learning environment "entices greater levels of extrinsic motivation." It is very likely that only high achievers and highly engaged students go through all preparatory material and do the required tasks *before* the class. As stated by McLaughlin et al., (2016, p. 29), "if students are able to engage without preparing or able to attend class without engaging at all, they may choose not to complete pre-class assignments." This area needs further studies to investigate what kind of strategies students use to get through their flipped classrooms, how they are motivated and maintain their motivation and what kind of learner and learning strategies in flipped classrooms achieves high learning outcomes.

***Risk* 5: All four risks for students equally apply to many teachers**

Our last risk is that the previous risks also apply to many teachers who design and implement flipped classrooms. Many teachers do not have time or skills to design and work in flipped learning environments (Risks 1 and 2), and require help to develop the skills and get institutional support when doing flipped classrooms. Like the students, teachers require significant retraining to become 'flexible teachers' in flexible learning environments (Gordon, 2014). The success of flipped classroom, as mentioned earlier, depends very much on the teacher and how the flipped classroom is designed. Flexible teaching and learning in a flipped classroom requires a high level of time commitment by the teacher for initial design and implementation. As argued previously by the authors (Wanner & Palmer, 2015, p. 365), "it becomes infeasible to teach in this way if there is no institutional support in form of teaching assistants or available learning spaces, and when teachers are required to teach multiple courses in one semester." The issue of increasing de-motivation and resistance by teachers even of innovative 'flip endorsers' through increasing time and work load pressures needs more research (Risk 3). For Risk 4, teachers will become less enthusiastic and motivated to be 'flip endorsers' and become more strategic rather than innovative and creative (which takes time and effort) in providing stimulating flipped learning experiences for students. In any case, this dependence on the teacher for successful flipped classrooms undermines, in our view, the main principle of more learning/learner driven learning environments.

***Risk 6*: Educational spaces and University support are inadequate for effective flipped learning.** As stated by EDUCAUSE (2012, point 6), with greater numbers of courses using the flipped classroom, "at a certain level of adoption, colleges and universities may need to take a hard look at class spaces to ensure they support the kinds of active and collaborative work common in flipped classes." In our university at least, the appropriate spaces for meaningful group work and interaction following the online component of a flipped classroom can be difficult to schedule. Whilst cabaret style spaces are particularly suitable for interaction and collaboration, many universities are likely to have significant issues in providing this infrastructure across all of their offerings.

Conclusion

There is much hype and debates about the value of the flipped classroom model of teaching and learning. "The question remains as to whether flipped classrooms will become a dominant paradigm in higher education over the coming decades" (McLaughlin et al., 2016, p. 35). We think, despite its growing popularity, that the flipped classroom, may not become the dominant paradigm anticipated in higher education because it depends too much on i) the students' ability to do critical and analytical work and on students' self-efficacy and motivation to do the required preparatory work; and (ii) on the teacher's abilities to create and implement effective flipped learning environments. Where it is teacher-centred rather than learning-centred the danger of flopped classrooms are too great. The way the course and assessment is designed might have a positive impact on the students' acceptance of the flipped classroom, in particular if it means little workload for the students. The risks outlined in this paper, in our view, still apply for any kind of flipped classroom.

We think that the flipped classroom is potentially a stepping-stone to more innovative, learning/learner-driven and personalised teaching and learning models which, unlike the flipped classroom, really have student empowerment and flexible learning and at its centre. The many institutional, pedagogical, personal, sociocultural and other challenges of the flipped classroom "require the reorientation of attitudes, beliefs and/or values-bases of educators and learners, towards valuing more learner-centric, autonomous, flexible learning experiences" (Wells & Holland, 2016, p. 10).

The best way to proceed is likely to be with caution. It wasn't long ago that MOOCs were going to change the face of higher education and whilst they provide useful and sometimes engaging approaches to learning, they are still to have the impact anticipated. The flipped classroom could go the same way, but if the risks above are acted upon it is still possible that this form of learning may have lasting impact.

The paper has shown that there needs to be more research on *how* students engage with tasks and assessment in the flipped classrooms, in particular in the context of increasing numbers of partially or fully flipped courses at Australian universities. Many important questions need answers, such as, what are the underlying motivations for their learning in flipped classrooms; what strategies do students employ to meet all the requirements; which students do best in flipped classrooms, how can the less-skilled and more introverted students be helped to succeed in flipped classrooms; what kind of learning is achieved through the pre-class activities? These and similar questions, as highlighted in our risks, require more empirical studies to get better understandings so that flipped classrooms do not become 'flopped classrooms'. More importantly, such future research is important to move forward with educational changes at Australian Universities where teaching and learning is not flipped but flexible and creative, and leads to student engagement where students are partners in teaching and learning (Healy et al., 2014).

References

Abeysekera, L. & Dawson, P. (2015). Motivation and Cognitive Load in the Flipped Classroom: Definition, Rationale and a Call for Research, *British Journal of Educational Technology*, 34(1), 1133-1148.

Allen, I. E., & Seaman, J. (2013). *Changing Course: Ten years of tracking online education in the United States* http://sloanconsortium.org/publications/survey/changing_course_2012.

Dawson, P. (2015). Will the University of Adelaide's lecture phase-out be a flop? *The Conversation*, 3 July 2015. http://theconversation.com/will-the-university-of-adelaides-lecture-phase-out-be-a-flop-44074.

EDUCAUSE. (2012). Seven things you should know about the flipped classroom. Available at https://net.educause.edu/ir/library/pdf/ELI7081.pdf.

Faculty Focus. (2014). *Special Report: Blended and flipped: Exploring new models for effective teaching & learning*. http://www.facultyfocus.com/free-reports/blended-flipped-exploring-new-models-effectiveteaching-learning/

Faculty Focus, (2015). *Flipped Classroom Trends: A Survey of College Faculty.* http://www.facultyfocus.com/free-reports/flipped-classroom-trends-a-survey-of-college-faculty/

Flores, O., del-Arco, I. & Silva, P. (2016). The flipped classroom model at the university: analysis based on professors' and students' assessment in the educational field. *International Journal of Educational Technologyin Higher Education*, 13(21), 1-12.

Foldnes, N. (2016). The flipped classroom and cooperative learning: Evidence from a randomised experiment. *Active Learning in Higher Education*, 17(1), 39–49.

Garrison, D. R., & Vaughan, N. D. (2011). *Blended learning in higher education: Framework, principles, and guidelines*. San Francisco: Jossey-Bass.

Gordon, N. (2014). Flexible Pedagogies: technology-enhanced learning. UK.: The Higher Education Academy. https://www.heacademy.ac.uk/sites/default/files/resources/tel_report_0.pdf.

Healey, M., Flint, A. & Harrington, K. (2014). *Engagement through partnership: students as partners in learning and teaching in higher education.* UK: The Higher Education Academy. https://www.heacademy.ac.uk/sites/default/files/resources/engagement_through_partnership.pdf

Koo, C.L., Demps, E.L., Farris, C. , Bowman, J.D., Panahi, L. & Boyle, P. (2016). Instructional design and assessment: Impact of Flipped Classroom Design on Student Performance and Perceptions in a Pharmacotherapy Course. *American Journal of Pharmaceutical Education*, 80 (2), 1-10.

McLaughlin, J.E., Paul J. White, P.J., Julia Khanova, J. & Elizabeth Yuriev, E. (2016). Flipped Classroom Implementation: A Case Report of Two Higher Education Institutions in the United States and Australia, *Computers in the Schools*, 33(1), 24-37.

McNally, B., Chipperfield, J., Dorsett, P., Del Fabbro, L., Frommolt, V., Goetz, S., Lewohl, J., Molineux, M., Pearson, A., Reddan, G., Roikos, A., & Rung, A. (2016). Flipped classroom experiences: student preferences and flip strategy in a higher education context. *Higher Education* (no volume and issue yet assigned), 1-18.

Partridge, H., Ponting, D., & McCay, M. (2011). *Good practice report: Blended learning*. Australian Learning and Teaching Council. http://eprints.qut.edu.au/47566/1/47566.pdf.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International journal of educational research*, *31*(6), 459-470.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, *93*(3), 223--231.
Sharples, M., Adams, A., Ferguson, R., Gaved, M., McAndrew, P., Rienties, B., Weller, M., & Whitelock, D. (2014). *Innovating Pedagogy 2014: Open University Innovation Report 3*. Milton Keynes: The Open University.
Wanner, T., & Palmer, E. (2015). Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course. *Computers & Education, 88*, 354-369.
Wells, M. and Holland, C. (2016). Flipped Learning! Challenges in Deploying Online Resources to Flipped Learning in Higher Education. In Keengwe, J. and Onchwari, G. (Eds.). *Handbook of Research on Active Learning and the Flipped Classroom Model in the Digital Age.* Hershey, PA, USA: Information Science Reference, pp. 1-18.

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Note: All published papers are refereed, having undergone a double-blind peer-review process.

Learning design@CSU

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Educational Designers at Charles Sturt University have recently completed a professional development program in course design. An outcome of this professional development activity has been the development of online modules which cover various learning and teaching strategies and as a by-product; learning design templates. The online modules are designed to provide an overview of how to use evidence based learning and teaching strategies, with the aim of changing teaching practice to positively influence student learning. After developing these modules, it was recognised that they could be adapted into templates that teaching staff could use directly in their subjects. This paper will discuss the progress of this multi-faceted project that focuses on professional development of Educational Designers and academic staff, development of online modules and learning design templates.

Keywords: Learning design, course design, professional development, learning design templates, learning and teaching strategies.

Introduction

Learning and teaching in higher education is becoming increasingly complex with leaders having to deal with environments that are volatile, uncertain, complex and ambiguous (Shapland, 2013; Johansen, 2009). Increased participation and the lessening of entry requirements has resulted in students less academically prepared entering higher education (Norton, 2014). There is also continued uncertainty about government funding, deregulated fees and the quality regulator (Norton, 2014). Academic staff face competing demands juggling research, teaching and curriculum development coupled with the increased use of technology in teaching including learning management systems, Web 2 technologies and mobile technology (Bennett, Thomas, Agostinho, Lockyer, Jones & Harper, 2011; Bexley, James & Arkoudis, 2011; Dalziel, Conole, Wills, Walker, Bennett, Dobozy, Cameron, Badilescu-Buga & Bower, 2016). They are required to understand and incorporate pedagogical sound approaches in their teaching, focus on 'student centered' approaches and embed Graduate Learning Outcomes in courses. To meet regulatory requirements (Higher Education Standards, Australian Qualifications Framework), threshold standards and specific Institutional standards, a holistic approach to course design is advocated. Many projects and fellowships funded by the Office for Learning and Teaching advocate a holistic approach to course design (Lawson, 2015; Rodger, 2011). Also as a number of authors indicate curriculum design and the development of courses is no longer an individual activity;

> The focus has shifted in recent years from the individual teacher designing a module or session to include teams designing whole courses (Laurillard, 2013, p.26)
>
> teaching is being conducted by teams in which the quality of the student experience and student learning is highly dependent on the seamless integration of the different individuals – both academic and professional staff – who contribute specialised roles, from curriculum designers and 'discipline experts', to small-group facilitators, assessors, eLearning experts, academic skills specialists and library skills support staff, to name a few (James, Baik, Millar, Naylor, Bexley, Kennedy, Krause, Hughes-Warrington, Sadler, Booth, & Booth, 2015, p.11)

This is the case at Charles Sturt University (CSU) where a holistic approach to course design has been adopted. It is a collaborative process with Course Directors leading an academic course team supported by experts in course design, graduate learning outcomes, online learning, and assessment. Educational Designers work closely with Course Directors co-leading the process and are an integral part of the team. Whilst course design is a collaborative team process, individual teachers have considerable autonomy in the way subjects are delivered; provided they teach within the designed curriculum, the intended learning outcomes for the subject and assess the stated learning outcomes (Bennett et al, 2011). Therefore, teachers would benefit from a professional development program in how to adopt learning and teaching strategies in their subjects (Bennett, et al, 2011). As Bennett et al states;

> Team planning often occurred at a course level, with individuals often left to design their own units within an agreed overall structure and approach (Bennett, et al, 2011, p. 165)

Terminology

The definitions of learning design and teaching strategies outlined by the Larnaca Declaration are appropriate for the context outlined in this paper (Dalziel, et al 2016). A learning design (uncapitalised) is a ‘sequence of teaching and learning activities’ and these have been developed based on various teaching strategies (active lecture, problem based learning, cooperative learning, scenario based learning, portfolios and reflection). The learning design templates developed are aligned to particular pedagogical approaches but may also be adapted to suit discipline contexts. As Dalziel et al suggests the templates may be used ‘as is’ or adapted to suit the needs of the learner and/or differences in disciplines.

Reference to ‘course’ in this paper is used to describe a degree program with ‘subject’ used to describe individual units of study.

Professional development

Educational Designers at CSU have traditionally been involved in supporting a wide array of learning and teaching activities. These include the use of technology in teaching, advising on assessment design in subjects, induction of academic teaching staff, and facilitating professional development activities. Educational Designers are also seen as change agents and are often involved in the rollout of University wide policies (Assessment and Moderation policy in 2014), implementation of Learning Management Systems (Blackboard, 2015) and other technologies (PebblePad, 2016). Educational Designers are increasingly involved in the process of course design and work collaboratively with Course Directors and course teams through a systematic course design process supported by bespoke software.

In order to ensure Educational Designers are able to fulfil this expanding role in course design, a six month professional development program was undertaken in the first half of 2016. Educational Designers attended weekly workshops where they were introduced to the Course Design process. Outside of these workshops, the participants were divided into teams and used the course design process to develop programs in learning and teaching strategies. The following professional development programs were developed; Active lectures, Problem Based Learning, Cooperative learning, Scenario based role play, Portfolios and Reflection. The programs will be delivered online using Blackboard (Interact 2) and are designed to upskill academic teaching staff as an individual development activity. The resources developed will also be used by Educational Designers in facilitated workshops for course teams and sessional teaching staff. The use of the professional development programs could also be considered further and incorporated into Graduate Certificate programs in learning and teaching or as series of badges that provide evidence of professional competency (Gibson, Ostashewski, Flintoff, Grant & Knight, 2015). Discussions about their use is currently underway.

The professional development modules are currently being peer reviewed by academic staff who have used the strategies successfully within their own teaching both online and face to face and/or by those who have conducted research in these areas. Feedback will be considered and changes incorporated into the online modules.

Academic staff at CSU are often recruited from professional roles in industry and are valued for skills and knowledge in their particular discipline area (Bennett et al, 2011). Because of their professional backgrounds, most academic teachers usually start teaching by reproducing the way they were taught and model a specific way of teaching for their discipline (Salmon & Wright, 2014; García, Arias, Murri, & Serna, 2010). Whilst new teaching staff may complete introductory courses in learning and teaching in higher education, teaching staff may not be exposed to a variety of teaching strategies. Whilst it is recognised that different strategies may be more appropriate for different subjects, disciplines or at certain stages of learning (Dalziel et al, 2016) the use of different learning and teaching strategies should not be excluded from consideration. Providing a number of design templates enables teachers to consider new learning and teaching strategies and be guided in a supportive manner which would ultimately improve student learning. As Laurillard et al, 2011 states;

> Teachers do not have the time to learn through books, papers, course and workshops, therefore the environment has to embed within its operations information, advice, and guidance on the current knowledge about teaching and learning (p.13)

Hence, learning design templates that could teachers could easily be re-used in their subjects will also be developed.

Learning design templates

The process of learning design is second nature to Educational Designers but the product or outcome of the design process has not been articulated for reuse at CSU (Corrin, Kennedy, de Barba, Lockyer, Gaševic, Williams, Dawson, Mulder, Copeland, & Bakharia, 2016). The product or outcome of a design process is a description of the pedagogical intent of the teacher represented as text and/or illustrations and are often referred to as design patterns (Corrin, 2016; Goodyear, 2005). The process of conceptualizing, planning, and orchestrating learning designs is a key component of the work undertaken by Educational Designers. The learning design of each online program was based on the underlying principles of a teaching strategy and identification of appropriate online tools that would support students engaging in the activities. Once the professional development programs were developed, work began on 'thinking through' how the teaching strategy could be adapted to become a 'template' or a design pattern that could be created within Interact2. Teaching staff could then export/import the templates into their Interact2 sites for use and customised to suit their students.

The learning design templates could be used to underpin the design of a whole course or subject or as the basis for a learning activity or experience within a subject. It was also recognised that not all teaching staff would have the time or inclination to work through the professional development modules. Various professional development workshops and online resources are available but attendance and use of the resources is variable. Whether professional development activities transform teaching practice is also not clear (Salmon & Wright, 2014). The development of both online modules and a template provides the 'either-or' or both option. The templates are a set of example designs providing guidance to teaching staff about how to use the teaching strategy whilst incorporating practical considerations such as online tool selection, processes with a learning management system, and learning activities.

Each template will be structured in a similar format and be designed to provide step by step instructions for the teacher to populate as required. The template will include the core elements of the learning and teaching strategy but also have a similar structure. All templates will include; an introduction to the activity, how it aligns with the subject learning outcomes, specific tasks that students will need to engage with, resources that support learning, the relationship to assessment tasks, the amount of time allocated for the activity and student feedback on the design of the task. The elements in the template reflect the planning stages of a learning activity outlined by Conole, Dyke, Oliver & Seale (2004). Since the templates are designed for use in the online environment recommendations to which tools to use will also be included. Employing a particular teaching strategy provides an underlying rationale for structuring the learning activities in a particular way. This will see variations in the design of each template. For example, active lecture may not necessarily include a group or peer learning experience whereas group activities underpin problem based learning and cooperative learning. The selection of online tools will also reflect the learning strategy employed.

Embedding the learning design templates into Interact2, enables the design to be easily exported into any Interact2 subject site and enables immediate use. So whilst the teacher may not complete the professional development modules for a particular strategy (even though this would be the ideal), using the template would ensure that evidence based teaching strategies are used. It is also possible that a variety of templates could be used in a subject. The use of templates in Interact2 enables a number of templates to be imported into subject sites and hence various learning and teaching strategies could be used; as long as the learning activities align to the learning outcomes for the subject and scaffolds students towards completion of assessment tasks. For example, a teacher may choose to use the active lecture template as well as cooperative learning template for students in the same subject. The learning experience could focus on a single activity or across an entire subject (Masterman & Craft, 2013).

Future directions

Work continues on refining the content and design of each professional development program based on peer feedback and as a consequence, to the learning design templates. Additional programs are being developed to add to the existing suite. Discussions about the use of the programs in our Graduate Certificate in Learning and Teaching in Higher Education are also ongoing. Further consideration will need to be given to how the online learning modules and templates will be promoted and supported. Technical aspects of ensuring that the template can be easily exported and used in subject sites will need to be investigated further as well as the development of help documentation. It is recognised that is unlikely that teaching staff will use the template without support from Educational Designers (McAlpine & Allen, 2007). Educational Designers are working on course reviews and it is possible that the professional learning programs and templates will be used by course teams to develop their skills and knowledge of learning and teaching strategies. The project offers a number of opportunities for further research including the how the online programs are used to support course teams and teaching staff, whether completion of a particular program changes teaching practice, and if/how the generic learning design template are used by teaching staff (too name a few!).

Conclusion

Participation in a professional learning program has not only improved the skills of Educational Designers in course design but also created an online learning program that will enhance the knowledge and skills of individual teaching staff. Ready to use online design templates combined with professional development and supported by Educational Designers would ensure that subjects use appropriate teaching strategies as well maintain the integrity of the course design. This multi-faced project offers the opportunity to support cultural change given the opportunity.

References

Bennett, S., Thomas, L., Agostinho, S., Lockyer, L., Jones, J. & Harper, B. (2011). Understanding the design context for Australian university teacher: implications for the future of learning design. *Learning, Media & Technology, 36*(2), 151-167.

Bexley, E., James, R. & Arkoudis, S. (Sept, 2011). The Australian academic profession in transition: Addressing the challenge of reconceptualising academic work and regenerating the academic workforce. Centre for the Study of Higher Education. Retrieved from; http://www.cshe.unimelb.edu.au/people/bexley_docs/The_Academic_Profession_in_Transition_Sept2011.pdf

Conole, G., Dyke, M., Oliver, M., & Seale, J. (2004). Mapping pedagogy and tools for effective learning design. *Computers & Education, 43*, 17-33.

Corrin, L., Kennedy, G., de Barba, P.G., Lockyer, L., Gaševic, D., Williams, D., Dawson, S., Mulder, R., Copeland, S., & Bakharia, A. (2016). Completing the Loop: Returning Meaningful Learning Analytic Data to Teachers. Sydney: Office for Learning and Teaching.

Dalziel, J., Conole, G., Wills, S., Walker, S., Bennett, S, Dobozy, E., Cameron, L., Badilescu-Buga, E. & Bower, M. (2016). The Larnaca Declaration on Learning Design. *Journal of Interactive Media in Education, 7*(1), 1-24.

Garcia, E., Arias, M. B., Murri, N. J. H., & Serna, C. (2010). Developing responsive teachers: A challenge for a demographic reality. *Journal of Teacher Education, 61*, 132-142.

Gibson, D., Ostashewski, N., Flintoff, K., Grant, S., & Knight, E. (2015). *Digital badges in education. Education and Information Technologies, 20*(2), 403-410.

Goodyear, P. (2005). Educational design and networked learning: Patterns, pattern languages and design practice. *Australasian Journal of Educational Technology, 21*(1), 82-101.

James, R., Baik, C., Millar, V., Naylor, R., Bexley, E., Kennedy, G., Krause, K., Hughes-Warrington, M., Sadler, D., Booth, S., & Booth, C. (2015). Advancing the Quality and Status of Teaching in Australian Higher Education. Lead Institution: The University of Melbourne. Retrieved from; http://www.olt.gov.au/resource-academic-workforce-2025

Johansen, B. (2009). *Leaders make the future: Ten leadership skills for an uncertain world*. San Francisco, CA: Berrett-Koehler.

Laurillard, D. (2013). "Forward" in Beetham, H. & Sharpe, R. (eds). *Rethinking Pedagogy for a Digital Age*. 2nd Edition, 26-30, Oxford: Routledge Falmer.

Lawson, R. (2015). Curriculum design for assuring learning – leading the way Final report, May 2015. 2013 National Teaching Fellowship. Retrieved from; http://www.olt.gov.au/resource-curriculum-design-assuring-learning-leading-way-2015

Masterman, E., & Craft, B. (2013). Designing and evaluating representations to model pedagogy. *Research in Learning Technology*, *21*, 1-14.

McAlpine, I., & Allen, B. (2007). Designing for active learning online with learning design templates. Proceedings ASCILITE conference Singapore 2007. Retrieved from; http://www.ascilite.org/conferences/singapore07/procs/mcalpine.pdf

Norton, A. (2014). *Mapping Australian Higher Education, 2014-15*. Grattan Institute Retrieved from; http://grattan.edu.au/wp-content/uploads/2014/10/816-mapping-higher-education-20142.pdf

Rodger, S. (2011). Building capacity among emerging occupational therapy academic leaders in curriculum renewal and evaluation at UQ and nationally. Final Report. The University of Queensland. Retrieved from; http://www.olt.gov.au/resource-building-capacity-among-emerging-occupational-therapy-academic-leaders-curriculum-renewal-a

Salmon, G., & Wright, P. (2014). Transforming future teaching through 'Carpe Diem' Learning Design. *Education Sciences*, *4*, 52-63.

Shapland, N. (2013). Academics are students too: Rethinking our approach. Proceedings of INTED2013 Conference, 4-6th March, 2013. Valencia, Spain. Retrieved from; http://library.iated.org/view/SHAPLAND2013ACA

Please cite as: Ward, L. (2016). Learning design@CSU. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 611-615).

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Technology choices to support international online collaboration

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Postgraduate business students participated in an international, fully-online collaboration pilot, focused on cultural intelligence skills needed to successfully navigate the global business world. Student projects utilized a transferrable learning design, with a changeable central case study posing challenges around (in this case) managing cross-cultural teams. This paper focuses on the learning design and choice of technologies to facilitate online collaboration. The combination of using new technology, and quickly developing relationships with counterparts from across the world, proved challenging for both staff and students. However, students quickly adapted, and strategically used the technologies to efficiently collaborate, albeit in ways different to the project leaders' expectations. Overall, the project provided an opportunity for students to network with students from other countries on real-world issues, and gain familiarity with technologies used by multi-national corporations.

Keywords: International student collaboration; online collaboration; Wikis

Introduction

Web2.0 tools have long been recognized as stable and reliable tools, and have become integral parts of the higher education sector (NMC Horizon report, 2005). And as mobile devices become more ubiquitous, the hyperbolic increase in mobile-friendly tools and apps has provided us with a plethora of choices when designing online curricula. In particular, when designing online student collaboration projects, we are no longer restricted to choices about which asynchronous technology to use, but can seamlessly integrate multiple technologies to best suit the purpose of the project and the student cohorts involved. And our choices are no longer confined to which one or two technologies we have access to at our institution, but rather, which collection of tools we will utilize for particular purposes.

Wikis as a tool for online collaboration have been well known in higher education as a stable and easy-to-use tool, yet the evidence of uptake of Wikis for student projects has been surprisingly low (Ebben et al, 2011). Literature around the use of Wikis for collaborative student work has been mostly focused on individual case studies (for examples, see Brack et al 2007; Weaver et al 2010). A more recent detailed study by Ebben, Kivatisky and Panici (2011) looked at how their students used a group wiki, and confirmed what most similar studies have found - groups tend to delegate work amongst individual members, and students used the Wiki as a facility to place their individual work. Group communication and discussion feature of the Wiki was underutilized, and little sharing of knowledge occurred. Similar results were reported by Prokofieva (2013), who found that students tended to cooperate rather than collaborate in their Wiki project, although this study did focus on a classroom setting, where students met face-to-face, and record their work on a group Wiki. Lai, Lei and Liu (2016) have raised concerns that by delegating work rather than collaborating on all aspects of their tasks, students can achieve different learning outcomes than those planned by their teachers.

Recent reports reveal that wikis are being used successfully amongst some professional groups to maintain and disseminate a body of knowledge (for example, Olver 2013), but this predominantly involves a key panel of experts modifying the content, based on contributions from feedback provided by a wider group of stakeholders. Despite only the selected group having the ability to edit the wiki pages, the inclusion of stakeholder feedback arguably meets a criteria of collaboration, but falls short of the collaborative construction of knowledge that we hope to facilitate in our student group projects.

Few detailed studies on technology-supported international collaboration seem to have been conducted, with most case studies seeming to leave the choice of communication and collaboration tools up to students, or simply providing LMS discussion boards. As detailed by Wang (2011), many factors contribute to the difficulty in developing a successful cross-cultural collaboration, including time zone and language differences, access to and familiarity with different technologies, and differences in online collaborative behaviours. McCarthy (2012) describes an international collaboration between students in Australia and USA, using facebook to post and comment on images, using only asynchronous communications, which met the needs of that project. However, with the increased ease of access and use of both synchronous and asynchronous technologies in recent years, current student collaborations can benefit from incorporating a range of tools to suit different purposes.

Case study: International student collaboration focused on cultural competencies

This paper describes a recent pilot study, trialing an international postgraduate student collaboration, between students studying their MBA programs in Australia and Brazil. The goal of the project was to provide opportunities for MBA students to develop cross-cultural competencies by partnering with similar business schools in a very different cultural environment.

The aims of the study are for the students to:

- become aware of their own cultural bias, and recognise there is not one right way to approach problems,
- understand the need to acquire knowledge from others in the group to solve a given problem,
- recognise the need to adapt their behaviour and learn from others with a different cultural background, and
- be motivated to learn more about dealing with cultural differences in their own workplace.

The collaborative project was designed around a real-world global communication need, requiring students to collaborate virtually with people from a different cultural background in real time and to jointly solve a series of management problems. Australian students were also invited to complete a Cultural Competencies questionnaire (www.CulturalQ.com), at both the start and end of the project, and were provided with their personal CQ report, as an aid to further understand their own cultural competency.

> Interaction in global workplaces requires individuals to be sensitive to different cultures, capable of analysing them as they are encountered, identifying what is required of people from other cultures and engaging in appropriate interactions with them. (Earley, Ang and Tan, 2006, p.2).

The project ran over a four week period during the students' normal semesters, but work on the project was completed outside class, and usually at late or very early hours to accommodate time differences between the two countries. The pilot program was non-assessed, meaning participation in this project was completely voluntary for students – a big ask for postgraduate students who are employed in management roles (a condition of entry to the La Trobe MBA program), with the normal other commitments of family and social lives.

This project is part of a wider project, which also included evaluation of student cultural competencies and consultations with key employer groups to discuss their workplace culture. Ethics clearance for all parts of the project were obtained from the Institutional Human Research Ethics Committee. This paper focuses on the learning design and technology choice – evaluation of CQ results is ongoing and will be published separately.

Finding a partner institution

Finding a similar group of students from an institution willing to collaborate on a voluntary non-assessed project was by far the hardest part of this project. Delays in confirming funding and ethics approval meant we only had weeks to set up and conduct this pilot, and the need to conduct all collaborations in English also limited our potential network. Email invitations were sent to over 100 Universities worldwide, with several expressing interest for future collaborations but not able to participate in this pilot on such short notice. Only one institution was able to participate quickly, so we were delighted to partner with Masters students from the Instituto Superior de Administração e Economia (Higher Institute of Administration and Economy) (ISAE) in Curitubo, Brazil. In this instance we were lucky to have a native Spanish speaker conducting the partner search, which helped smooth many hurdles. Working with students from Brazil was ideal for our project purposes, with so many differences in culture between the two countries providing a valuable source of discussion.

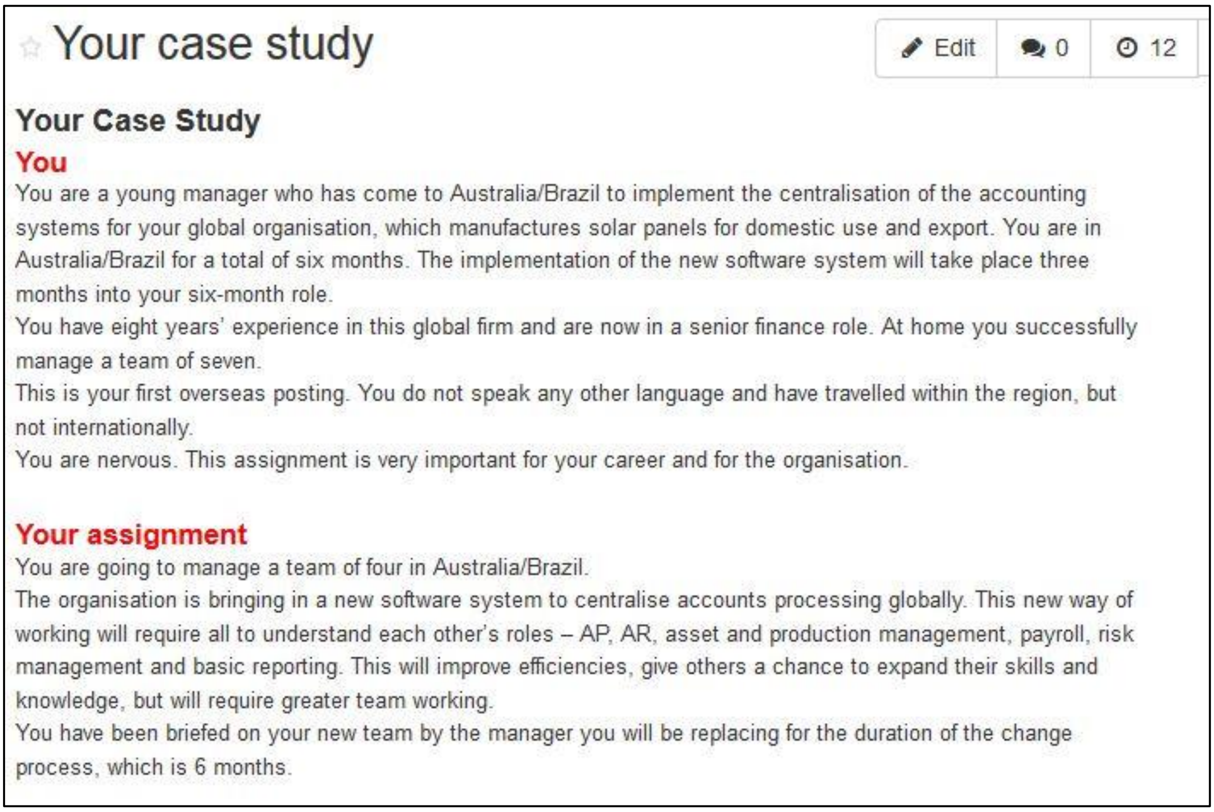
The Learning Design

We started with a consistent learning design, (see Table 1), intended to be reusable and applicable across a wide range of discipline areas. The learning design centred on a case study, which could be changed for different disciplines, countries or student cohorts. The first week of the design includes orientation activities to familiarize students (and teaching staff) with the technologies being used, and with introductions to the activities and timelines.

Table 1: Stages and tasks in the learning design

Week 1 - in home country teams	Introductions to project and technology platforms Pre-test CQ survey Online introductions to fellow students Country teams collaborate to list up to 10 things they would do to prepare for their assignment before leaving their home country.
Week 2	Country teams give feedback to other team's response on how to prepare Cross-country teams established, start work on case study questions (about meeting new team and starting work on assignment)
Weeks 3 -4	Cross-country teams continue work as case study rolls out (one month and two months after arrival, as issues within new team arise)
Week 4	Case study winds up Debrief and evaluation Post-test CQ survey

In the example discussed in this paper, the central case study revolved around a scenario of a middle-level manager being required to undertake an overseas posting and lead a team working on a critical project.


Your case study

Edit 0 12

Your Case Study

You

You are a young manager who has come to Australia/Brazil to implement the centralisation of the accounting systems for your global organisation, which manufactures solar panels for domestic use and export. You are in Australia/Brazil for a total of six months. The implementation of the new software system will take place three months into your six-month role.

You have eight years' experience in this global firm and are now in a senior finance role. At home you successfully manage a team of seven.

This is your first overseas posting. You do not speak any other language and have travelled within the region, but not internationally.

You are nervous. This assignment is very important for your career and for the organisation.

Your assignment

You are going to manage a team of four in Australia/Brazil.

The organisation is bringing in a new software system to centralise accounts processing globally. This new way of working will require all to understand each other's roles – AP, AR, asset and production management, payroll, risk management and basic reporting. This will improve efficiencies, give others a chance to expand their skills and knowledge, but will require greater team working.

You have been briefed on your new team by the manager you will be replacing for the duration of the change process, which is 6 months.

Figure 1: Case study for the pilot program (screen shot from the project Wiki)

Choice of technologies

For this project, students needed to be able to meet to discuss responses to questions, synchronously if possible, and a platform where they could collaboratively prepare their written responses. We decided on a Wiki for the collaborative platform, as it provided an easy-to-edit interface, with the facility for students to communicate asynchronously (using the comments function), and add additional pages as required. We selected Wikispaces (http://www.wikispaces.com) as our preferred Wiki, because it is free for educational purposes, independent of either institution, and particularly because of the advanced team functions available within the Wikispaces Projects feature. This allowed us to easily create sets of teams for different purposes, so that individual students could be members of multiple teams, and also allowed for easy changes to access to team wikis, so that we could open up team wikis to the wider cohort for review and feedback.

For synchronous communications, we chose the Zoom web-conferencing platform (http://zoom.us/), which was also free for students to start instant meetings, but required using licenses owned by members of the teaching staff to pre-schedule meetings. Zoom is intuitive and easy to use, and allows screen sharing of individuals' computer screens, and recording of meetings if required. Students and staff participating in the project also shared email addresses, as an added form of communication if required.

Student uptake of the project:

Students in both countries were introduced to the project by their own lecturers in their face-to-face classes, and invited to participate. This introduction was followed up with an email invitation to the Wiki. Thirty-one students signed up to the Wiki, with 19 of those then introducing themselves on the Wiki page. Eighteen of these students continued to the case study discussions, although several dropped their participation during the project. We believe about 12 students completed all stages of the project (based on Wiki participation and reports from fellow students - exact figures are not known as some students may have still been contributing to their groups' work via Zoom sessions but not leaving a footprint in the Wiki).

Twelve Australian students completed the pre-test CQ questionnaire (funding was not available to extend this to the Brazilian students), and eight of these completed the post-test CQ questionnaire.

Implementation and outcomes

For a small cohort of students working voluntarily for no credit, we were delighted with the uptake and with the overall outcomes – student teams engaged deeply with the case study, and drew eagerly on the insights from their international colleagues. However, much of the collaboration occurred in ways very differently to the original expectations of the teaching team, and many lessons were learnt to aid us in future iterations of similar projects.

An early exercise asked students to introduce themselves by uploading a photo and a brief description to a pre-formatted table in the Wiki. This was intended both as an icebreaking activity, but also to provide practice in editing the Wiki. Nineteen students contributed an introduction, as well as all members of the teaching team, and all took this seriously, providing fascinating reading, and proving successful as both a technical training exercise and an ice-breaker.

Name	Photo	Something about me...
Susan Keller		Welcome everyone, I am the MBA Deputy Director and my background is in Information Systems. I have four children and my youngest son is getting married in Italy very soon! In my spare time, I enjoy swing dancing including the Lindy Hop and Charleston. I live in Melbourne's outer eastern suburbs and enjoy visiting the many beautiful gardens in the nearby Dandenong ranges
Susan Inglis		Ola! Hello! I am a Professor of Practice - Management in the La Trobe Business School and teach Leadership and Management in our MBA program. I'm currently lecturing to the Management Fundamentals class and learning a lot from the students in the class. I'm married and we have a dog (no children). However, I have five brothers and two sisters so (at last count) about 25 nieces and nephews!! When not teaching I'm in a choir, a bookclub, part of a community garden, facilitate a couple of women's circles and am in a group striving to reduce our carbon emissions called Livewell Yarra.

Figure 2: Teaching team introductions in the Wiki (with permission from the staff members featured)

The first stage of the case study involved students collaborating within their own country groups, to decide on a list of tasks they would undertake as preparation to move to the new culture. At the end of the week, these responses were shared with students from the other country for feedback, and provided some amusing and eye-opening examples of how little groups knew of each other's culture. For example, the Australian students suggested taking salsa dancing lessons before departure, as a means of helping socialization on arrival in Brazil. However, the Brazilian students pointed out that while dancing is a great socialization activity, salsa dancing is not practiced as much in their city (Curitiba) as it is in Rio or other major Brazilian cities – perhaps similar to the geographical differences of popular football codes in Australia. This task was very popular with both student groups, involving researching the destination country, and providing further interaction and relationship-building than the simple introductory ice-breaker exercise.

For the remaining stages of the case study, students worked in small cross-cultural teams, of about four to six members. We expected students to work asynchronously in their team Wikis, preparing collaborative text-based responses to the problems. Students did contribute their ideas to the Wikis, but we were surprised to find they were highly reluctant to edit each other's words, even while discussing different response to the questions posed. When asked about this, students reported that they felt it was rude or disrespectful to change another's written work, and were not comfortable with another student editing their own work, despite collaborative responses being a clearly understood as a requirement of the project. Even when we strongly encouraged this, and demonstrated how easily students could view who had made which edits, they preferred to add their own suggestions in a different coloured text below the original contribution, or simply to add their individual contributions as a comment to the page, thus using the Wiki more as a discussion forum than a shared collaborative document.

On the other hand, we had originally thought students would use Zoom only for an initial meeting, to get to know each other and build relationships within their teams, and then communicate asynchronously via the Wiki as they prepared their shared responses, thinking the asynchronous mode would be more useful. Instead, once students became more familiar with Zoom, teams preferred to meet regularly via this synchronous technology, discuss their responses verbally while one student recorded their outcomes, and then post their agreed response to the Wiki later on. This effectively circumvented the need to edit a peer's contributions on the wiki page, yet still meant that students collaborated efficiently on a shared response – even though the collaboration itself was largely hidden from the view of the teaching staff (unless we participated in the Zoom meetings).

Unavoidable differences in semester teaching dates meant that the Australian students started the project a week before their Brazilian counterparts, and quickly progressed through the relationship-building stages (at least, with their fellow Australian students). When the Brazilian students started, they seemed very excited to join in, and were posting very friendly messages, which were largely unanswered by the Australian students, who were noticeably task-focused by that stage. This was particularly apparent in the first activity around preparation for departure – most Brazilian students gave feedback on the Australian students' list, but only one Australian student commented on the suggestions proposed by the Brazilian students. This was disappointing, especially since all student teams identified relationship-building as a key component of working with their new teams in their responses to the case study questions.

The case study was originally designed to apply in a two-way direction, i.e. to apply to Australians moving to a new position in Brazil, as well as Brazilians moving to a new position in Australia. However, again likely due to the Australian students starting work on this before their Brazilian colleagues became active, it was tackled by the student teams only as a one-way scenario of Australians moving to Brazil. Australian students took the lead by preparing suggested responses to the case study questions, and the Brazilian students then provided feedback triggering some quality dialogue between students. For future iterations, if this situation recurs, we intend to prompt the teams to consider the reverse situation, and discuss whether their responses still applied.

Dealing with the differences in time zones posed some challenges for scheduling team meetings, so including links to time zone converters in all wiki pages and reiterating times in the local zones in email communications was helpful. However, we neglected to take into account the changes from standard time to summer time in Australia, and the corresponding end to summer time in Brazil which occurred one week later, so most student teams had to reschedule at least one missed Zoom meeting due to confusion around agreed times.

On completion of the case study, all students who participated were invited to both complete an online feedback survey, and to participate in a combined Zoom session to debrief on the project and provide feedback for future improvements. Survey responses were low (only 6 responses – three from Australia and three from Brazil), and reiterated what we already had picked up:

- Students' motivations to participate were primarily to interact and learn from peers from a different culture. (e.g. *I enjoy meeting people from different cultures and enjoy the exchange of cultural knowledge*").
- They enjoyed the interaction around the case study (e.g. *"Seeing the way in which people with different backgrounds applied cultural stereotypes"*).
- The key issue identified was associated with different (and changing) time zones.
- Few suggestions for improvements were made, and these were mostly about increasing familiarity with the technologies (e.g. *"have a trial project using the communication tools before going cross countries").*

We struggled to find a convenient time slot for a combined post-project Zoom session, but managed a session with five students and five teaching staff (with representatives of both country groups). While discussion questions had been prepared prior, this session ended up as a mostly informal debrief on what worked and what could be improved. The overall design, duration and the specific case study were popular with both staff and students. Areas identified for improvement were generally around the more practical aspects of the project – trying to ensure groups all started the project together, dealing with time zone issues, and providing improved access to Zoom (students did not have access to licenses, so required staff members to host team meetings). Discussion also centred around using this project for a possible future assessment activity.

Figure 3: Screenshot of a live Zoom session (included with permission of all session participants)

Discussion

For a pilot study involving no assessment or credit for students, we were delighted with the uptake and participation by students in both countries. The learning design (centred around a changeable case study) seemed to work well for our purposes, and is currently being trialed in a different discipline (Accounting), using a different case study. The actual case study used in this project also seemed to work well for our purposes – students were engaged with the scenario and with the challenges that it posed, and the questions provoked valuable discussion on the difficulties for managers working across different cultures.

While our choice of technologies to use (Wikis and webconferencing) proved successful for the original purposes of the project, the way that students used these technologies was different to our (perhaps naïve) assumptions. Students preferred to discuss and negotiate their shared response synchronously, and then record that agreed answer, rather than edit work posted by individual group members (or allow other members to edit their own work), missing one of the touted benefits of Wikis:

> A major benefit of wikis was that they allowed students to structure their collaborative writing in a flexible way, which encouraged creativity. The experience of working in a wiki also encouraged students to consider issues such as individual versus shared authorship, and permanence versus ephemerality of the text. (Kear, 2011, p.80).

These results are very similar to those reported by Zorko (2009), who noted that students preferred to collaborate in live meetings. However, if students are negotiating shared responses via synchronous web-conferencing tools, this is still a form of shared authorship, albeit one not immediately visible to the teaching team.

> …given the multiple ways in which most technologies can be used, we might also consider giving students more freedom of choice about how and when to use a new technology beyond the requirement that they use it. …In essence, a good approach may be to require a collaborated project and allow students to determine the best technology to use in the completion of that project. (Ebben et al, 2012, p.182).

Admittedly, this study involved a small group of self-selected and committed students. However, we do believe that the learning outcomes for the project (for students to gain insight into their own cultural bias and to learn more about dealing with cultural differences in the workplace) were achieved by the interactions between the different student groups engaging with the case study. Further evaluation of the cultural intelligence survey results is ongoing, and will be published separately.

The form of collaboration achieved in this project met our original project goals, although not in the form that we expected. Accordingly, our teaching team response was that the academic learning outcome of the project was paramount, and our ability to view student collaborations, while of great interest to us as teachers and learning designers, was not essential for the success of the project for students. This stance is likely to be different for those teaching undergraduate subjects, where developing teamwork skills may in itself be one of the desired learning outcomes, and thus the ability to give feedback on individuals' skills requires greater visibility of those skills in action.

Recommendations for educational practice

The following recommendations may be useful for others planning similar collaborative online projects:

- Schedule projects so that all student groups can start at the same time (not always possible for cross-country collaborations).
- Be aware of time zone differences, including any changes for summer time zones.
- Provide a range of technologies for student groups to use – both communication and shared writing technologies, ensuring that technologies are mobile friendly.
- Allow student groups the freedom to decide how they collaborate – as long as collaboration does take place and all students have equal opportunity to participate, the platform used should be irrelevant.
- Include an ice-breaker activity around cultural differences which requires interaction (rather than simply posting an introduction), to encourage relationship-building between the different international groups.

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References

Brack C., Stauder, A., Doery, J. & Van Damme, M-P. (2008). Collaborative learning online: Integrating media in case-based learning for clinical biochemistry. In C. Montgomerie & J. Seale (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2007* (pp. 187-192). Chesapeake, VA: AACE.

Brass, J. & Mecoli, S. (2011). The (Failed) Case of the Winston Society Wikispace: Challenges and Opportunities of Web 2.0 and Teacher Education. *Contemporary Issues in Technology and Teacher Education* 11(2), 149-166

Earley, P.C., Ang, S & Tan, J-S. (2006). CQ: developing cultural intelligence at work. Stanford, Calif.: Stanford Business Books

Ebben, M., Kivatisky, R., & Panici, D.A. (2011). Critical insights: Net generation, Wikis and group collaboration. In Ferris, S.P (Ed) *Teaching, Learning and the Net Generation: Concepts and tools for reaching digital learners.* IGI Global.

Kear, K. (2011). *Online and Social Networking Communities: A Best Practice Guide for Educators*. Routledge.

Lai, C., Lei, C., & Liu, Y. (2016). The nature of collaboration and perceived learning in wiki-based collaborative writing. *Australasian Journal of Educational Technology*, 32(3), 80-95.

McCarthy, J. (2012). International design collaboration and mentoring for tertiary students through Facebook *Australasian Journal of Educational Technology*, 28(5), 755-775

NMC: The New Media Consortium (2005) *The Horizon Report 2005 Edition*. http://www.nmc.org/pdf/2005_Horizon_Report.pdf

Olver, I. (2013) Keeping cancer guidelines current using a wiki approach. *BMJ Quality & Safety*, 22 (Suppl 1), p.A4

Prokofieva, M. (2013). Evaluating types of students' interactions in a wiki-based collaborative learning project *Australian Journal of Educational Technology*, 29(4), 496-512.

Wang, C-N., (2011). Instructional design for cross-cultural online collaboration: Grouping strategies and assignment design. *Australasian Journal of Educational Technology*, 27(2), 243-258.

Weaver, D., Viper, S., Latter, J., & McIntosh, P.C. (2010). Off campus students' experiences collaborating online, using wikis. *Australasian Journal of Educational Technology*, 26(6), 847-860.

Zorko, V. (2009). Factors affecting the way students collaborate in a wiki for English language learning, *Australian Journal of Educational Technology*, 25(5), 645-665

Please cite as: Weaver, D. (2016). Technology choices to support international online collaboration. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 616-623).

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The Sociological Imagination Machine (S.I.M.): Using game elements to help learners apply the sociological imagination

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A leading online education provider used gamification and a custom built technology to assist the understanding and application of the sociological imagination in first-year Sociology students. In a sixteen-week period, a collaborative team including learning designers, teaching staff, education technologists and a graphic designer, devised and developed a gamified weekly activity for students featuring randomising and roleplay mechanics. Results indicated that the use of gamification improved students' engagement with their class group and assisted them in learning key concepts. The considered and purpose driven use of gamification has proven to be a valuable tool in online learning.

Keywords: gamification, sociological imagination, engagement, collaboration, technology, randomising, roleplay, learning design, social constructivism

Introduction

Online teaching and learning encounters a variety of problems relating to student engagement that are both similar and different to those experienced "on campus"; such as participation in weekly discussions of academic concepts. Approaches to resolving these issues vary, and increasingly the use of gamification to assist with engagement and the learning of complex cognitive material has resulted in positive feedback from both students and staff (Domínguez et al., 2013; Simpson & Elias, 2011). Gamification, defined as "the application of game elements to real life tasks, which can help change behaviour, improve motivation and enhance engagement" (Cassells, Broin & Power 2015), has been applied to education for decades, though new possibilities provided by technology have led to a recent resurgence of interest in the topic. The mechanics of gameplay (or parts thereof) can be used in novel and functional activities that may offer students alternative methods of learning without necessarily requiring the expense of fully coded and realised game environments.

The online education provider was keen to explore gamification as a potential solution for decreased student engagement in a first-year Sociology unit. Although still high, student satisfaction scores had slightly decreased the previous teaching period resulting in a need to recover and surpass the high student satisfaction scores previously attained. In addition, teaching staff endeavoured to identify why a decline in engagement on the unit's discussion board had occurred, with only suggestions that the unusual decline may have simply been a result of the annual timing of the teaching period or features of the cohort. A potential factor was that this unit required students to understand, develop and use their sociological imagination, a concept considered central to the discipline of Sociology. Use of the sociological imagination requires the ability to "think yourself away from the familiar routines of everyday life" (Mills, as cited in Hayes, 2015, p.3) and is a cognitively and socially challenging critical analysis task, which faculty often cite as difficult for students of sociology, and likely exacerbated by the online medium.

Simpson and Elias (2011), suggest that games are "tools through which cognitively complex learning may take place, resulting in greater critical analysis skills" (p. 43). With this statement in mind, learning designers at the education provider proposed the use of elements of gamification, specifically scenario and role-playing based techniques. These were used in the introductory sociology unit to encourage students to use their sociological imagination as part of a gamified weekly activity, therefore enhancing their critical thinking. As a result, it was expected that engagement would increase on the discussion board via interaction with other students, which itself would determine better understanding of the unit content resulting in increased overall grades.

Sociology and the sociological imagination in practice

Sociology, the study of human society and our role within it, requires an understanding of day to day life to allow an objective view of the world and the way in which it functions. Gallmeier (2004) recounts his introduction of students to sociology stating that it forces them “to look at the world differently. I warn them they will need to acquire a pair of sociological glasses to begin to understand structural explanations versus individual explanations, or what is often referred to as human nature or personalized causes, to explain social behavior and social problems” (p.86). At an early stage of their degree, Sociology students must engage with critical thinking as a fundamental skill in all aspects of their course. Specifically, they require mastery of the sociological imagination, requiring them to look at the world through other people’s eyes and consider new perspectives different from their own (Gallmeier, 2004). Students often need to make a jump on a cognitive and emotional skill level (specifically empathy) to exercise their sociological imagination. Without use of the sociological imagination - many of the assessable components of even a first year sociology unit can become difficult. The concept, and the required skills that accompany it, can be difficult to convey; videos, readings, and lectures alone can fail to help students step outside their own perspective, and instead carefully constructed activities are required. But still, students need to be motivated to achieve this change in perspective.

An additional problem in sociology, also related to the use of the sociological imagination, is that students are required to discuss and challenge each other on these different perspectives at a critical level. Students may be happy to engage in debate when supporting their own non-evidential view, as they employ passion and personal experience to aid their discussion. But educational debate needs to occur at a more sophisticated level, in which students must utilise their critical thinking to analyse, develop, and support their argument when challenged by others. Within sociology, students are not only challenge with academic debate, but also the additional demand of using the sociological imagination. It was therefore important to find a way to engage students with each other, and their use of the sociological imagination, so that they would participate in the discussion boards. Another key reason was to improve grades as research by Chen, Lambert and Guidry (2010) has indicated that overall, students who participated in discussion forums tended to have better performance in their course.

Utilising gamification and the technology

Previous studies suggest that “games are motivating because of their impact on the cognitive, emotional and social areas of players” (Domínguez et al., 2013, p.381), therefore applicable and useful in education. The sociological imagination lent itself to the concept of roleplay, a method used in many games, which would allow students to achieve the change in perspective and motivation to engage on a social, cognitive, and emotional level with the weekly activities. Thus, we built gamified elements into the first year unit that centered around the idea of roleplay, in which random characters and traits would be generated for students to share with each other and prompt critical thinking, sharing of perspectives, and discussion.

Roleplaying games (RPGs) had previously been used in on-campus units to engage the sociological imagination (see Simpson & Elias, 2011), though the focus of this gameplay was more traditional with dice-rolls that generated statistics and character traits. However, the use of gamification was proven to have had a positive impact:

> “Through the mechanics of RPGs, we found that students employed already-internalized social scripts but were empowered to view society through another person’s point of view. This change in perspective allowed them to develop a sociological imagination and identify linkages between individuals and larger social structures. This led to critical analysis and a reevaluation of their worldviews. The game created a distance from the students’ personal life [sic] that allowed for greater objectivity” (Simpson & Elias, 2011, p.52).

A carefully structured tool therefore needed to be developed to operate within the course learning materials to encourage students to roleplay.

The initial idea involved students creating a character based on a pool of attributes using a randomising tool throughout the 12-week course. Within the activities of the learning material for each week, students would consider the issues from the perspective of this particular character to exercise the sociological imagination. When considering how this would be applied, it was determined that, due to the variety of topics throughout the course, it would be difficult to make one character relevant and relatable to each week. More practical was the idea to use the randomising tool to generate relevant attributes on a weekly basis.

While generating new characters each week overcame our initial problem, the idea lacked a unified narrative to tie each weekly activity together. Using the focusing statement “explain it to me as though I know nothing”, the narrative was based around a future sociologist who had lost historical archival records of all societies as a result of a disaster. As seen in Figure 1, communicating with the students via video each week (yet “from the future”), this sociologist would enlist students to research and generate sociological information with the assistance of a machine called the S.I.M. (the Sociological Imagination Machine). The story explained that the S.I.M. had the capability to transport students to anytime and anyplace, so that they could complete their tasks each week.

On “launching” the S.I.M., students would be presented with an image and text which had a number of attributes randomly taken from a pool of possible outcomes. Figure 1 shows the activity from a week which discussed urbanisation. Although the scene was set in Australia, students could be provided with a variety of outcomes based on the attributes of era (in the example below, “1950-1970” was the era which was generated. Other potential outcomes were “2000-2010” and “2010-2015”), and; family type (in the example below, “an Italian family” was the family-type which was generated. Other potential outcomes were “a farming family” and “professional couple”). Students were then required to ask the family a series of questions and report back. To achieve this, students were required to answer from the family’s perspective. In the example in Figure 1, the text read (with randomized attributes italicised):

> I found myself in Australia between *1950-1970* where I met an *Italian family (undecided about where to live)*. I asked them about the opportunities urbanisation presents to people living in cities that are otherwise not available to people living in small towns or villages. I also asked if they think urbanisation has affected the social environment negatively or positively for them. This is what they said:

Students could then begin their discussion post by copying this text via a button on the page.

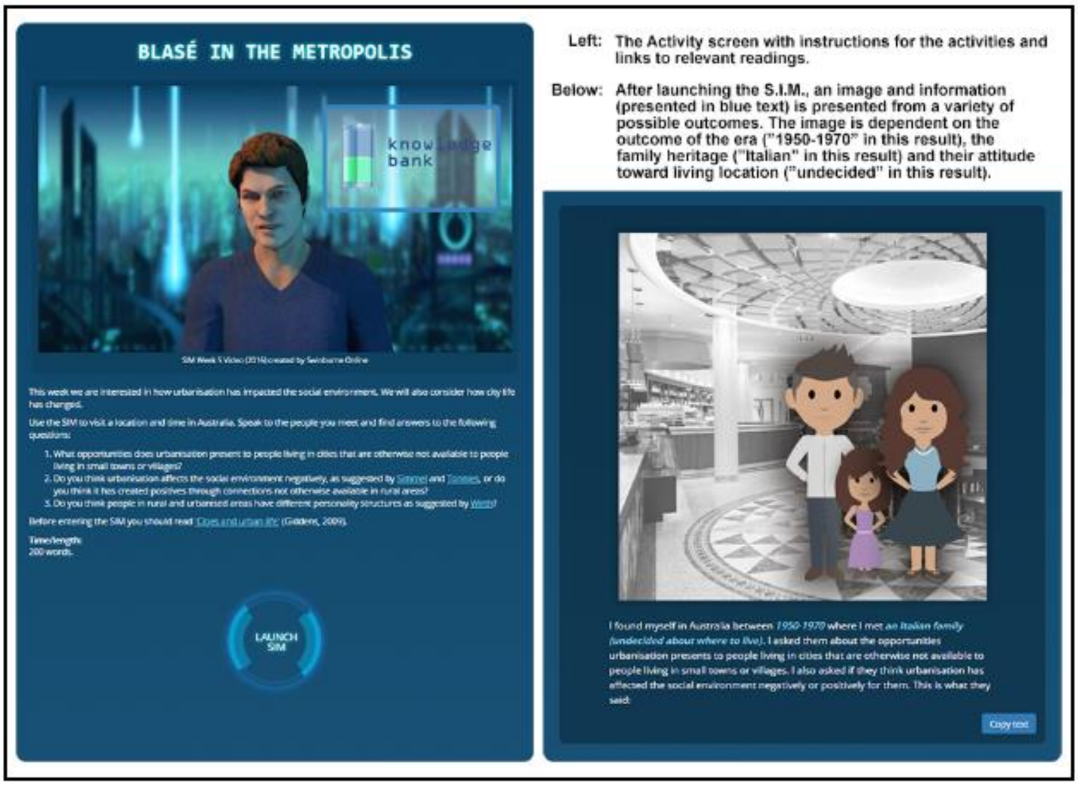

Figure 1: Version of the *Randomiser*

The weekly tasks tied in with the learning objectives of that week, creating a structured scenario that required students to read the relevant readings and undertake the necessary additional research to successfully complete the task. This ensured unit alignment, and guaranteed that the gamified elements served to both assist with the application of the sociological imagination and understanding of key concepts relating to assessment.

Technology was employed in several ways to achieve the roleplay required for the S.I.M. Firstly, the education technologists worked to produce code that allowed a series of randomised choices to be generated at the push of a button, therefore offering students a set perspective to which they had to respond. Additionally, a video was recorded using software to simulate the future sociologist, offering a way for him to communicate with students. Thirdly, based on the randomisation that occurred, a set of images custom developed by our graphic designer would be deployed along with prescriptive but modified text that described what the students encountered after activating the S.I.M. Thus, each week the students were presented with a visual, audio, and textual tool which employed gamification in the form of narrative and mechanically randomised elements.

Student response

To determine how the students responded to the S.I.M., we deployed an anonymous survey in addition to our standard feedback mechanisms and results review. This allowed students to respond directly to questions about their interaction with the S.I.M. tool, specifically whether they believed it assisted them to better understand the learning materials and promote meaningful engagement with other students. Although respondent numbers were low (N=47 which was 13% of the overall cohort), the results were positive with 93.5% of survey respondents taking part in the weekly activities. Of those respondents, the majority suggested that it assisted their learning (Figure 2).

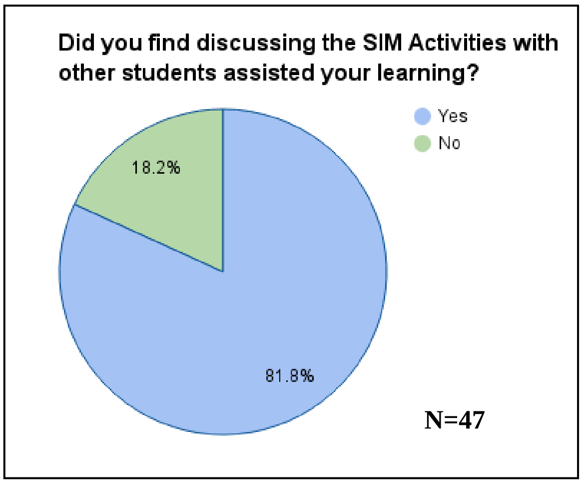

Figure 2: Results from student survey

This assisted learning was also reflected in a comparison of overall cohort grades from the previous delivery of the unit. There was a decrease in fail rates from 33% to 23% (Figure 3) which resulted in an increase in Distinction, Credit and Pass rates (Figure 4).

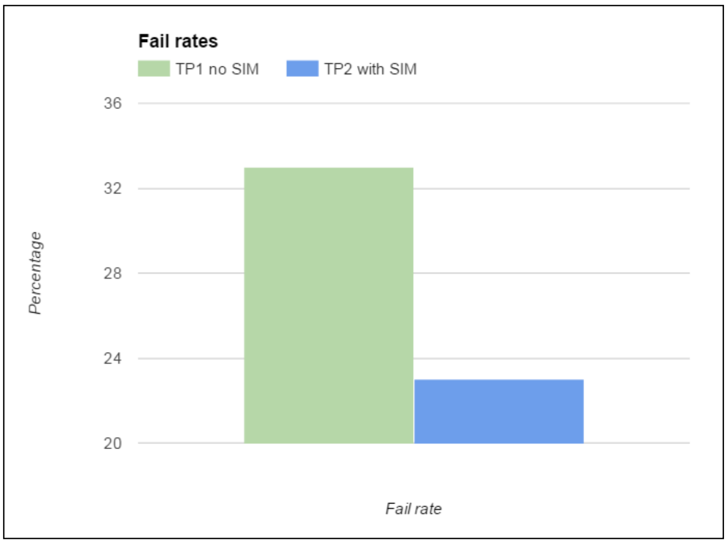

Figure 4: Fail rate comparison from two different teaching periods

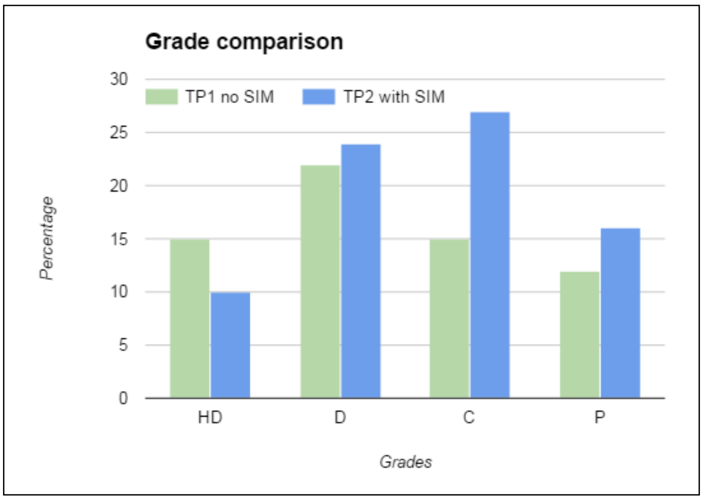

Figure 3: Grade comparisons from two different teaching periods

In addition, the teaching staff noted an increase in the use of the discussion board and meaningful interaction and debate between students. Although the student voice through the survey was overwhelmingly positive, there were some students who preferred more traditional activities. This was exemplified in a comment from the following student who said “I don't think the SIM provides any benefit to the learning and I would prefer we had questions that we needed to answer and we could post on the DB [discussion board] and discussion could stem from there”.

However, the suggestion that the S.I.M. encouraged discussion board use and supported meaningful interaction for the majority of students came through in the following qualitative feedback:

> “[The S.I.M.] was an essential part of the TP for me”.
>
> “I like that the SIM put me on one side of an argument. This challenged me to view it from another perspective and allowed for respectful debate.”
>
> “This allowed the activities to be a little more entertaining. It would be interesting to have these similar activities used in other units”
>
> “It honestly helped me understand the materials, and the interaction helped me put theory into practice, and personally helped me remember more!”
>
> “I liked the visual aspect and interactive process - much more motivational than just having access to reading material.”

The increase in results, when considered in conjunction with the survey feedback, suggest that the S.I.M. played a pivotal role in this improvement of student grades.

The combination of both increased and meaningful engagement in the discussion board with an increase in academic results, offers an opportunity to further consider the value of social constructivist learning in certain online environments and within specific disciplines. Sociology and roleplay lends itself to a social constructivist pedagogy, and the S.I.M. gamification tool capitalises on this aspect.

Conclusion

This paper suggests the value of purpose built and designed gamification technologies in online learning and the value of collaboration between learning designers, education technologists, graphic designers, and teaching staff. Importantly, gamification can be implemented within a short time period and offer a substantially intellectual and visual engaging aid to enhance the understanding of complex concepts such as the sociological imagination. The combination of visual, audio, and textual elements ensured greater accessibility to the weekly material. The technology behind the S.I.M. can now be utilised in additional units at the online education provider based on their suitability for gamification. If suitable, the narrative and other elements can be adapted to the discipline content and context. While it is important to ensure that the introduction of gamification elements are fit for purpose, we would suggest that the collaborative approach to integrating gamification within a pedagogical framework is instrumental in increasing the likelihood of success. The data shows that gamification can improve students' engagement with their class group and assist them in learning key concepts such as the sociological imagination.

References

Cassells, T., Broin, D. O., & Power, K. (2015). Increasing student engagement with gamification. Proceedings of the European Conference on Games-Based Learning, 2015-Janua, 770–773. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-84955057612&partnerID=tZOtx3y1

Domínguez, A., Saenz-De-Navarrete, J., De-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J. J. (2013). Gamifying learning experiences: Practical implications and outcomes. Computers and Education, 63, 380–392. http://doi.org/10.1016/j.compedu.2012.12.020

Gallmeier, C. P. (2004). Reflections on teaching: Introducing Sociological Virgins to the Sociological Imagination, 83–94.

Hayes, S. (2015). Criminal Justice Ethics: Cultivating the moral imagination. New York: Routledge.

Lee, J. J., & Hammer, J. (2011). Gamification in education: what, how, Why Bother? Definitions and uses. Exchange Organizational Behavior Teaching Journal, 15(2), 1–5.

Mills, C. W. (1959). The sociological imagination. New York: Penguin.

Simpson, J. M., & Elias, V. L. (2011). Choices and Chances: The Sociology Role-playing Game--The Sociological Imagination in Practice. Teaching Sociology, 39(1), 42–56. http://doi.org/10.1177/0092055X10390646

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Straddling the technology adoption chasm in university teaching practice using Multi-Mediator Modelling

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This poster presentation demonstrates how a computer simulation can be applied to examine the problem of spreading the adoption of elearning innovations that originate 'bottom-up' in higher education teaching practice. The computer simulation used in this doctoral study allows enabling and inhibiting links to be drawn between factors in 'bottom-up' technology adoption. These factors have been identified from case studies of 'bottom-up' elearning adoption found in the research literature. The resulting computer model provides an interactive view across a whole university system of stakeholder relationships between university management, central support services, elearning innovators and elearning adopters involved in university teaching. The poster provides an explanation of how the computer modelling process works when different stakeholder experiences and perspectives are applied to connect the factors in the model. The application of a computer simulation in interviews for this study addresses the limitations of case study research methods to examine this problem.
1
2 Keywords: elearning, innovation, diffusion, sustainability, technology adoption, modelling

The diffusion of elearning innovations

The failure to gain mainstream adoption of elearning innovations that originate in university teaching practice is well documented in university case studies from around the world. The point where a failure in the diffusion of technology innovations occurs is commonly described using the metaphor of a *chasm* (Moore, 1999) that occurs between technology enthusiasts and visionaries, on one side, and the mainstream of a population on the other side (Pacansky-Brock, 2015). Rogers (2003), in his seminal Diffusion of Innovations Theory, segments these groups into *innovators*, *early adopters*, *early majority*, *late majority* and *laggards*, as illustrated in Figure1.

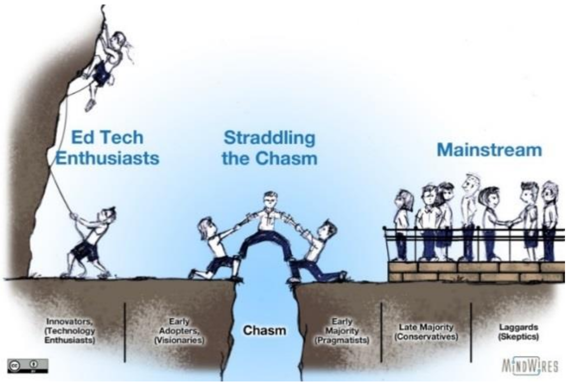

Figure 1. Straddling the Chasm. Retrieved from http://mfeldstein.com/ posted by P. Hill (2015, March 13) and licensed under a [Creative Commons Attribution 3.0 Unported Licence](#).

The study, presented in this poster session, demonstrates how universities can develop insights into how to straddle this chasm by using a Multi-Mediator Modelling computer simulation. This computer model allows interview participants in the study to link the factors and actors involved in their experience with the diffusion of elearning innovations that originate in university teaching practice.

Multi-Mediator Modelling

Multi-Mediator Modelling (MMM) offers a new way of gaining insights into the dynamic, complex and often competing relationships, values and attitudes experienced today by university staff when adopting new technologies. MMM assists in simulating this dynamic and complex environment. The coding and concepts behind the MMM computer simulation have been developed by Professor James (Jim) Levin at the University of California San Diego (UCSD) Department of Education Studies (Levin, 2015). MMM originates from Agent Based Modelling (ABM) which has been described as a “third way of doing science” (Axelrod, 2005, p. 1) that extends traditional social science research methods commonly used in educational research. ABM is a research method derived from the emerging field of the complexity sciences. Jacobson (2015) suggests that “the use of computer modelling, particularly ABMs, can provide research and policy insights about complex educational systems” (p. 310) and concludes that using computer modelling “can provide analytics and information that goes beyond traditional quantitative and qualitative educational research approaches” (Jacobson, 2015, p. 310).

Applying this method in a doctoral study allows an exploration of the connections between the factors associated with different actor, or stakeholder, roles involved in technology adoption within the complex environment of a university ecosystem. The poster session explains how an MMM computer simulation is applied in this study using an example from a pilot study shown below in Figure 1. This example is from a prototype MMM computer simulation used in interview trials for a pilot study and the findings will not contribute to the final research data collected for this doctoral study.

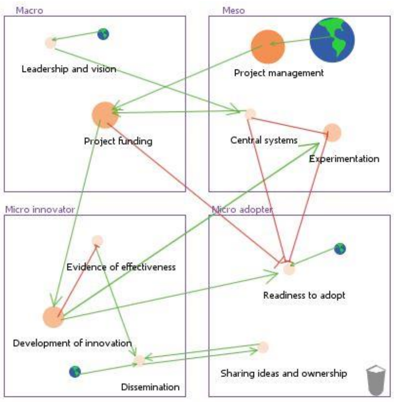

Figure 1. Connected actors, factors and levels of influence

The factors in the above example were drawn from a preliminary analysis of extant case studies conducted by Gunn and Herrick (2012). Factors in the model are represented by the labelled orange dots; influences on factors are shown by globe icons; green arrows show enabling relationships; red lines indicate inhibiting relationships, and the whole model is contained within the four stakeholder quadrants representing actors from university management (Macro) and central support services (Meso) at the top and the (Micro) actors below who are the innovators and adopters involved directly in university teaching.

Jacobson (2015) proposes that using a computer modelling method, such as MMM allows a "simplicity-complexity epistemic view" (p. 311) of complex systems. This allows researchers and interview participants to look for patterns of interactions based on simple rules rather than seeking complex explanations for complex behaviours. It is anticipated that this approach will be of value to universities and other education providers who are seeking to straddle the technology adoption chasm and who want to know “***What do we need to change***?” .

References.

Axelrod, R. (2005). Advancing the art of simulation in the social sciences. In J.-P. Rennard (Ed.), *Handbook of Research on Nature Inspired Computing for Economy and Management* (pp.1-13). Hershey, PA: Idea Group.

Gunn, C., & Herrick, R. (2012). *Sustaining eLearning innovations: A research study report*. Auckland: The University of Auckland Centre for Academic Development. Jacobson, M. J. (2015). Education as a complex system: Implications for educational research and policy. In B. A. Furtado, P. A. M. Sakowski, & M. H. Tóvolli (Eds.), *Modeling Complex Systems for Public Policies* (pp. 301-316). Brasilia, Brazil: IPEA.

Levin, J. (2015). *Creating and evaluating multi-agent models of learning with qualitative and quantitative data*. San Diego: Department of Education Studies University of California, San Diego. Retrieved from https://docs.google.com/document/d/15mJloMh4sZ_CGnEYjMYHLjoTc6tXhbQyE75A4EqjlXc/edit?pli=1

Moore, G. A. (1999). *Crossing the chasm: Marketing and selling high-tech products to mainstream customers.* New York: Harper Business.

Pacansky-Brock, M. (2015, September 23). *Straddling the chasm: Rethinking faculty support*. Retrieved from http://www.teachingwithoutwalls.com/2015/09/straddling-chasm-rethinking-faculty.html

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: The Free Press.

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Levelling the playing field: student and staff experiences of a curated, self-assessed, self-paced multimedia resource

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SkillBox, a curated, self-assessed, self-paced multimedia resource was developed for use by students as a way to increase their knowledge and confidence specific topics such as statistics, basic mathematics or referencing that are required in many tertiary subjects. A SkillBox uses adaptively scaffolded text, video and self-assessment quizzes, and is provided to students as an optional supplementary resource. We surveyed students and staff to evaluate the success of SkillBox across three teaching sessions. We found that engaging with SkillBox increased students' confidence, attitude and knowledge in the topic area covered in that SkillBox, and that both students and staff found the addition of SkillBox useful and would recommend its use in other subjects. Although more research is needed, we suggest that a resource such as SkillBox can positively contribute not only to student knowledge and confidence in a range of topics, but also to equity, retention, engagement and academic performance in the subjects where a SkillBox is promoted.

Keywords: SkillBox; online multimedia resources; self-assessment; adaptive scaffolding

Introduction

Many University subjects assume a certain level of existing knowledge or skill in learning areas taught within the subject. This existing knowledge or skill may have been learned in earlier subjects in the current course, or prior to entering the course. However, due to the time that has elapsed since learning a skill, how well the skill was learned, and the individual's learning background and current skill competency, there can be a significant variation in expertise in this learning area among cohort members (Webby *et al.*, 2015, Galligan, 2013). As a result, a significant amount of time can be spent ensuring all students are brought up to a comparable skill level, however it is important to ensure an equitable, flexible learning experience for all students (Garrison and Vaughan, 2013).

A number of learning areas were identified across a range of subjects and disciplines that can prove problematic in teaching those subjects. The learning areas identified include referencing, basic statistical concepts, matrix calculations and the use of the statistical software package, R, in subjects as diverse as Geographical Information Systems Algorithms, Environmental Data Analysis, Scientific Statistics, Forecasting and Risk Management, and Organisational Behaviour. The authors sought to find a solution that involved minimal ongoing effort of teaching staff, and minimal addition to student workloads.

Since the advent of Web 2.0 there has been a cultural shift of sharing and collaboration amongst society via technology, which has extended to the higher education sector (Collins, Deek and Hiltz, 2015). This shift has lent itself to the reuse of resources through digital curation, which can be defined as "the art and science of searching, analysing, selecting and organising content" (Antonio and Tuffley, 2015).

This form of digital resource reuse, coupled with an adaptive scaffolding design was seen as a potential approach to the identified problem and solution parameters. Individually, research has shown that multimedia elements (such as video, text, sound) and self-assessment and formative quizzes have the potential to improve student engagement, performance, retention, motivation and learning outcomes (Chen, 2014; Faridhan *et al.*, 2013; Nagel and van Eck, 2012). Bradley and Boyle (2004) demonstrated that a learning object approach – in their case, using multimedia learning objects in a programming subject – improved students' learning experience and results, reflected in improved grades.

Online learning in the higher education setting is now a popular form of delivery due to the significant growth and advancement of internet technologies and internet use (Wei, Peng and Chou, 2015). Even simple online resources can sometimes improve engagement (Anderson and Jacoby, 2013), while self-assessment quizzes have also been shown to improve both engagement and academic performance (Nagel and van Eck, 2012). Careful curation of multimedia resources such as videos and interactive tutorials can increase motivation, engagement and learning outcomes (Antonio et al., 2012) and ensuring the relevance and quality of the curated resources, as well as considering how students will navigate through them, is important for a successful learning experience (MacGregor and Lou, 2004). An adaptive scaffolding design provides the opportunity to guide students through a single knowledge area in a supported manner. This allows them to access the resources as needed at their own pace and in their own time, can be more appealing and motivational to students than a fixed learning sequence (Chen, 2014). Suggesting alternative ways to approach a task (strategic scaffolding in Hill and Hannafin's (2001) typology) can allow students to develop alternative perspectives and help them find new ways to solve problems (MacGregor and Lou, 2004).

In planning to build this resource, it was identified that the solution must integrate with the University's LMS Blackboard, be reusable by academic staff, require little to no interaction by academic staff once added to their LMS subject site, not form part of the subject assessment nor add significant workload for the student. The solution should be self-paced and scaffolded in such a way that students do not need to interact with teaching staff. Concepts covered in each learning area should be structured such that students can progressively work their way through the content and resources provided, but can also skip sections where they already possess sufficient knowledge and skills, assessing their understanding with a combination of formative self-assessments.

In this paper we discuss SkillBox, a suite of tools developed across a number of learning areas, to help "level the playing field" for students in a number of subjects and disciplines across Charles Sturt University (CSU). We start by describing the SkillBox framework. We then describe the methodology used to research how successful the SkillBox approach is, in terms of increasing student confidence and knowledge in the topic area, followed by results, and a discussion of the research outcomes.

SkillBox

SkillBox is a set of curated online resources that have been scaffolded to guide students through a single knowledge area, allowing them to access the resources at their own pace and in their own time. Each SkillBox address a single knowledge area that has been identified as problematic within certain subjects, for example the use of basic statistical functions within a business subject, or the use the statistical computing language R in a statistics subject. Figure 1 shows a screenshot from a section of the Descriptive Statistics SkillBox.

Each SkillBox consists of a series of subtopics, comprising introductory text and worked examples, existing high quality videos and online tutorials, additional resources for consolidation or deeper learning, and small, repeatable self-assessment quizzes. Each SkillBox is designed to be worked through by a student in less than ten (non-consecutive) hours, including revisiting resources and repeating quizzes as necessary.

Reusability is a key tenet of the SkillBox concept, both for the student and the academic. Subject coordinators are able to reuse previously created SkillBoxes, without the workload often required to source and provide high quality relevant resources. Students are able to access, or reuse, elements of each SkillBox as much or as little as they need, thereby meeting the needs of students across a wide range of pre-existing knowledge.

SkillBox does not form part of the curriculum or assessment for the subject and does not replace prerequisite or assumed knowledge; rather it fills in knowledge gaps or reinforces previously learned topics. As each SkillBox is designed to be 'set and forget', no interaction by academic staff is required to progress students through the SkillBox. If the SkillBox cannot be structured this way, then the knowledge area is considered not suitable for use within the SkillBox framework.

We anticipated that SkillBox would promote equity in the topic areas covered, and improve confidence and knowledge in the topic areas for those students who chose to engage with the tool. We also anticipated the subject coordinators would readily promote SkillBox for use in their subjects where appropriate.

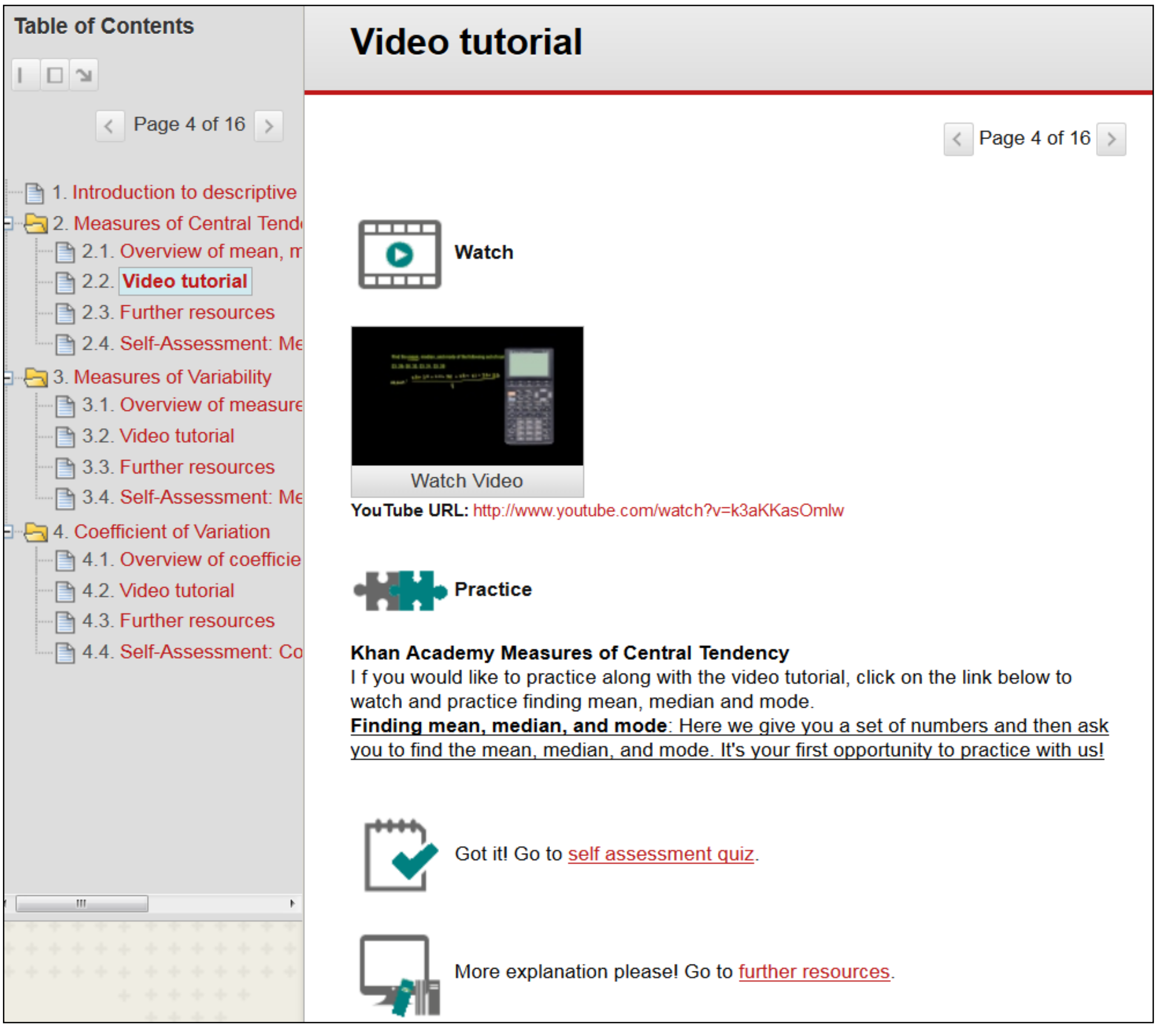

Figure 1. Screenshot from Descriptive Statistics SkillBox

Methodology

The research on SkillBox consisted of three components: a student pre-engagement survey, a student post-engagement survey (both implemented within Blackboard), and a follow-up survey for both students and subject coordinators (both implemented using SurveyMonkey) (Figure 2). These are described in more detail below.

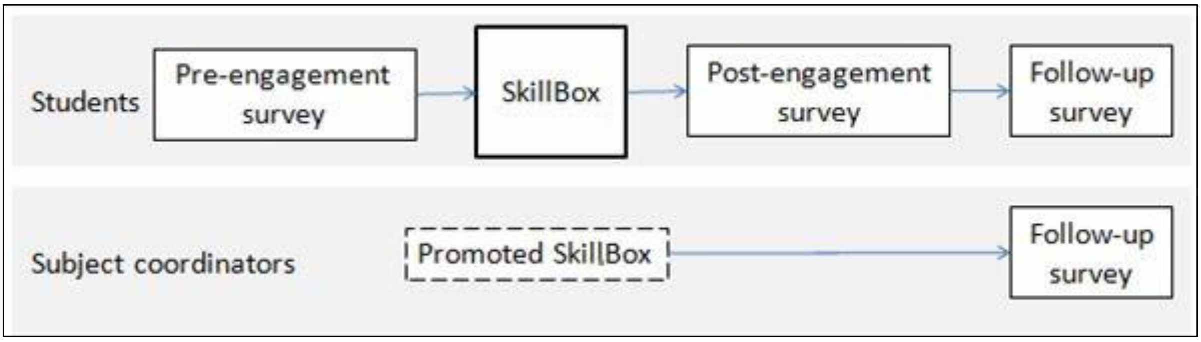

Figure 2. Research workflow

We invited students in subjects where a SkillBox had been promoted to participate in two surveys – one before engaging with SkillBox, and one after engaging with SkillBox. The surveys were designed to assess their attitudes, confidence and knowledge on the topic area, partly based on a validated questionnaire designed by Fogarty *et al.* (2001). Responses were recorded on a 5-point Likert scale, plus a category of Don't Know / Not Applicable. The final survey also asked for their feedback on what they found most and least useful about SkillBox, and how long they spent engaging with SkillBox. Survey questions are included in the Appendix. To date this research has covered three teaching sessions – in the two 2015 teaching sessions, Matrix SkillBox (basic matrix operations including addition, multiplication, determinants and inverses) was evaluated in a different graduate level distance education subject in each session. In the first 2016 teaching session, R SkillBox (introduction to the statistical computing language R) was evaluated in five subjects, a mix of face-to-face and online, and undergraduate and graduate level. In this session the Descriptive Stats SkillBox (basic descriptive statistics including mean, median, mode, standard deviation, normal distribution) was also evaluated in a graduate level distance education subject.

The relevant SkillBox was made available to students at the beginning of a semester. Students were emailed by the researchers to invite them to participate in the research, and to access SkillBox. Subject coordinators were also asked to bring SkillBox to students' attention at relevant points in the subject. Students were sent two follow-up emails in the first half of the Session to remind them of the SkillBox availability, and to complete the post-engagement survey when they felt they had finished using the SkillBox.

In addition to the pre- and post-engagement surveys, during the first session of 2016 we also asked students to rate their confidence in the answer they had just given when working through the SkillBox self-assessment quizzes. In July 2016 we invited students who had fully engaged in a SkillBox previously to complete a follow-up online survey. We also surveyed staff who had instructed subjects where a SkillBox had been promoted. We tested the shifts in responses between pre- and post-engagement surveys for statistical significance using the Wilcoxon Signed Rank Test (Bauer, 1972) and we also measured the correlation between accuracy (whether a question was answered correctly) and confidence (self reported confidence on a 4-point scale), using Wilcoxon Mann-Whitney test (Bauer, 1972). We recorded and classified by theme qualitative answers from post-engagement surveys and follow-up surveys.

Results

During the research period (March 2015-July 2016), in total 281 students were enrolled in subjects where a SkillBox was available. Of these 125 (44.5%) accessed SkillBox at least once, and 82 (29.2%) completed at least one self-assessment quiz. Not all enrolled students were invited to participate in the research for various reasons (e.g. their subject coordinator was one of the research investigators, or they had already had access to a SkillBox in a previous session). During the research period 234 students were invited to participate in the research, of which 26 (11.1%) accepted and completed the first survey, and 13 (5.5%) completed the post-engagement survey. These 13 students were invited to complete the follow-up survey, of which four responded. In addition, six subject coordinators who had promoted SkillBox in their subjects were invited to complete a follow-up staff survey, of which three responded.

On average, students reported spending 3 hours 28 minutes using SkillBox (range 40 minutes – 20 hours). From access patterns across students who used SkillBox, we observe that some students accessed SkillBox just once, and some multiple times over several weeks.

Confidence in the topic covered in the SkillBox (Q1: I am confident in the topic) increased on average by 0.92 points on the 5-point scale (Responses are classified so that for positively framed questions 1 = strongly disagree, 5 = strongly agree, and for negatively framed questions 1 = strongly agree, 5 = strongly disagree), significant at 95% confidence interval ($n=13$, $p=0.031$). Attitudes towards the topic (Q6: I find the topic frightening) also improved on average by 0.38 points after engagement with SkillBox, although not significantly at 95% confidence interval ($n = 13$, $p = 0.073$). Responses to other survey questions indicated increased confidence, and unchanged attitudes, but changes were small and not statistically significant (Figure 3).

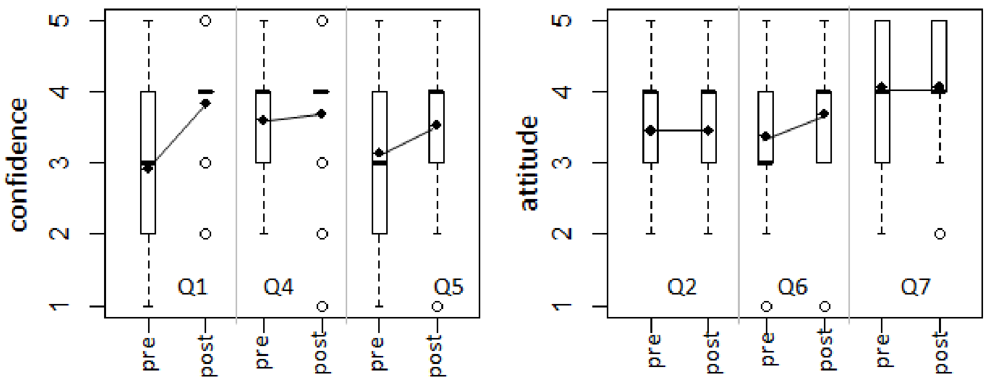

Figure 3. Changes in confidence (left) and attitude (right) pre- and post-engagement. See Appendix for questions

There is a correlation between self-reported confidence (How confident are you that you answered the previous question correctly?) and accuracy (whether the question was correctly answered) (Figure 4). On a 4-point scale the confidence mean was 2.86 (between “not very confident” and “somewhat confident”) for incorrect answers, and 3.60 (between “somewhat confident” and “very confident”) for correct answers. The difference is statistically significant ($p = 0.00$).

The students who participated in the follow-up survey found SkillBox somewhat or much better than multimedia resources provided in other subjects. All said that if SkillBox had not been available, they would have searched for similar third-party resources themselves, but they were not very, or only somewhat confident that these resources would be accurate and relevant to what they were studying.

The subject coordinators who participated in the survey all agreed or strongly agreed that introducing multimedia resources into their subjects helps students learn core concepts better. They reported that having SkillBox in their subject either didn’t impact or decreased their workload. Whether subject coordinators usually provided their students with multimedia resources (their own or from other sources) or not, they all found the addition of SkillBox useful in guiding students through basic concepts and bringing their skills up to the level required.

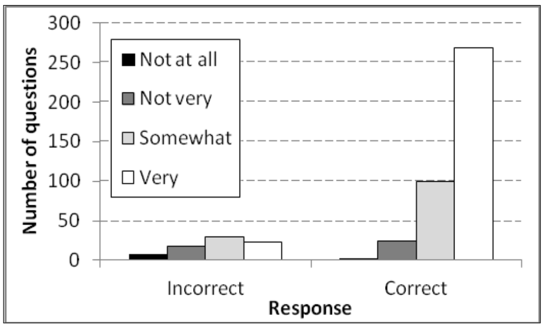

Figure 4. Self-reported confidence and accuracy

Qualitative data collected from the post-engagement and follow-up surveys showed that the many students found SkillBox very useful:

> A number of elements were useful: use of simple examples to highlight core principles, easy to access format and repeated access (Student – Matrix SkillBox)
>
> I really relied on SkillBox... SkillBox provided me with all the relevant information I needed to get started with the subject and as a reference tool to return to later... It was for me at least a very valuable tool (Student – Matrix SkillBox)
>
> I was very satisfied with the SkillBox experience (Student – Matrix SkillBox)

The elements they found most useful were the videos, and the fact that the instruction was basic and relevant to their subject:

> I liked that it was quite basic instruction (Student – Matrix SkillBox)
>
> (Most useful were) the video tutorials and the quizzes offered (Student – Descriptive Statistics SkillBox)

Some called for more examples and explanations:

> Explain more what can be learned from the examples...What it teaches us (Student – Descriptive Statistics SkillBox)
>
> (Need) more examples of the application / relevance ... early on (Student – Matrix SkillBox)

Both students and staff saw the need for more SkillBoxes in more subjects:

> I would recommend incorporating SkillBox in as many other subjects as possible (Student – Matrix SkillBox)
>
> (I would promote the use of SkillBox as) it provides engaging meaningful content which helps students get prepared for the subject (Subject coordinator – Matrix and R SkillBoxes)

Discussion

This research shows positive results for both students and subject coordinators who engaged with a SkillBox. However, the response rates were low for a variety of reasons (Sankey and Whitsed, 2016), and in addition only students who actually engaged in SkillBox also participated in the research. It is much more difficult to discover why students chose not to engage in SkillBox, or disengaged without completing any of the self-assessment quizzes. This may be because the SkillBox was unnecessary for them (they already possessed the skills and knowledge covered), or because they found it confusing or not useful.

SkillBox was designed to be a resource that should take no more than ten hours for a student to work through. The average reported time spent was around three and a half hours, but it is possible that students who did not participate in the research spent less time than this engaging in SkillBox. It was always intended that SkillBox would be a resource to be used only by those who needed it to bring their skills up to the required level, so it is acceptable that some students might spend very little time looking at the content, while others might return to the resource often, completing the self-assessment quizzes multiple times.

We measured an increase in confidence in the topic area after engaging with SkillBox. Although student levels of confidence are not necessarily an indicator of performance (Lodge and Kennedy, 2015), in this study we did find a clear correlation between higher confidence and correct answers. It is not clear however whether the confidence was gained because of the SkillBox content, or whether the students already possessed confidence in and knowledge of the topic.

The students and staff who responded to the surveys all found the SkillBox resource useful in some way, although again it's possible there were students who did not find it useful who did not participate in the research. Most liked the way the SkillBox is currently structured, with the combination of videos, worked examples and self-assessment quizzes, but it is clear that as new SkillBoxes are created, they need to be carefully curated to contain appropriate content delivered at the right level for the students using it.

The SkillBox concept was also designed to be easily incorporated into subjects with no extra workload for subject coordinators, and so far this appears to be the case. Students increasingly expect richer multimedia resources in their subjects (Devlin and McKay, 2016), and a SkillBox is one way for subject coordinators to provide this, with minimal cost (i.e. time and effort that can be spent elsewhere in the subject).

We also hypothesise that provision of a SkillBox in a subject could have a positive impact on student satisfaction, student retention and academic performance, not just because of the SkillBox content, but due to the equity provided in providing all students the opportunity to increase their skills and knowledge independently. Testing these hypotheses is outside of the scope of the current research however.

To date four SkillBoxes have been created (Matrix, R, Descriptive Statistics and Referencing) and research is continuing until the end of 2016. We are currently establishing processes to ensure that SkillBoxes (existing and future) can be promoted and used across the university, and eventually more widely in the academic community.

We have referred to the benefits of an adaptive scaffolding design, however it should be noted that SkillBox is only adaptive in the sense that the student can decide how to proceed based on their experience of the resources. The need for a truly adaptive design will be considered in future versions of SkillBox. In addition, although this research was designed to measure the success of the SkillBox instrument, a design-based research approach (Reeves *et al.* 2005) could be used to address the wider issue of providing scaffolding for tertiary students, and how best to approach this. The suitability and applicability of a design-based approach will be investigated in future research on the use of SkillBox.

Conclusion

In order to provide an equitable tertiary learning experience for all students, flexibility is needed in the way content is conceived and delivered (Garrison and Vaughan, 2013). Appropriately curated online multimedia resources can play an important role in ensuring equitable access, by scaffolding students' knowledge and skills so that they approach the core content of a subject on a more equal footing.

A resource such as SkillBox can be one piece of the puzzle in improving outcomes for students across a range of measures, including confidence in a topic, content knowledge, attitudes towards the topic, and possibly wider measures such as student satisfaction, engagement, motivation, retention and academic performance.

This research demonstrates that there is a need for such resources, however further research is required to determine the impact of resources such as SkillBox on students' overall academic performance and experience.

Acknowledgements

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References

Anderson, C. and Jacoby, J. (2013) Using simple technologies to improve student engagement and success in an online applied-science course: a case study. In H. Carter, M. Gosper and J. Hedberg (Eds.) *Electric Dreams*. Proceedings ascilite Sydney 2013 (pp. 47-51). http://www.ascilite.org.au/conferences/sydney13/program/papers/Anderson.pdf

Antonio, A., Martin, N. and Stagg, A. (2012) Engaging higher education students via digital curation. In M. Brown, M. Hartnett and T. Stewart (Eds.) *Future challenges, sustainable futures*. Proceedings ascilite Wellington 2012 (pp. 55-59) http://www.ascilite.org.au/conferences/wellington12/2012/images/custom/antonio%2c_amy_-_engaging.pdf

Antonio, A. and Tuffley, D. (2015) Promoting information literacy in higher education through digital curation. *M/C Journal 18*(4)

Bauer, D.F. (1972) Constructing confidence sets using rank statistics. *Journal of the American Statistical Association 67*, 687-690

Bradley, C. and Boyle, T. (2004) The design, development and use of multimedia learning objects. *Journal of Educational Multimedia and Hypermedia, 13*(4), 371-389

Chen, C.-H. (2014) An adaptive scaffolding e-learning system for middle school students' physics learning. *Australian Journal of Educational Technology 30*(3), 342-355

Collins, R., Deek, F., & Hiltz, S. (2015). Share and Share Alike: Integrating Internet Resource Sharing Into Learning, *Twenty-first Americas Conference on Information Systems*, Puerto Rico, 2015

Devlin, M. and McKay, J. (2016) Teaching students using technology: Facilitating success for students from low socioeconomic status backgrounds in Australian universities. *Australian Journal of Educational Technologies 32*(1), 92-106

Faridhan, Y.E., Loch, B. and Walker, L. (2013) Improving retention in first-year mathematics using learning analytics. In H. Carter, M. Gosper and J. Hedberg (Eds.) *Electric Dreams*. Proceedings ascilite Sydney 2013 (pp. 278-282). http://www.ascilite.org.au/conferences/sydney13/program/papers/Faridhan.pdf

Fogarty, G.J., Cretchley, P., Harman, C., Ellerton, N. and Konki, N. (2001) Validation of a questionnaire to measure mathematics confidence, computer confidence and attitudes towards the use of technology for learning mathematics. *Mathematics Education Research Journal 13*(2), 154-160

Galligan, L. (2013) A systematic approach to embedding academic numeracy at university. *Higher Education Research and Development 32*(5), 734-737

Garrison, D. R., and Vaughan, N. D. (2013). Institutional change and leadership associated with blended learning innovation: Two case studies. *The Internet and Higher Education, 18*, 24–28
Hill, J., & Hannafin, M. (2001). Teaching and learning in digital environments: The resurgence of resource-based learning. *Educational Technology Research and Development, 49*(3), 37–52
Lodge, J.M. and Kennedy, G. (2015) Prior knowledge, confidence and understanding in interactive tutorials and simulations. In T. Reiners, B.R. von Konsky, D.Gibson, V. Chang, L. Irving & K. Clarke (Eds.) *Globally connected, digitially enabled*. Proceedings ascilite 2015 in Perth, pp. FP: 178-FP:188
MacGregor, K. and Lou, Y. (2004) Web-Based Learning: How Task Scaffolding and Web Site Design Support Knowledge Acquisition, *Journal of Research on Technology in Education,*(37) 2, 161-175
Nagel, L. and van Eck, L. (2012) Sustainable learning through formative online assessment: using quizzes to maintain engagement. In M. Brown, M. Hartnett and T. Stewart (Eds.) *Future challenges, sustainable futures*. Proceedings ascilite Wellington 2012 (pp. 692-699) http://www.ascilite.org.au/conferences/wellington12/2012/images/custom/nagel%2c_lynette_-_sustainable.pdf
Reeves, T.C., Herrington, J. and Oliver, R. (2005). Design research: a socially responsible approach to instructional technology research in Higher Education. *Journal of Computing in Higher Education, 16*(2), 96-115
Sankey, M. and Whitsed, R. (2016, submitted) Failing forward in research around technology enhanced learning. Submitted to *Show me the Learning*. Proceedings ASCILITE Adelaide 2016
Webby, B., Quinn, D., Albrecht, A. and White, K. (2015) Mind the gap: Exploring knowledge decay in online sequential mathematics courses. In T. Reiners, B.R. von Konsky, D. Gibson, V. Chang, L..Irving & K. Clarke (Eds) *Globally connected, digitally enabled*. Proceedings ascilite 2015 in Perth, pp. CP: 235-CP:240

Appendix

Pre-and post-engagement student survey

Unless indicated, responses are on a 5-point Likert scale from Strongly Agree to Strongly Disagree

Q1. I am confident in the topic
Q2. I am not interested in the topic
Q3. I can see the relevance of the topic to my degree
Q4. I think it will take me (took me) longer to understand the topic than the average person
Q5. I know I can handle difficulties in the topic
Q6. I find the topic frightening
Q7. I think understanding the topic will be (was) important in this subject
Q8 – pre: I have studied this topic previously (Y/N)
Q8 – post: I have learned a lot about the topic
Q9 – post: How much time did you spend using SkillBox? (open answer)
Q10 - post: What did you find most useful in SkillBox? (open answer)
Q11 – post: What did you find least useful in SkillBox? (open answer)
Q12 – post: Do you have any suggestions for improvement? (open answer)

Follow-up student survey

Q1. Which SkillBox did you use? (R / Matrix / Stats)
Q2. Which subject did you use the SkillBox in? (open answer)
Q3. Have you been provided with multimedia resources (not SkillBox) in other subjects (not this subject)? (Y/N) If so, what? (open answer)
Q4. How would you rate SkillBox compared with multimedia resources provided in other subjects? (Much better / Somewhat better / About the same / Somewhat worse / Much worse / Not applicable)
Q5. Did you source alternative multimedia resources in addition to using SkillBox in this subject? (Y/N) If so, what? (open answer)
Q6. How did these resources compare to SkillBox? (Much better / Somewhat better / About the same / Somewhat worse / Much worse / Not applicable)
Q7. If SkillBox had not been available in this subject, would you have searched for similar third party resources yourself? (Y/N)
Q8. How confident are you that the third party resources you find yourself are accurate and relevant to what you are studying? (Very confident / Somewhat confident / Not very confident / Not at all confident)
Q9. How motivated are you to find third party (non-CSU) resources to support your study? (Very motivated / Somewhat motivated / Not very motivated / Not at all motivated)
Q10. When you find resources that you have found to be useful and beneficial, do you share them with other students? (Often / Sometimes / Rarely)
Q11. Do you have any further comments about your experience with SkillBox? (open answer)

Follow-up staff survey

Q1. Which SkillBox did your students use? (R /Matrix / Stats)
Q2. Do you believe that introducing multimedia resources into your subject helps students learn core concepts better? (Strongly Agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree)
Q3. How did having SkillBox in your subject impact on your workload as Subject Coordinator / Lecturer? (Descreased my workload / did not impact my workload / increased my workload)
Q4. To what extent do you create your own multimedia resources in this or other subjects? (Often – many resources in most subjects / Sometimes – some resources in some subjects / To a small extent – one or two resources in one or two subjects / Almost never)
Q5.To what extent do you source existing multimedia resources from credible third party sources? (Often – many resources in most subjects / Sometimes – some resources in some subjects / To a small extent – one or two resources in one or two subjects / Almost never)
Q6. Have you had any feedback from students in this subject about using SkillBox? (open answer)
Q7. What changes, if any, have you found in students being able to comprehend the core concepts portrayed in SkillBox? (open answer)
Q8. Would you promote the use of SkillBox in future offerings of this subject? Why or why not? (open answer)
Q9. Do you have any suggestions on how SkillBox could be improved? Are there any other topics that you would like to see a SkillBox developed for? (open answer)
Q10. Do you have any further comments about your experience with SkillBox? (open answer)

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Note: All published papers are refereed, having undergone a double-blind peer-review process.

No More Lonely Learning: Applying Salmon's *Carpe Diem* process of subject re-design to three fully online postgraduate nursing subjects in a regional Australian university

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This study contributes to the literature on curriculum design for nursing education. Three fully online, postgraduate nursing subjects in a regional Australian university were re-designed using Salmon's Carpe Diem team-based, two-day intensive workshop process. An exploratory descriptive mixed methods design was used to evaluate both the process undertaken and the deliverables produced in this project. Workshop participants unanimously reported strongly positive experiences during the workshop itself, and both the teaching staff and the students enjoyed a positive, enthusiastic and engaged teaching and learning experience when the re-designed subjects were deployed. Student statistics regarding access to the subject website, and student performance in the subject, were both markedly improved when compared to prior offerings of the subjects. The Carpe Diem process was demonstrated to be fit for our purpose and context.

Keywords: online learning, Carpe Diem, nursing, active learning, curriculum design.

Background:

Registered nurses embrace the ethos of lifelong learning, which is a key requirement for maintaining their professional registration, and also necessary when seeking promotion. However, nurses experience barriers to on campus university attendance, due to a multiplicity of factors, including geographic location, family commitments, and work commitments, specifically those necessitated by the need to staff many of their health care facilities around the clock, 365 days per year. Distance learning neatly works around these time and space constraints, and has done so credibly for decades, originally using a text-based postal model for delivery of learning materials, with low tech support by telephone. As a regional university serving a large geographic footprint comprised of moderately sized regional centres interspersed with sparsely populated areas, James Cook University has continuously embraced distance learning as a means of providing educational opportunities, particularly for students who might not otherwise be able to participate in professional development via the tertiary education sector.

Distance learning can, however, present its own problems, particularly for shift workers, often resulting in a lonely learning experience, where students download, print and 'consume' their study materials while they are 'home alone' and with no/minimal contact with other learners or even with their teacher (Mulienburg & Berge, 2001). Computer technology and the increasing penetration of high-speed internet access, even in regional, rural and remote areas, offers the opportunity for learning that is both more active and more interactive, even in distance mode. However, such aspirations require more than mere 'horizontal to vertical' repositioning of didactic content, wherein text-based Study Guides were simply loaded into a Learning Management System (LMS) such as Blackboard and viewed vertically on screen, instead of horizontally as a printed booklet on the student's desk.

Practicing registered nurses, and the nurse educators teaching them, generally learned in face-to-face environments for their own undergraduate degrees. Both teacher and student may, therefore, struggle to embrace the many technological opportunities to enhance distance learning, particularly without an evidence-based pedagogical framework to guide both the curriculum design and the learning experiences. We aspired to the principle that the technology should be made to serve the pedagogy (McGee & Reis, 2012), and not the other way around.

With the above context and considerations in mind, internal learning and teaching development funding was sought and obtained to trial the use of the Salmon model of "Carpe Diem" to re-design two postgraduate subjects during a team-based, two-day intensive workshop. Our aim was to achieve more active and interactive learning for postgraduate registered nurses, by building the learner's online confidence and efficacy by scaffolding them through Salmon's Five Stage Model for online/blended learning (Salmon, 2011; Salmon, 2013; Salmon, Jones & Armellini, 2008; Salmon & Wright, 2014).

The success of this endeavour prompted an expansion of the project parameters to include a third "bonus" subject as well. The positive experience of using the Salmon framework for re-design will be briefly discussed, as well as the marked contrast in learner engagement with the Blackboard LMS, as gleaned from a cohort comparison of data from learning analytics for the subjects as 'delivered' in the pre-Salmon and post-Salmon pedagogy.

Methods

An exploratory descriptive mixed methods design was used to evaluate both the process undertaken and the deliverables produced in this project. Three postgraduate subjects were re-designed using the Salmon "Carpe Diem" two-day workshop structure, with an on-site team including nursing academics as 'knowledge owners' (Salmon & Wright, 2014), (e.g. content experts); a librarian assigned as the health liaison librarian; the manager of Blackboard LMS; and an educational designer from the Learning, Teaching and Student Engagement directorate. The Principal Investigator (PI) functioned as the Workshop Facilitator for all three workshops, given her training in the model, received in a MOOC about Carpe Diem undertaken in early 2014 with Professor Gilly Salmon and Professor Alejandro Armellini, and applied at that time to her own undergraduate fully online subject. The steps undertaken over the two days of a Carpe Diem are listed in Appendix A, and are further detailed in the Creative Commons licensed Facilitator Workbook that guided the process, and that is freely available online at:
http://www.gillysalmon.com/uploads/1/6/0/5/16055858/carpe_diem_planning_process_workbook_v17-january_2015.pdf

Data Collection/Data analysis

All design team members were interviewed by a research project officer who was not involved in either the design or delivery of any of the three subjects (JJ), and who has strong qualitative research experience in the healthcare field. She also interviewed five students upon their completion of one or more of the fully online subjects. All interviews were conducted either face-to-face or by phone, for the participant's convenience, at a mutually agreed upon time and location, after signing the consent form. Interviews were recorded and transcribed by a professional transcription service. A basic descriptive qualitative analysis of all interview data is underway by another research assistant (NB) with experience in qualitative analysis for nursing research, using Excel for sorting and categorising excerpts into themes as they arise.

Quantitative data was obtained from the existing university business intelligence system (Cognos) and from learning analytics available within the university's branded version of the Blackboard Learning Management system, called LearnJCU. Subject statistics on students' performance and their utilisation of the LearnJCU subject website were reviewed for the most recent delivery of the subject before the Carpe Diem re-design, as compared to the first delivery of the subject after Salmon re-design.

Results and Discussion:

Qualitative Data:

Staff feedback on Carpe Diem workshops
All staff interviewed were highly positive about their experience in the two-day workshop. They described the process as a high energy, enthusiastic one, that was enjoyable and immediately gratifying and reinforcing, due to seeing the LearnJCU subject site being built online before their eyes. They reported that the well-researched model provided a strong structure, which served to keep the process moving along at the brisk pace intended by the model. The pace and energy were also noted to be maintained by the skills, enthusiasm and lived experience of the facilitator, who had previously applied the model to re-design and deliver an undergraduate fully online subject. This finding concurs with Salmon's reported staff involvement (Salmon & Wright, 2014, p. 54).
They also reported that the unique contributions of each of the recommended roles were clearly evident as being necessary and crucial to the success of the process, and that it saved considerable time by having immediate access to experts to finish building an online component in the moment. Similarly, the interaction between the team members, even though some of the composition of the teams changed from one subject to the next, was also deemed to be valuable, productive and enjoyable.

The steps outlined in the Carpe Diem process were viewed as logical, linear, and correctly sequenced for optimal effect, with appropriate time frames for each stage. The original intention of the project was to use an evidence-based curriculum design approach, so the structure was followed carefully, and the rationale behind certain sequencing and approaches became evident as the process unfolded. While all stages were necessary and fruitful, the Storyboard stage and the use of this powerful tool throughout the rest of the workshop was a clear highlight for all participants, and proved to be a pivotal focal point and a versatile, colourful, engaging and practical method of ensuring that all components of the subject fit together well, and scaffolded the student to success across the semester. See Figure 1 for a photograph of the storyboard from the second subject.

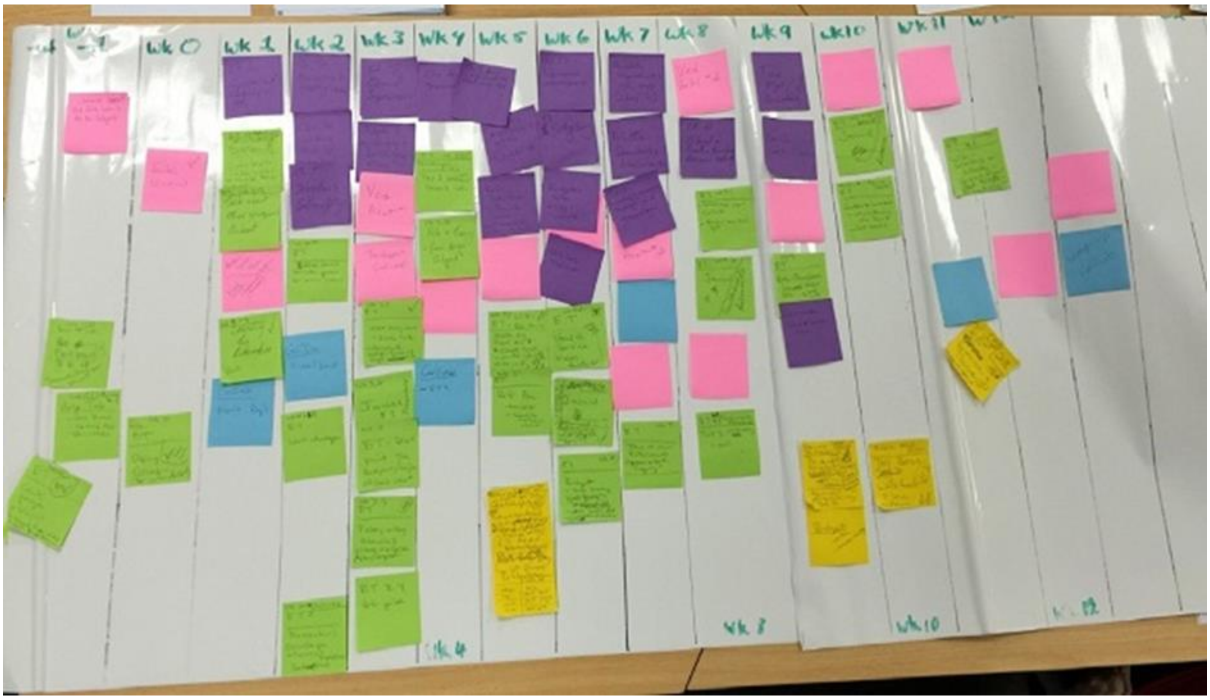

Figure 1: Photo of storyboard in progress for the second re-designed subject, Nursing Management

The prioritizing of time was an interesting element of the process. While all participants were convinced the return on investment was worthwhile in the end, this was a potential stumbling block: finding a time when all team members could be present for the full two-day workshop; and the consequences of setting aside other tasks during the two six hour days that then had to be addressed upon completion of the workshop. Participants encouraged scheduling well in advance as one workaround, and noted that the time taken was less than what would have been consumed if the process had been done alone and/or in rushed fragments of leftover time around the edges of other duties. The momentum of the fast paced process and the 'permission' to set aside other duties during this dedicated time, seemed to serve to create a retreat-like culture during the workshop, and to focus and energise the group. These findings reflect similar observations made by Salmon and Wright (2014, p. 58).

Staff feedback on teaching in the re-designed subjects
Subject Coordinators perform all the online teaching for their own subjects, and noted a qualitatively different experience from previous online teaching. There was a greater sense of connection to the students, a more energetic 'buzz' to the feel of the subject, and far greater student-to-student interaction, as well as student-to-teacher interaction. Student comments within the LMS reflected a sense of conquest over the technology, pleasure in learning, and appreciation for the palpable support of their colleagues and teachers, reflecting a successful ability to project an online social presence.

Student feedback on learning in the re-designed subjects
Data analysis for the student interviews is still underway, with some students having only just completed their re-designed subject within the last month. Preliminary data analysis indicates that students found the cohesive subject structure to be helpful, and recognised the multiple benefits of the E-tivities in helping them to be more active, to learn the technology, and to build up to their summative assessments. Students particularly appreciated the built in high levels of 'how to' support that helped them to master the technology requirements of online learning, an aspect emphasised heavily in *Stage One: Access and Motivation* of Salmon's five stage model of online learning (Salmon, 2013). Stages Two through Five are: Online Socialisation, Information Exchange, Knowledge Construction, and Development (Salmon, 2013).

Quantitative measures of student engagement and student learning

When comparing student behaviour in the re-designed subjects to that of their predecessors in the previous offering, we found that students were entering the subject website about twice as often, (see Table 1), and spending more than twice as many minutes within the subject site (see Table 2). In addition, they were using the LMS in more interactive ways, versus prior patterns of only logging in to passively download content and upload assessments (see Table 3). The higher levels of engagement online also translated to better performance, with three to five times as many fails in the prior offerings, as compared to the re-designed offering. The results were far less marked in the subject Contemporary Issues in Acute Care Nursing, but with only 6 students involved, those statistics are less robust. The other two subjects each had better numbers, with 25-30 students, as is usually seen in our typical postgraduate nursing subjects.

Student access and engagement with the Blackboard LMS (LearnJCU)

Table 1: Average number of times a student accessed the subject website in LearnJCU, per student:

Subject Title	PRE	POST
Nursing Management	34	69
Clinical Governance	45	71
Contemporary Issues in Acute Care Nursing	46	56

Table 2: Average Minutes spent on the subject website in LearnJCU, per student:

	PRE	POST
Nursing Management	518	1368
Clinical Governance	878	1854
Contemporary Issues in Acute Care Nursing	666	1044

Table 3: Average number of interactions on the subject website in LearnJCU, per student

	PRE	POST
Nursing Management	277	780
Clinical Governance	327	867
Contemporary Issues in Acute Care Nursing	415	466

A limitation of the study was the relatively small sample size, both of the design team and of the student participants. A strength of the study was the triangulation of data sources, including qualitative staff data, qualitative student data, and quantitative student data.

Conclusions and Future Directions

The search for workable pedagogical frameworks to guide curriculum design for nursing education is ongoing. This study offers one approach that has been received positively by both academic staff and students, with high levels of satisfaction reported by the design team, and improved student parameters of engagement, performance and satisfaction being noted. The study also shows that the Carpe Diem model of online subject design is suitable for use in the context of an Australian regional university. Salmon and Wright (2014) note that more research into the experience and use of the Carpe Diem process in various disciplines is needed, and this study has provided an exploration of its successful application in the discipline of nursing. Further in depth analysis of the remaining qualitative student data from this study will result in additional publications that will further contribute to the nursing education literature.

References

McGee,P. & Reis, A. (2012). Blended course Design: A synthesis of best practices. *Journal of Asynchronous Learning Networks*,*16*(4),7-22.

Muilenburg, L. & Berge, Z.L. (2001). Barriers to distance education: A factor-analytic study. American Journal of Distance Education,15@, 7-22, DOI: 10.1080/08923640109527081

Salmon, G. (2011). E-moderating: The key to teaching and learning online, 3rd ed. New York: Routledge--Taylor & Francis Group.

Salmon, G. (2013). E-tivities: The key to active online learning, 2nd ed. New York: Routledge--Taylor & Francis Group.

Salmon, G., Jones, S., & Armellini, A. (2008). Building institutional capability in e-learning design. *ALT-J, Research in Learning Technology*, *16*(2), 95-109.

Salmon, G. & Wright, P. (2014). Transforming future teaching through 'Carpe Diem' learning design. *Education Sciences*, *4*, 52-63. DOI: 10.3390/edusci4010052.

Salmon, G. (2015) Carpe *Diem Planning Process—Handbook.* Retrieved: http://www.gillysalmon.com/uploads/1/6/0/5/16055858/carpe_diem_planning_process_workbook_v17-january_2015.pdf

Appendix A

Carpe Diem Two Day Subject Re-design Workshop		
Day	**Session**	**Component Tasks**
Day One:	Write a blueprint-envision the future	Our mission is….
		The 'look and feel' of our unit
		Start at the end (learning outcomes)
		Explore how you will assess these outcomes
	Make a storyboard	Create a table with a column for each week of the study period, and add in coloured post-its with components of the subject placed in the weeks they seem to fit together best.
		Begin with summative assessments as yellow post-its, then build backwards, adding in green post-its for the e-tivities; blue for campus or virtual class meetings; and lastly, content resources like textbook chapters (pink) and video lectures (purple), etc.
		Move post-its freely as creativity flows, and to ensure students will progress through The Five Stage Model over the semester.
	E-tivities on paper	Break in to pairs and use the E-tivity template to create and build E-tivities; can do so on paper for now.
Day Two:	Build your prototype on line	Move your E-tivities to your LMS online environment, complete with sparks and links, and using the LMS tools (e.g. Discussion Boards, Journals, Wikis, etc.) as suits the E-tivity's purpose.
	Check Reality	Students or other academics external to the team, road test your E-tivities within your LMS, using the Reality Checker feedback form.
	Review and adjust	Incorporate feedback from your Reality Checkers to revise E-tivities; check storyboard for cohesion across semester and reasonable student time commitments in hours per week/semester (carpe horam).
	Planning your next steps	Complete your action plan, stipulate the remaining tasks to be completed by when and by whom; schedule a short (1.5 hour) follow-up session in a few weeks, or sooner if subject will be commencing shortly.

Adapted from: Salmon, G. (2015) Carpe *Diem Planning Process—Handbook.* Retrieved 4 August 2016 from: http://www.gillysalmon.com/uploads/1/6/0/5/16055858/carpe_diem_planning_process_workbook_v17-january_2015.pdf

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Working with social media in tertiary education: A contested space between academics and policies

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Managing the use of social media in tertiary institutions is not as straight-forward as it may first seem. There is a multiplicity of facets which interplay within this space, from the espoused University policies on the one side of the coin, to the actual practices by students and staff on the other. At times, this misalignment is not the result of deliberate waywardness. For academics, deciphering and adhering to institutional policy whilst simultaneously attempting to enrich students' learning experiences is a difficult feat. This paper explores this contested space, examining the tensions between social media as a disruptive technology, coupled with the interpretation of institutional policies. Our analysis points to a call for clarity in and around institutional policy in the implementation of social media for teaching and learning in higher education.

Keywords: social media, policy, tertiary education, learning, teaching, professional development

Introduction

With the rapid rise of technology in all aspects of our lives, it would be an understatement to propose that the use of educational technology is now an expected common practice in tertiary education. Indeed, Selwyn (2010, p. 65) has noted that technology has become "a standard feature of contemporary education provision and practice". In particular, technology has evolved from the read/write web to become the site presumption (or production by consumers) (cf. Toffler & Alvin, 1981). In Web 2.0, there is the opportunity for creating, storing and sharing of vast content through the web/cloud/internet/technology. This has brought along with it changes in the use of technology in the tertiary sector. Among the Web 2.0 technological tools rapidly adopted for teaching and learning in higher education is social media, utilised for the creation of meaningful connections and networks (Siemens, 2014). It has been argued that social media facilitates an active, authentic and social learning environment for students (Johnson et al., 2016). It does this in part by enabling formal and informal learning opportunities (Bateman & Willems, 2012), between educators and students, among students themselves, and for interaction between students and the learning content (cf. Moore, 1989).

Yet possibilities for learning aside, social media is the site of contestation in tertiary education. From the institution's viewpoint, changes in the use of technology can cause disruption to the status quo, and social media itself viewed as a disruptive technology as it is becoming increasingly used, thereby displacing the dominant technology (Flavin, 2012). The governance of social media requires institutional policies, defined as "the formal laws, regulations, rules, and guidelines that govern institutions" (Johnson et al., 2016). Policy, in turn, can either promote acceleration of the adoption and use of particular technologies for learning (ibid), or block them. The same policy may be contradictory in that it promotes one aspect but dissuades another, causing confusion in the interpretation of the governing policies in different contexts. This is a challenge for key stakeholders such as academics in tertiary education finding policies confusing and jargonistic. This analytical paper sheds a spotlight on these issues. Beyond the remit of this paper, we flag also that where an institutional policy may be clear, users themselves can wilfully or accidentally overlook them.

Social Media

Social media is a subset of Web 2.0 technologies. The term 'social media' is broadly defined in this paper as synonymic term for any technology which encompasses "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content" (Kaplan & Haenlein, 2010, p. 61). Aichner and Jacob (2015, p. 259) have discerned 13 different types of social media. These include blogging tools, networking tools, forums, photo sharing tools, business collaboration tools, service and product reviews, research networks, video sharing tools, and virtual worlds. In tertiary education, social media are available for a variety of uses including research, marketing, and the creation and promotion of professional student personas. In this paper, we are specifically referring to the use of social media for teaching and learning in the context of tertiary education. The rise of the social media is exponential, and this trend is expected to flourish into the future. As Johnson et al. (2016, p. 30) note, "As well-established as social media is, it continues to evolve at a rapid pace, with new ideas, tools, and developments coming online constantly". This has real implications for the sector of tertiary education. We know that social media is being used in a variety of ways - one way being an alternative learning management system (LMS). For example, research shows that in developing countries the uptake and the prevalence of social media in curriculum bridges the gap which exists in University's digital infrastructure (Sobaih, Moustafa, Ghandforoush, & Khan, 2016, pp. 296-297). In first world countries, social media is also being used deliberately (cf. Willems, Sutton, & Maybery, 2015), or even by accident (cf. Bateman & Willems, 2012).

University policies and procedures – data privacy versus academic freedom and student engagement

Use and policy are the two opposing sides of the same coin in this debate. On the one side, there is student engagement and academic freedom; on the other, data privacy and the protection of the institution's branding and reputation. As Bateman and Willems (2015) have suggested, the use of social media for teaching and learning in tertiary education is outpacing policy, putting the 'cart before the horse'. The authors have argued that the provision of clear principles and policies to guide the use of rapidly emergent technologies will enable the execution of an increased duty of care for all stakeholders within the tertiary education community. The issue of social media policy is becoming a key need for consideration for those of us who work in academia. The press – both in Australasia and around the globe - is more frequently reporting on the intersection between student and staff breeches of institutional social media policy. Some recent Australian exemplars include the case of one academic being temporarily suspended by her institution due to her *Twitter* comments about the Australian flag, and another who was stood down without pay by his institution due to his comments on *Facebook* relating to his perceptions of *Sky News* viewers (Joyner, 2016).

While there is a great deal of literature on the use (and abuse) of social media in higher education, there is less research on the intertwining of policy (Pomerantz, Hank & Sugimoko, 2015). University policy and procedures exist to guide practices within the institution. This is decided by a myriad of factors from legislative changes at one end of the spectrum, to user expectations at the other. The policy exists to govern the use of social media by stakeholders within the reach of the institution: students, academic staff, professional staff, and the institution itself and yet, the organisation requires a single policy point (Blair & Willems, 2015), if one exists at all (Boudreaux, 2011). As Pomerantz, Hank and Sugimoko (2015, p. 2) note: "policies are difficult to construct in a way that suits all stakeholders and protects academic freedom". On the flip side, policies also exist to uphold institutional branding and reputation, with the increasing corporatisation of higher education (Joyner, 2016).

Regardless of their importance, policies and procedures are generally considered difficult to comprehend in the tertiary education sector, including those policies that relate to learning and teaching, and in particular within the context where academic freedom deems a virtue. This creates a lack of clarity around whether academic staff should engage with students in certain spaces such as social media and whether or how these staff will be supported by university policies.

Highlighting some excerpts from one Australian tertiary institution's policies, we aim to reveal how this confusion can arise. First, we will look at some examples which deem to discourage the use of social media – mainly pertaining to the data privacy and maintenance of students' data.

Some key issues that may be interpreted as reasons not to use social media include privacy of student information and data or record keeping for education and training activities (see Table 1). First and foremost, Information and Records Maintenance Policy states that no university data shall be sold or have ownership to a third party company such as Facebook or Twitter. However, there are social media platforms such as Facebook that acknowledge their right to access and use certain user data within their private policy under certain circumstances. In the case of University communications (under Information and Communications Technology Use Procedure), it is a requirement that all records (including education and training activities) are kept safely for an adequate period of time and destroyed after certain periods. This becomes problematic when staff and students are asked to mind its storage and maintenance of learning activities outside of University's formal learning spaces such as LMS and also when social media platforms might have direct access to private data and its maintenance (e.g. Facebook). Finally, when academic staff use social media for teaching – namely, under the banner of conducting university 'business', they are invited to use the institution's email accounts. This could also be an obstacle when academics already have Facebook accounts, for example that they need to create another Facebook account to just be able to do the teaching and learning with their students. Archiving of data relating to the learning and teaching activities within social media also becomes an issue.

Table 1: Policies which potentially discourage the use of social media (emphasis added)

POLICY- SECTION	RELEVANT CLAUSES
INFORMATION AND RECORDS MANAGEMENT POLICY SECTION 4 - POLICY	(9) No University information will be sold or have ownership transferred to a third party without the approval of the Vice-Chancellor.
	(10) The University will manage its records throughout their lifecycle to ensure that they are **a complete and accurate record of its business activities and that they remain the property of the University.**
	(11) The Records Unit will maintain an information and records management program that includes: a. guidelines, including requirements for information classification b. **education and training activities** c. a retention schedule, including instructions about the disposal and archiving requirements for records.
INFORMATION AND COMMUNICATIONS TECHNOLOGY USE PROCEDURE SECTION 5 - PROCEDURE	(21) Staff members are required to **use only their [University] email accounts and [University] resources when undertaking business transactions on behalf of [The University] and not other and personal email addresses.**
PRIVACY POLICY SECTION 4 – POLICY Security and disposal	(17) The University will ensure that Personal Information and Health Information is: a. **kept secure and protected from misuse, loss, unauthorised access, modification or disclosur**e b. **destroyed or permanently de-identified when it is no longer needed by the University**, subject to the University's obligations under the Public Records Act 1973 (Vic) and other legislation.

There are, on the other hand, other policies which seem to encourage the use of social media for teaching and learning in tertiary education. From the same policy document in Table 1, the second set of policies (listed in Table 2, below) essentially evolve around the concepts of academic freedom and engagement with students. Academic freedom in that established scholars should have the autonomy to promote and perform teaching that resonates with their teaching philosophies and students. Academic staff are encouraged to seek advice where necessary in complying with the University's code of conduct as described above, and advised to state that their views expressed in social media are personal detached from University's views in relevant media. Above all, staff are generally encouraged to make personal connections and interactions with students so that their learning experiences (both face to face and online) are personal, engaging and relevant (under Teaching and Learning Policy).

Table 2: Policies which potentially encourage the use of social media (emphasis added)

POLICY - SECTION	RELEVANT CLAUSES
MEDIA POLICY SECTION 4 - POLICY	4) In accordance with the Academic Freedom Policy, the University recognises and values the tenets of **academic freedom** as central to its endeavours in scholarship, teaching and research and is committed to its promotion and protection within the University. It supports the right of its scholars to engage in critical inquiry and robust and unfettered critical debate which extends to engagement with the media. In their exercise of academic freedom staff and associates must at all times comply with the requirements for personal and professional behaviour in the Code of Conduct.
	(5) Academic staff are encouraged to engage freely with the media in their areas of expertise, but on politically or socially sensitive issues, they are encouraged to seek the advice of the Media Relations and Corporate Communications Unit.
	(6) Academic staff may make other public comments **as long as the staff member makes it plain he or she does not represent the University when making these comments.**
	(9) The University recognises the use of and participation in social media to learn, advocate, collaborate, exchange and contribute information and ideas. **Social media is recognised by the University as a key channel for remaining active, aware and fully engaged with its students, staff and communities.**
	(10) Use of social media by University staff and students, where there is a connection with the University, must comply with this and all relevant University policies and procedures. Use of social media will have a connection with the University in each of the following circumstances: a. if the social media account is established or used as an official University social media channel; b. if the social media is accessed using University information technology systems or equipment; **c. if it is clear there is an affiliation between a staff member or student and the University on the site;** or d. **if the content of the social media is specifically about the University or its staff or students, in whole or in part**.
SOCIAL MEDIA PROCEDURE SECTION 5 - PROCEDURE	(10) All social media content and comments linked to the University (including official University social media accounts), must comply with the University's Code of Conduct, the Student Code of Conduct, the Equity and Diversity Policy, and the Public Relations and Marketing Policy.
TEACHING AND LEARNING (HIGHER EDUCATION COURSES) POLICY SECTION 4 - POLICY	(6) The University's courses, led and taught by educators with teaching expertise and discipline specific knowledge, have an integrated and inclusive curriculum with: a. clearly articulated course learning outcomes, consistent with [University], Graduate Learning Outcomes, the Australian Qualifications Framework and professional standards where relevant, and clearly communicate standards of expected student performance b. **a focus on personal connections and interactions between learners and fellow students and educators so that located and cloud learning experiences are personal, engaging and relevant** c. learning experiences, including assessments, that enable students to create and share evidence of their learning achievements, with particular emphases

Understanding the variety of policies and procedures around the use of social media is only the first step for academics to safely dive into the initiative. Once academics are in the space under the guiding policies, academics ought to still learn how to best use social media and practice so that that they become efficient operators of social media for learning and teaching. It is these multi-facet steps that academics find themselves caught in-between to move forward, which calls for a need for ongoing professional development. Finally, we must not forget that these policies (in particular those associated with privacy) are only the ones practiced at the university, and that there are even more complex and multiple of terms and conditions with which each social media requires its users to agree to and sign on, outside of institutional policies. We will not touch on each social media's policies, except to mention that they certainly add to the complexity of understanding policies and legal agreements in deciding whether social media is an appropriate tool for learning and teaching.

Building capacity for academics through professional development

The unpacking of various policies in tertiary institutions can be an onerous task, yet alone how to effectively facilitate social learning within the space once academics are there. Not only to talk about the wide range of policies and procedures available at universities, it is imperative that academics are guided and supported in exploring the pros and cons, opportunities and challenges of using social media for their teaching. There are often no university-wide professional development opportunities provided as a forum for academics to engage and unpack these policies related to their teaching and learning. Following Willems (2016), we advocate that professional development opportunities that allow discussions on what affordances and risks social media would bring to academics and their students are crucial. Staff professional development is essential to expand educators' awareness of contributing "to the effective education of their students and the accomplishment of the organisation's objectives"(Marriss, 2011, p. 1); to improve the quality of student learning and to help produce capable graduates who are work-ready (Pleschová et al., 2012); and to aid the institution survive ever-changing demands and to meet accountability measures (Seyoum, 2012). In summary, for an "effective staff development process [it] is supportive of the individual and beneficial for the organisation" (Marriss, 2011, p. 4). However, as Altany (2012) has noted, professional development is not just something to employ to remediate problems; it is a necessary initiative that is a necessary prophylactic measure, ensuring stability for the academic and the institution.

Conclusion

This paper highlights the contested space where academics find themselves in thinking about social media for learning and teaching when dealing with diverse and complex university policies and procedures. Drawing on excerpts from an Australian institution, our analysis reveals that arguments both for and against the use of social media can be supported by those policies. This can in turn cause confusion for academics.

In summary, the tensions created by actual and espoused use of social media for teaching and learning in tertiary education, versus institutional policy and procedures can no longer be overlooked. Often, policies and procedures lag behind the rapid rise of the various social media technologies. As Blair and Willems (2015) have argued, social media policy requires agility in development, management and application. Pomerantz, Hank and Sugimoko (2015) join this call by arguing that in order to keep pace with the rapid development of social media use in higher education, institutions not only need policy, but need to revisit these policies frequently as the technology, applications and uses of social media evolve. To this, we add that social media policy needs to be adaptive and current, and especially able to provide clarity around interpretation of specific policies which will relate to their desired teaching practice. Ongoing and dedicated staff professional development can also help to address this issue. To conclude, we call for further research into this contested space.

References

Aichner, T., & Jacob, F. (2015). Measuring the degree of corporate social media use. *International Journal of Market Research*, *57*(2), 257-275.

Altany, A. (2012). Professional Faculty Development: The Necessary Fourth Leg. *Faculty Focus*.

Bateman, D., & Willems, J. (2012). Facing off: Facebook and higher education. *Misbehaviour Online in Higher Education: Cutting-edge Technologies in Higher Education, 5*, 53Á79.

Bateman, D., & Willems, J. (2015, July 6-9). *The horse or the cart: Social Media, policy and Higher Education.* Paper presented at the the Higher Education Research and Development Society of Australasia, Melbourne, Australia.

Blair, S., & Willems, J. (2015, July 12-15). *Social media, policy and higher education: An organisational context*. Paper presented at the The 2nd European Conference on Social Media, Portugal.

Boudreaux, C. (2011). Social Media Policies. In *The Social Media Management Handbook: Everything You Need To Know To Get Social Media Working In Your Business* (pp. 274–285). Hoboken, N.J: Wiley.

Falvin, M. (2012). Disruptive technologies in higher education. *Research in Learning Technology*, 102-111. http://www.researchinlearningtechnology.net/index.php/rlt/article/view/19184?trendmd-shared=0

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Hall, C. (2016). *NMC Horizon Report 2016 Higher Education Edition* (0989733556). http://cdn.nmc.org/media/2016-nmc-horizon-report-he-EN.pdf

Joyner, T., (2016). It's uni brand vs personal stand in social media's grey area. *The Australian.* 29 June 2016. http://www.theaustralian.com.au/higher-education/its-uni-brand-vs-personal-stand-in-social-medias-grey-area/news-story/0fa55882d1b75c2e81a3a2a2002aed53

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business horizons, 53*(1), 59-68.

Marriss, D. (2011). Academic staff development. In A. McIntosh, J. Gidman, & E. Mason-Whitehead (Eds.), *Key Concepts in Healthcare Education* (pp. 1-5). Los Angeles: SAGE.

Moore, M. G. (1989). Three Types of Interaction. *American Journal of Distance Education, 3*(2), 1-7.

Pleschová, G., Simon, E., Quinlan, K., Murphy, J., Roxa, T., & Szabó, M. (2012). The professionalisation of academics as teachers in higher education. *Science Position Paper. Standing Committee for the Social Sciences*. http://www.esf.org/fileadmin/Public_documents/Publications/professionalisation_academics.pdf

Pomerantz, J., Hank, C., Sugimoto, C.R. (2015). The State of Social Media Policies in Higher Education. *PLoS ONE 10*(5), 1-17. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4445913/pdf/pone.0127485.pdf

Selwyn, N. (2010). Looking beyond learning: notes towards the critical study of educational technology. *Journal of Computer assisted learning, 26*(1), 65-73.

Seyoum, Y. (2012). Staff Development as an Imperative Avenue in Ensuring Quality: The Experience of Adama University. *Education Research International*, *2012*.

Siemens, G. (2014). Connectivism: A learning theory for the digital age. http://www.itdl.org/journal/jan_05/article01.htm

Sobaih, A. E. E., Moustafa, M. A., Ghandforoush, P., & Khan, M. (2016). To use or not to use? Social media in higher education in developing countries. *Computers in Human Behavior*, *58*, 296-305.

Toffler, A., & Alvin, T. (1981). *The third wave*: Bantam books New York.

Willems, J. (2016). *Professional Development of Academic Staff in the use of Social Media for Teaching and Learning.* Paper presented at the The 3rd European Conference on Social Media, Caen, France.

Willems, J., Sutton, K., & Maybery, D. (2015). Using a Delphi process to extend a rural mental health workforce recruitment initiative. *The Journal of Mental Health Training, Education and Practice, 10*(2), 91-100.

Please cite as: Willems, J., Adachi, C. & Grevtseva, Y. (2016). Working with social media in tertiary education: A contested space between academics and policies. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 648-653).

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The promise and pitfalls of social media use in Higher Education

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Social media is pervasive in all aspects of modern life, including health, education, parenting, entertainment personal relationships and current affairs. In Higher Education however, social media is becoming a site of tension between those pursuing connected and innovative educational practice on one hand and an increasingly constrained policy environment reacting to reputational damage resulting from subversive and risky online behaviour by students and staff on the other. Social media has polarised academics, many of whom dismiss it as time-wasting and trivialising academic work and others who embrace it as an open and evolving form of scholarship and academic practice. Students engage with it for learning despite the expected norms of traditional academic practice. This symposium will highlight and explore key issues dominating current debates around the use and misuse of social media in Higher Education drawing on the wisdom of the crowd to find solutions to such challenges.

Keywords: social media, higher education, policy, research, learning, teaching, digital, identity

Overview

Social media use is rapidly permeating every aspect of contemporary university life (Johnson et al., 2016; Kaplan & Haenlein, 2010). However the more it proliferates the more universities struggle to provide effective governance and policy frameworks to protect their standards and interests. This symposium will highlight the challenges and opportunities currently facing University staff who choose to connect, collaborate and create through the plethora of social media platforms available.

Some of the core university functions most impacted are:

- **Research** - crowd sourcing, crowd funding, dissemination, collaborations, open access publishing, blogging, ResearchGate, AcademiaEdu, etc.
- **Learning and Teaching** - engaging students and managing distractions, connecting with experts, knowledge is everywhere but is it valid, managing digital identity/footprint/tattoo, the walled garden of the LMS and possibilities for alternative platforms
- **Engagement** - Alumni relations, Industry/ Professions, global partnerships, blurring boundaries and the emergence of new credentials
- **Recruitment and retention** - Brand promotion, marketing, attracting potential students, tracking student progress

The symposium will be presented in the form of a debate around the pros and cons of using social media in Higher Education (HE). We will cover what is social media (in its broadest definition), consider the push and pull of social media in HE, examine the issues around policy, and consider whether it is social or in fact anti-social. We will also examine the various purposes of using social media beyond teaching and learning, such as research, creating a digital identity, and connecting with various networks, for example:

- Why is social media an issue of interest in HE?;
- Is social media a new paradigm in HE?;
- How is the use of social media being perceived, championed and challenged?;
- How is social media different in terms of the disruption and subversion?; and finally
- What questions do we need answered by collective wisdom?

Symposium structure: format, strategies, audience

This symposium will run for one hour. The structure of this symposium will be twofold. We will first start with a 'great debate' with a panel unpacking social media as a contested space in HE. Proposed panel members are listed in the biographies below. Audience participation will be encouraged throughout the debate via the use of social media - e.g. questions on twitter will be picked up for discussion by the chair. Following the debate, the chair will ensure that the floor will be opened for a participatory discussion around this contested space. Recommendations will be drafted and fed back to Australian Journal of Educational Technology (AJET) through a subsequent paper.

References

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Hall, C. (2016). *NMC Horizon Report 2016 Higher Education Edition* (0989733556). Retrieved from http://cdn.nmc.org/media/2016-nmc-horizon-report-he-EN.pdf

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons*, *53*(1), 59-68.

Please cite as: Willems, J., Adachi, C., McCluskey, T., Doherty, I., Bussey, F., O'Donnell, M. & Huijser, H. (2016). The promise and pitfalls of social media use in Higher Education. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning*. *Proceedings ASCILITE 2016 Adelaide* (pp. 654-655).

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WIL-fully flipping online: A novel pedagogical approach in STEM

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Work integrated learning (WIL) is becoming an important focus in tertiary education as we attempt to prepare students with graduate attributes that are fit for the real world outside academia. Developing students' employability skills during their course of study is the focus of new purpose-created WIL programs. These may be delivered in face-to-face, blended or fully online modes. When online options are chosen as the mode of teaching, and as an alternative to instructivist approaches where material is provided in passive ways, how can the learning engage the students and provide active and connected learning opportunities? The pedagogical approaches, the chosen learning design and associated assessment tasks, all play a key role. This paper reports on the transformation of twin online WIL units at an Australian university through the adoption of a novel fully online flipped learning approach through a Science, Technology, Engineering and Mathematics (STEM) lens.

Keywords: flipped learning; online learning; work integrated learning (WIL); Science, Technology, Engineering and Mathematics (STEM)

Introduction

In the realm of Science, Technology, Engineering and Mathematics (STEM) in higher education, there is a call to develop industry oriented learning activities within a student's course of study (Office of Chief Scientist, 2015; The Australian Industry Group, 2015). This is the realm of work integrated learning (WIL). Patrick et al. (2014, p.1) note that in the Australian context, WIL "is a response to demonstrable and increasing demands for the tertiary education sector to provide graduates with improved employability skills through an industry relevant curriculum". To this end, WIL approaches are commonly being utilised in higher education to provide students with opportunities to develop their employability.

At the same time, institutions are adopting ways to foster student work readiness into their strategic plans. Deakin University is no exception. For example, as part of the 'Live the Future 2020' strategic plan, Deakin University aims to "empower learners for the jobs and skills of the future" (2015, p.20). The related strategic direction at Deakin University sees an enhancement of courses whereby students undertake authentic tasks and professional skills proximal to industry to enhance employability (Oliver, 2015). Typically, units which are high in authenticity and proximity are 'work placement units'. At Deakin University, these work placement units are promoted to students as an opportunity to gain exposure to industry, as a valuable way for preparing for graduate employment, and thus increasing graduate employability. To this end, these units are aimed to help students in a variety of ways, including the opportunity to apply and consolidate knowledge gained from their course of study; to help them gain discipline specific and non-discipline industry exposure; to explore career options relevant to the student's discipline; and to help them develop a professional network (Deakin University, 2016a). As such, WIL units aim to prepare students for their unknown careers of the future.

Early and scaffolded engagement of students in multiple and varied WIL opportunities during their course of study is the focus of new purpose-created programs. These may be delivered in face-to-face, blended or fully online modes. For the purposes of scalability, online options tend to be chosen as a viable alternative to face-to-face modes. However, the online mode of learning can tend to rely on instructivist approaches, where content is uploaded and thus provided to students in passive ways. This paper reports on the transformation of twin online units at Deakin University through the adoption of a novel fully online flipped learning approach, driven by the question, how can the learning engage the students, foster connectivity and collaborative learning opportunities, and provide innovative active learning opportunities?

Flipped learning; fully online

Around the globe, the traditional chalk and talk, content-driven lecture style remains the norm in the field of STEM, and while staff and students might be familiar with this approach, it is not the best approach for every student, or for every context (Love et al., 2014). At the same time, teaching and learning in higher education is changing with advancements in educational technology. In the 2016 Horizon report, an identified mid-term trend in teaching and learning in the context of Higher Education as the result of technological change is the 'Redesigning of Learning Spaces'. This redesign involves "new forms of teaching and learning [which] necessitate [the facilitation of] emerging pedagogies and strategies" (Johnson et al., 2016, p. 12).

One emergent pedagogical strategy noted making a difference both in the literature within Higher Education is flipped learning (cf. Johnson et al., 2016). Flipped learning is also showing promise in STEM fields for increasing student interest and improving student learning (Love, Hodge, Grandgenett & Swift (2014). So what is flipped learning? It is not simply a way of teaching or a modality of learning as some would suggest.
The term flipped learning, and the often associated term of flipped classroom, are most often associated with a mixed mode or blended learning approach. This is evident from definitions such as that from Strayer (2012, p. 171) who defines flipped learning as "a specific type of blended learning design that uses technology to move lectures outside the classroom and uses learning activities to move practice with concepts inside the classroom". In contrast to the traditional lecture format of academia, technology-mediated, cloud-based opportunities are utilised for the pre-class and post-class activities, and campus-based, face-to-face opportunities used for during the in-class session. Under this model of flipped learning, students participate actively during the in-class session, completing applied activities in lieu of the place of what would be the lecture in the traditional format. In this face-to-face opportunity, the students participate actively, applying the material they have learnt in the pre-class time. Finally, the learning is reinforced in post-class activities (Abeysekera & Dawson, 2015), before the cycle continues again. There are an increasing number of exemplars found in the literature of the adoption of flipped learning in the blended learning environment of tertiary education (Strayer, 2012; Johnson et al., 2016).

What is not found as frequently in the literature are attempts to construct a flipped learning environment into fully online environments, where there is no opportunity of face-to-face learning, and where there is the absence of physical staff presence due to resource allocations and challenges of scalability. While flipping learning online might sound like an oxymoron or simply a synonym for asynchronous learning, Honeycutt and Glover (2014, n.p.) have defended this question. They argue that:

> In our work, we continue to push the conversations toward more comprehensive definitions of the flip. At its core, the flip means shifting the focus from the instructor to the students. You can do this by inverting the design of the course so students engage in activities, apply concepts, and focus on higher-level learning outcomes…Using this definition, the flip moves away from being defined as only something that happens in class [versus] out of class. Instead, we focus on what students are doing to construct knowledge, connect with others, and engage in higher levels of critical thinking and analysis…The real flip is not about where activities take place—it's about flipping the focus from you to your students. (ibid)

Flipped learning is, therefore, a broad pedagogical approach in which there is increasing student self-regulation. To emphasise this, Toivola and Silfverberg (2014) note that flipped learning flips not only teachers' and students' actions, but also their pedagogical assumptions about teaching and learning". As such it is about pedagogy, not simply about presentation of content.

It is difficult to find a definition of flipped learning that is not related directly to the mode of learning. Fortunately, the organisation Flipped Learning Network (FLN) defines flipped learning as:

> a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter. (FLN, 2014, p.1)

As such, flipped learning is a pedagogical approach to teaching and learning and is not about the mode of learning. Rather, flipped learning involves the key concepts of student engagement with their peers in the learning environment, connectivity, the application of concepts learnt in practical ways, and higher level learning outcomes, all to be addressed in the learning design.

Case study

Background

WIL programs offered within the Faculty of Science, Engineering and Built Environment (SEBE) at Deakin University are actively responding to both the call for STEM educators to transform traditional pedagogies (Office of Chief Scientist, 2014), along with Deakin University's 'Live the Future 2020' strategic plan (Deakin University, 2015). The primary means for enabling an increasing number of students' access to work integrated learning, is via work placements. These work placements, referred to variously as internships, professional practice and industry based learning, are core and elective credit point units within a student's degree. Through these, it is hoped to transform education by producing relevant, contemporary learning experiences to prepare students for careers and life more broadly in a rapidly changing world (Deakin University, 2015).

However, a missing element in these offerings was a preparatory and connective phase for students going on work placements. Recognising this deficit, a dual undergraduate and postgraduate Introductory WIL placement unit was created in the Faculty in 2013. These units – STP010 and STP710 (Introduction to Work Placements) – function as a core pre-requisite unit to any WIL placement and industry project unit within the Faculty. As of 2017, all undergraduate students must successfully complete the compulsory zero credit point unit. Deakin University runs on a Trimester system, and at present, these fully online prerequisite units run each trimester, as well as in a new 'start anytime, finish anytime' mode. The unit has approximately 1600 enrolments per year at present (Trimester 2, 2016).

Unit review

As with any good teaching practice, cyclical reviews of unit offerings are necessary for good practice through the process of unit reviews (Deakin University, 2016b). The online units STP010 and STP710 (Introduction to Work Placements) are no exception. Informal student feedback, along with feedback from staff, had indicated that unit reinvigoration was required. To give some background, the pre-existing structure of the twin units will be outlined.

At the time of the review, STP010 and STP710 were static and transmissive in the learning design. When students entered the learning management system (LMS) – Brightspace (Desire2Learn) – they were informed that the purpose of the units was to prepare them for a work placement, and in a broader sense, improve their employability. The unit content was structured around four key modules plus both an introduction and revision module. The existing four modules were: Work Placement Opportunities; Career Planning; Professionalism; and Searching for a Placement.

Material in each module was delivered as text-based webpages with supporting information such as videos and PDF text-based documents for students to read and work their way through. The LMS also had a discussion forum designed for intra-cohort and cohort-to-unit chair communication. Once students completed their reading and viewing of the unit content, they then had to complete and upload to the LMS three pieces of hurdle assessment. The first was a personal résumé. The second was a personal career plan. The third was either a Strengths, Weakness, Opportunity, Threats (SWOT) analysis or, alternatively, a 'Me in a Minute' script ready for the creation of a future video recording. Me in a Minute is an innovative initiative for students at Deakin University (Deakin University, 2016c) wherein they are encouraged to create a one-minute video presentation about themselves for the purposes of prospective employers. This free service results in a video-clip which students can then use to actively promote themselves in the employment market. Thus, the writing of the Me in a Minute script as part of the assessment task was to prepare students for the preparation of this personal marketing tool.

These assessment items were intended to encapsulate their capabilities for potential employability. Finally, students were required to undertake a short automated quiz with a required pass rate of 70% or above to verify that they had successfully met the unit learning outcome requirements (see Figure 1).

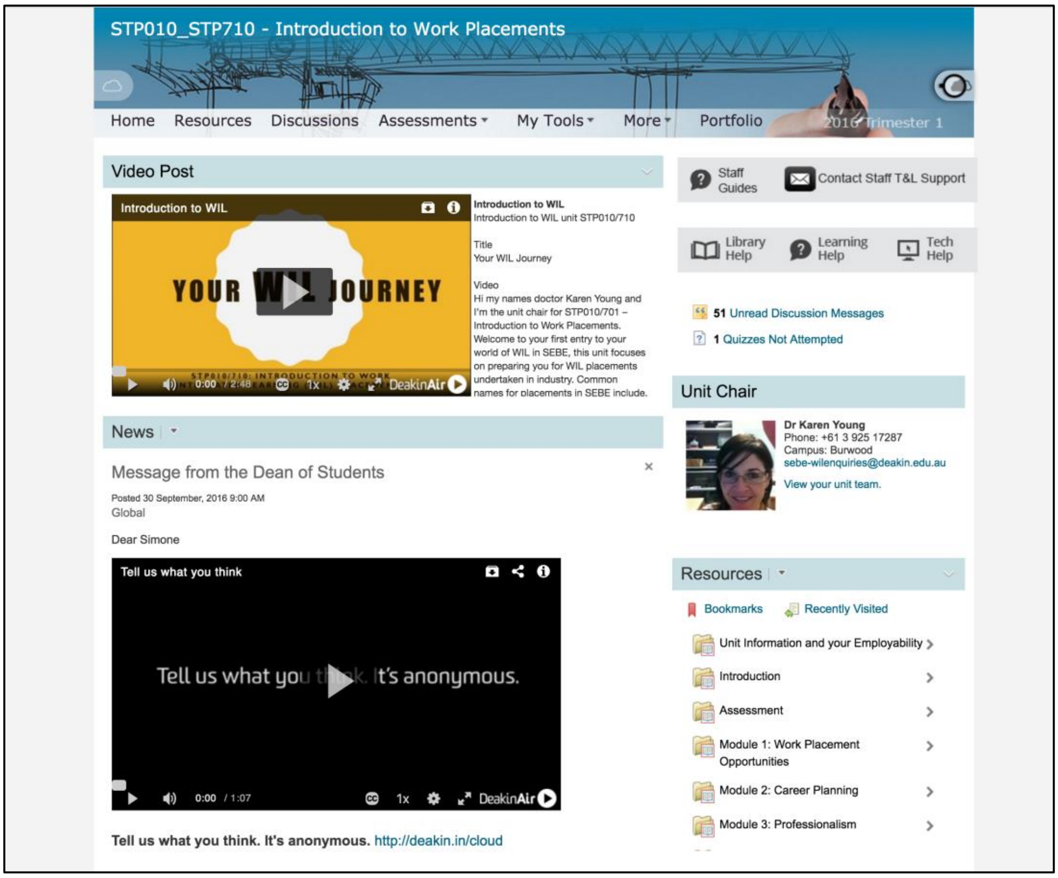

Figure 1: Screenshot of existing unit site Trimester 1 2016 before unit reinvigoration

During a recent formal internal curriculum review of the twin units, six major concerns and accompanying strategies for overcoming the shortfalls emerged. These are as follows.

First, and as noted, the unit was instructivist in its pedagogy. The passive nature of the learning environment has led to the perceived need to make way for active learning approaches in the online learning environment (Figure 2). Passive learning, "where students passively receive instruction from the instructor", is often considered the antithesis of active learning which encourages "are student activity and engagement in the learning process" (Prince, 2004, p.223). As active learning, both in located and Cloud-based learning environment, is a priority for Deakin University, the unit team raised concerns that the unit was under-delivering in the Deakin promise to provide engagement for deep learning.

Second, and leading on from this, strategies for optimal ways for delivering the fully online units were required. These needed the creation of learning environments which were active, connected and social. This is a challenge for any online unit, let alone one that has a zero credit point outcome.

Third, the discussion forum was typically being used by students as a means for communicating directly with the unit chair, rather than as a means for collaboration or communication online with peers. Strategies for increasing purposeful traffic for peer-based communication were needed to alleviate perceptions of isolation for the online student cohort.

Fourth, content in the modules was not directly and logically linked to the assessment, but instead loosely to the concepts and ideas around preparing students for a work placement through the development of career transition tools. Rigorous curriculum alignment was needed in order to improve clear satisfaction of the unit learning outcome.

Fifth, the allocated workload model for the zero credit point unit inhibited robust academic feedback on the 4000+ assessment submissions. Technologically driven initiatives for meeting the high assessment demand of the unit was needed in order to meet Deakin assessment guidelines.

Sixth, the online unit was required to remain fully automated due to increasing scalability concerns and workload pressures, impacted by the directive that there was to be a minimal physical staff time allocation to the 'teach' the unit. Countering this thought was necessary to consider how one might still reflect an active teacher presence within the unit.

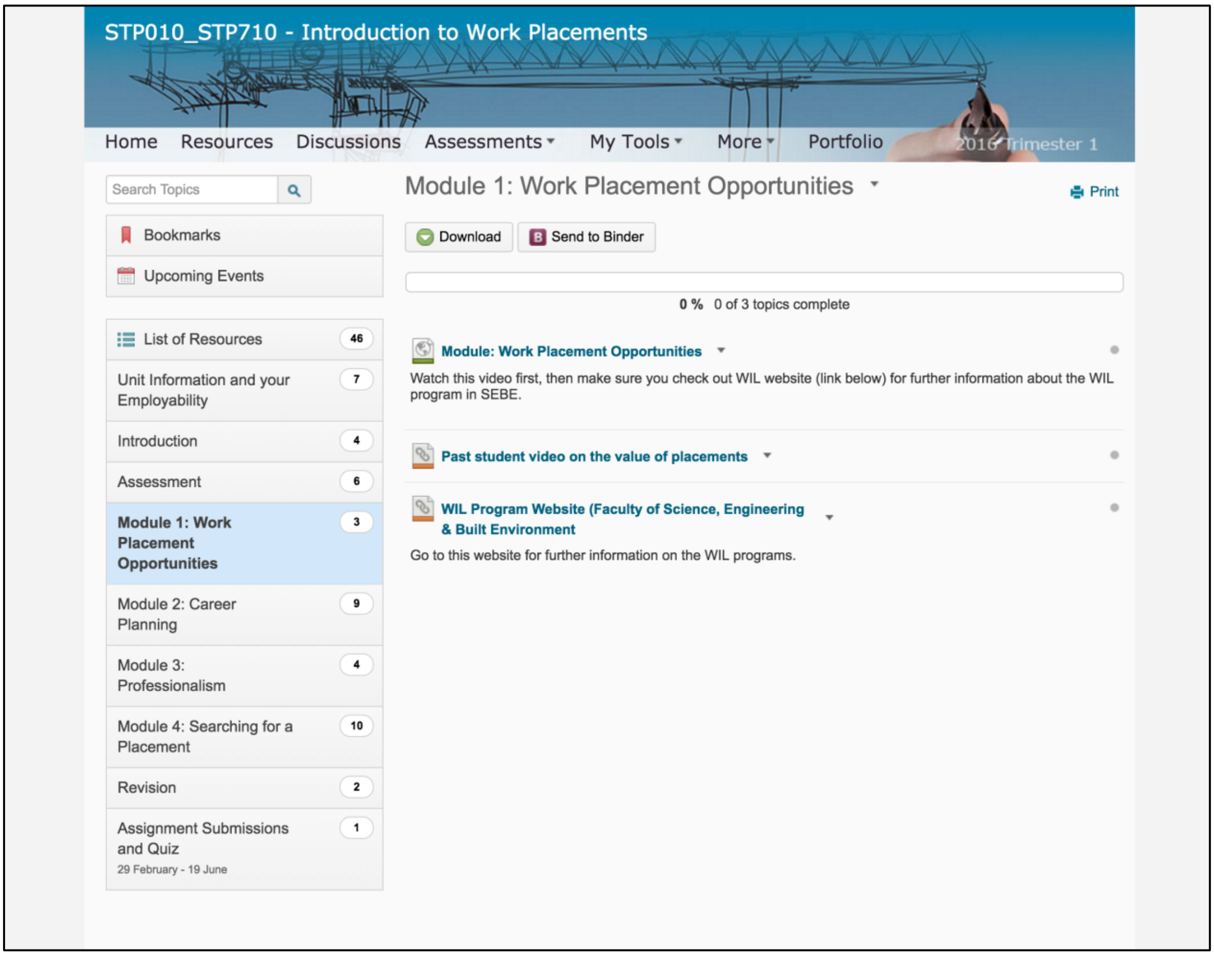

Figure 2. Transmissive nature of the modules (Trimester 1 2016)

Added to these was the need of these units, following their reinvigoration, to become a showcase for fully online learning to the rest of the Faculty, supporting the broader call for innovation in STEM education (Office of Chief Scientist, 2013). A critical factor for consideration during the review process was whether the unit adhered to the mandated policy at Deakin University that premium cloud-based (online) learning needs to be accessible, media-rich, interactive and relevant educational experiences designed for excellent learning outcomes and optimum employability (Deakin University, 2015, p.7). This is important as 25% of Deakin University's students are fully online students, and the remainder will have some component of blended learning. As Atkinson, Rizzetti and Smith (2005, p. 44) note, "The analysis that precedes any design of online resources examines student and curricular needs, but it also must consider the teaching context in which the resources are to be used".

Subsequently, the aims of unit renewal project were to address the six concerns noted in the existing offerings through an exploration of possible strategies and the implementation of novel approaches to improve the online unit. STP010 and STP710. The way that we approached the redesign of the units, factoring in each of the identified six concerns will be discussed in the following section.

Unit reinvigoration – WIL-fully flipping online

We adopted a fully online flip to reinvigorate the twin Introductory to WIL units STP010 and STP710. In this environment, while all content and practical application was completed online, the focus was not on transmission and dissemination of information, or the mode of delivery, rather the pedagogical underpinning and scaffolding. We achieved this on a two-dimensional tripartite grid structure with a vertical plane and a horizontal plane. Three figures have been added to the following section as exemplars of the changes to the learning design in the unit that were made, should colleagues be interested in exploring how to consider adopting the flipped learning approach in general, and in the online context in particular.

On the horizontal plane, as students moved through the unit, they progressed through three modules, aimed to also deepen student awareness of the role of WIL during their studies. Module One was a 'retrospective of self', looking back at what they had already achieved in their past. Module Two examined the student's current self – what they were currently doing to prepare themselves for future work opportunities. Finally, Module Three was a future-focussed, professional-self module.

In these modules, students were encouraged to reflect on their past, current (present) and future employment opportunities, as well as their transferable skill acquisition experiences. On a practical level, this structure also assisted students in understanding how and why to create three professional career transition tools that were to become the new hurdle assessment pieces: a résumé ('Past'), a 'Me in a Minute' script for the creation of a future short video recording ('Present'), and a Capacity Building Plan ('Future'). A Capacity Building Plan (CBP) is a career development tool, rather like a Career Plan, but instead shifts the focus to capacities for multiple careers and connects the student's current identifiable capabilities (skills, knowledge and values) with their short- and long-term career goals, and in relation to self-awareness and opportunity awareness. The CBP utilises Specific, Measurable, Assignable, Realistic and Time-related (SMART) goals to enhance student employability and enable a successful transition to a fulfilling working life.

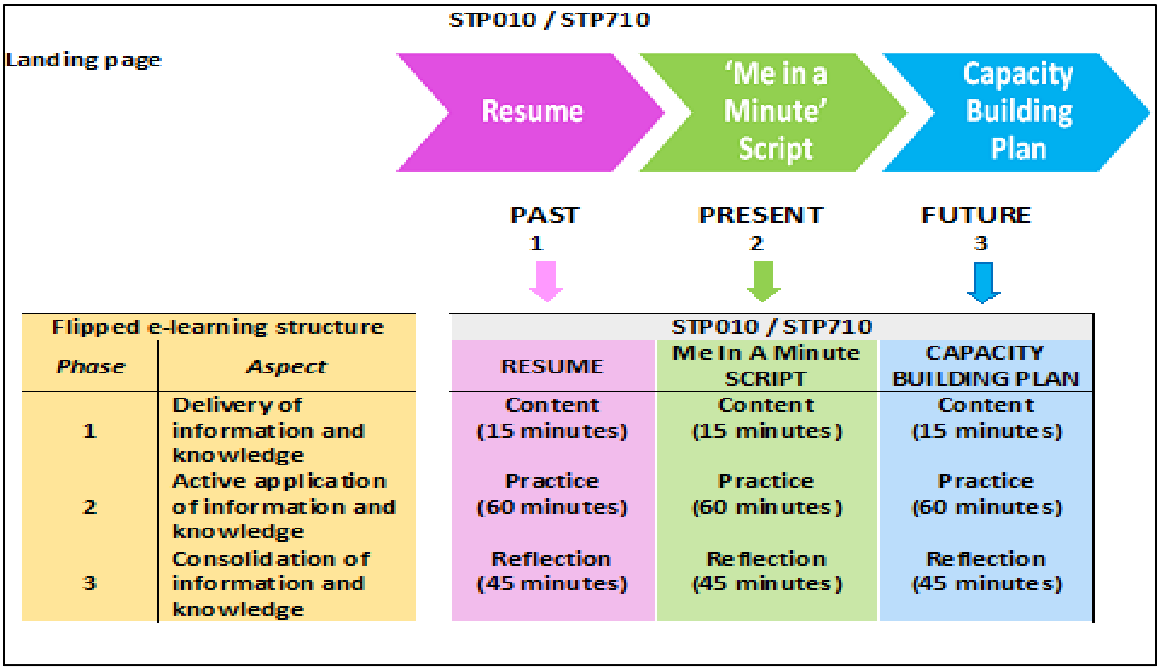

Figure 3. Storyboard for the flipped learning pedagogy showing horizontal and vertical structure

On the vertical plane the three modules adopted an identical tripartite structure as an alternative to the usual 'pre-class', 'in-class' and 'post-class' structure of flipped learning. It was initially decided for this redesign project that we would use the terms 'pre-practicum', 'practicum', and 'post-practicum' to delineate the new structure. Subsequently, we have since relabelled these as 'Content', 'Practice' and 'Reflection' (CPR) to better reflect to the student the alternate pedagogy in their online journey through each of the three modules. Phase One was labelled Content as it was the section for the delivery of information and knowledge in each module. Phase Two was labelled Practice as this was the phase for the active application of information and knowledge. Phase Three was labelled Reflection, and in this section, activities were designed for the consolidation of information and knowledge. In this redesign, there was also an intended play on words: the new structure for learning was intended to signal to the student that they were about to breathe new life into their learning through the inclusion of CPR. Figure 3 (above) is the storyboard for the rebuild of the unit site in the learning management system, breaking down the CPR activities showing both the horizontal and vertical structure. Figure 4 (below) is the landing page of the reinvigorated unit in the LMS. Figure 5 is part of the new Trimester 2 2016 unit rollout, showcasing part of both the flipped online learning structure with its associated CPR structure in Module 1 (Past).

A combination of video and written instructions ('Content') for each of the three modules and for the unit introduction and conclusion were created to clearly articulate the process which students need to follow in order to do the Practice and complete the unit. Before submitting the work that was undertaken during the Practice stage of each module, students were directed to Reflect on the content and their interactive activities in the practice section to actively reinforce key learnings. In addition, a suggested timeline to complete the unit was also added. Figure 4 is part of the new Trimester 2 2016 unit rollout, showcasing the CPR process.

Another innovation used in the reinvigoration includes the implementation of personalised feedback mechanisms in the dual units. This was necessitated as they have zero hours of instructor time allocated to the provision of feedback. A work around was though the implementation of intelligent agents. Intelligent agents (IA) are defined by Tran and Tran (n.d., n.p.) as "software that assists people and act on their behalf. Intelligent agents work by allowing people to delegate work that they could have done, to the agent software". Intelligent agents were integrated into the units via the functionality of Brightspace (Desire2Learn). Brightspace (2016, n.p.) states that IA can assist those involved in the LMS by "providing an automated notification when defined activity occurs in a course or when there is a lack of login or course entry." This enables opportunities to engage, motivate and retain students through the release of a timed personalised email when a student does, or does not do, a certain action. For example, an email can be set to send if a student has not logged into a site for a number of days. Intelligent agents and interactive automated feedback innovations were adopted in the gamification of the new structure.

Figure 4: Reinvigorated unit site reflecting the flipped learning approach (launched Trimester 2 2016)

For feedback on the résumé assessment, the co-opting of a pre-existing but separate university service was used. As part of 'Preparing students for jobs and careers of the future', Deakin University's Graduate Employment Division offers the guidance of job application essentials to all students. This unit was co-opted to provide their expert feedback to students on their submitted résumés, doing so directly through the unit's LMS. Figure 5 (below) captures part of this student WIL learning journey.

Guided peer assessment was also employed for the ‘Me in a Minute’ script, providing an alternate form of feedback to students. Students were required to post their script to the LMS's inbuilt discussion forum to receive peer feedback and to provide feedback on at least one of their peers scripts. A rubric was provided to students to help them determine whether the different components of the script deserved a 'Fail', 'Weak', 'Satisfactory' and 'Excellent' mark. They were also encouraged to leave direct text based feedback explaining what could be improved about the script. Students had to both submit their script and provide feedback for one other script before they were given access to the next component of the course. This was only possible because the peer feedback system was implemented through the LMS's inbuilt discussion forum which provided the option of requiring students to participate in this activity before continuing.

Figure 5. Part of the Content, Practice, Reflection (CPR) structure in the revised unit rollout, Trimester 2 2016 (Module One – Past)

The CBP also included advanced coding to give each student tailored but still automated feedback. The CBP diagnostic interactive tool invites students to judge and rank three different quality plans using specified criteria and then provides video tips and feedback on how to create a high quality plan. Firstly, students rank each plan section by selecting a drop down menu choice of 'good, better or best' and then submit their answers for feedback. Each CBP section has a predetermined ranking in the advanced code of 'good, better or best' and students must match all three correctly before preceding to the next section. The feedback students receive is either 'Great! You correctly ranked this plan as [GOOD]' if they have correctly ranked the selection, or 'Hrm, not quite. You ranked this plan [BETTER]- why not try again?', if they got the order incorrect on their first selection. If students receive the second type of feedback, they are then asked to have a second go at ranking the sections. Regardless of students getting either all the choices correct or incorrect the second time, the tool forces students to a feedback screen where each of the CBP sections are then teased apart and each of the important CBP elements that students need to have are colour coded to demonstrate why each of the CBP sections are ranked in the order that they are. Once students have finished with the initial feedback screen, they proceed to a video reiterating the feedback in the previous screen. This sequence of events happens two more times until all of the sections of the CBP are successfully completed.

Future Research Directions

There were a number of deliverables to this project. In addition to the revitalisation of the units themselves, the evaluation and reporting on the success of these changes was also a high priority for the team. Love et al. (2014, p. 317) note that in researching the integration of flipped learning in STEM in higher education, that to date the evidence of success tends to be anecdotal rather than data driven, stating that "very little research has been undertaken to rigorously assess the potential effects on student learning that can result from the flipped…environment". By placing research in and around the reinvigoration process, we hope to assess the impact of the structure of the unit on the students.

As a consequence, ethics has been gained to further explore the impact of the changes in the redesign of this unit on student learning. Our purpose is to collect both quantitative and qualitative data from a verity of means to ascertain the success of the changes from the students' perspective. Several research avenues have been put in place behind the new learning design. These include the collection of unit analytics, formal student responses, and student focus groups, all backed by ethics permissions. In this way, our research will add to the scholarship of the field.

The units have also attracted funding to ensure the meeting of their inclusion requirements for students, so this aspect too will need careful monitoring. In addition, while the units remain fully online, they will become increasingly automated and self-sustaining. Whereas the twin online units are currently being run every Trimester, an adaptation to 'start anytime; end anytime' units is to be trialled. This too will have further implications for research and development.

Conclusion

The literature suggests that the pedagogical model of the flipped learning is promising for improving STEM learning and increasing student interest in STEM fields (Love et al., 2014). However, as noted previously, the usual flipped learning model involves a blended learning approach. Little, if any, material exists on adopting this process in a fully online environment. Brought about by a process of review, this paper has explored the novel approach in delivering introductory WIL units in STEM through a flipped learning pedagogy to actively engage students. Our adaptation of the pedagogical approach of the flipped learning model to the online environment is through our structure of 'Content', 'Practice' and "Reflection'.

With the first round of reinvigoration of the compulsory fully online units STP010 and STP7010 launched, the research is underway, through collection a variety of quantitative and qualitative indicators. The results of the data will inform the refinements of the ensuing version of the units. The research continues.

References

Abeysekera & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research, *Higher Education Research and Development, 34*(1), 1-14.

Atkinson, L., Rizzetti, J., & Smith, S. (2005). Online resources for Work Integrated Learning: A case study in re-usability and flexibility. In H. Goss (Ed.) *Proceedings of ascilite 2005: Balance, fidelity, mobility: Maintaining the momentum?* (pp. 37.45). Brisbane: QUT.

Bhatia, R. (2014). Intelligent Agents: A Deep Insight. *International Journal of Computer Applications and Information Technology, 4*(2), 11-13.

Brightspace (2016). Intelligent uses of Intelligent Agents. https://community.brightspace.com/tlc/wiki/intelligent_uses_of_intelligent_agents

Deakin University (2015). *Live the Future Agenda 2020: 2015-2017 Triennium.* Deakin University. http://www.deakin.edu.au/about-deakin/strategic-direction

Deakin University (2016a). Work Integrated Learning. http://www.deakin.edu.au/sebe/enhance-study/work-integrated-learning

Deakin University (2016b). Higher Education Courses Approval and Review Procedure. https://policy.deakin.edu.au/view.current.php?id=00130#maj2

Deakin University (2016c). Me in a Minute. https://blogs.deakin.edu.au/meinaminute/

Flipped Learning Network (FLN). (2014). The Four Pillars of F-L-I-P. http://flippedlearning.org/cms/lib07/va01923112/centricity/domain/46/flip_handout_fnl_web.pdf

Hassall, C. (2014). Flipping the classroom – how to make lectures engaging and interactive. *Katatrepsis Blog.* https://katatrepsis.files.wordpress.com/2014/01/flipped-vs-trad1.png

Honeycutt, B., & Glover, S. (2014). Can you flip an Online Class? *Faculty Focus.* http://www.facultyfocus.com/articles/blended-flipped-learning/can-flip-online-class/

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Hall, C. (2016). *NMC Horizon Report: 2016. Higher Education Edition*. Austin, Texas: The New Media Consortium.

Love, B, Hodge, A., Grandgenett, N., & Swift, A.W. (2014). Student learning and perceptions in a flipped linear algebra course. *International Journal of Mathematical Education in Science and Technology*, *45*(3), 317-324.

Office of the Chief Scientist (2013). *Science, Technology, Engineering and Mathematics in the National Interest: A Strategic Approach*, Australian Government, Canberra.

Oliver, B. (2015). Redefining graduate employability and work-integrated learning: Proposals for effective higher education in disrupted economies. *Journal of Teaching and Learning for Graduate Employability*, 6(1), 56-65.

Patrick, C.-J., Fallon, W., Kay, J., Campbell, M., Cretchley, P., Devenish, I., Lawson, J., Russell, L., Tayebjee, F., (2014). Developing WIL leadership capacities and competencies: A distributed approach. In Moore, K (Ed). *Work Integrated Learning: Building Capacity – Proceedings of the 2014 ACEN National Conference*, (pp. 232-237). Tweed Heads, 1st- 3rd October, 2014.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*(3), 223–231.

Strayer, J.F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environment Research, 15*, 171-193.

The Australian Industry Group. (2015). *Progressing STEM skills in Australia*, Workforce Development, Victoria, Australia.

Toivola, M., & Silfverberg, H. (2014). Flipped learning-approach in mathematics teaching: A theoretical point of view. In P. Hästö & H. Silfverberg (Eds.) *Proceedings of Annual Symposium Of The Finnish Mathematics And Science Education Research Association 2014* (pp.93-102). http://www.protsv.fi/mlseura/julkaisut/malu_2014FINAL.pdf

Tran, H., & Tran, T. (n.d.). Intelligent Agent. http://groups.engin.umd.umich.edu/CIS/course.des/cis479/projects/agent/Intelligent_agent.html

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Models for understanding student engagement in digital learning environments

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Digital learning environments are increasingly prevalent in higher education. The flexible and less constrained nature of these environments, means students often need to be more autonomous in managing their own learning. This implies that students are sufficiently self-motivated to successfully engage in autonomous learning. The concept of "student engagement" has shown promise in assisting researchers' and educators' understanding of how students' general involvement in study, and their more specific completion of learning tasks, can lead to beneficial outcomes in digital learning environments. However, student engagement has taken on multiple, diffuse definitions in higher education creating confusion about what engagement is and how best to promote it. In this paper we build on a model of engagement from organisational psychology that offers insight into task-level engagement. Established models in the area of student motivation are integrated to bring clarity to the construct at task-level in digital learning environments.

Keywords: Student engagement, flow, learning technology, digital learning environments.

Introduction

Autonomous learning is increasingly important in digital learning environments in higher education, as these environments often have reduced academic support either in person or via digital presence (Rai & Chunrao, 2016).
One implication of this trend is that students' self-motivation and independence in learning may need to be greater than in traditional learning contexts due to a reduction in contact time with teaching staff and peers. Research in areas such as achievement motivation, while traditionally applied to more conventional face-to-face learning environments, has more recently been applied in digital environments (e.g. de Barba, Kennedy, & Ainley, 2016). A core construct in this research deals with "student engagement". This research shows that models of student engagement have demonstrated some utility in understanding student motivation in learning (Shernoff, 2012), but the literature lacks cohesion, particularly in terms of the granularity of the engagement construct and the context in which it is applied (Kahu, 2011).

Conceptions of student engagement

The concept of student engagement has had a long history in higher education (Shernoff, 2012). In part, this is because student engagement in learning has been shown to lead to broad outcomes such as psychological wellbeing and physiological health (Steele & Fullagar, 2009), as well as to improved concentration and perceived control (Guo & Ro, 2008), cognitive performance (Steele & Fullagar, 2009), and creativity (Ghani, 1995). The term "engagement" is used in a variety of ways in educational contexts but in lay terms refers to students' active involvement or deliberate investment of effort in their educational activities.

From an academic perspective, engagement has been conceptualised as having three dimensions, cognition, behaviour, and affect (Fredricks, Blumenfeld, & Paris, 2004). When a student is cognitively, behaviourally, and emotionally involved in an activity, they may be said to be 'engaged' in that activity. The term “meta-construct” is sometimes applied to engagement, which seeks to describe it as a distinct construct, but comprised of these three key dimensions (Fredricks et al., 2004). The absence of any one of the dimensions limits the degree to which a student is involved in the activity, such as a student who is behaviourally going through the motions of participating in class, but is not cognitively or emotionally invested in that activity. When a person is engaged, they are behaviourally involved, show high levels of cognitive awareness, and are emotionally invested in the activity and relational connections centered around that activity (Kahn, 1990).

A degree of confusion exists in the academic literature when education researchers discuss *levels of engagement*. Consistency is lacking in the use of terms such as *deeper-shallower* and *higher-lower* across multiple contexts. At a macro level student engagement may relate to students' behaviour and attitudes towards an institution or course (Kuh, 2009). A 'deeper' (meso) level may examine students' attitudes and behaviours toward study patterns, persistence, and effort within a course or a subject (Biggs, 2012). At a task (micro) level, students' engagement behaviours might be observed within a particular learning activity. This scale or 'granularity' of the learning environment (macro-meso-micro) is often then overlapped with the intensity of the engaged experience itself, which is also defined in terms such as *higher* and *deeper*. For example, the psychological state of "flow" is considered to be one of the 'deeper' levels of engagement (Csikszentmihalyi, 1990).

A considerable body of research on engagement has been produced in organisational psychology, which also reveals similar confusion between levels of engagement situated in varying contexts (Shuck, 2011). Kahn (1990) attempted to clarify the construct by differentiating between employees' temporally enduring stances (e.g. job involvement, organisational commitment), and those 'moments' when people are physically, cognitively, and emotionally *present* during a particular task. These moments or *episodes* of 'deep' engagement are thought to foster positive psychological states (Csikszentmihalyi, 1990), and enhanced performance outcomes (Rich, LePine, & Crawford, 2010). Understanding these episodes of deep task-based involvement, absorption and engagement is highly relevant to educators and educational designers whose goal is to build digital learning tasks that not only capture students' attention, but also elicit from them the fullest investment of their cognitive, behavioural, and emotional resources – that is, to deeply engage them in a digital learning task.

The importance of engagement in digital learning environments

A longstanding area of interest in engagement research has been *within-person engagement* at a *task-level* within digital learning environments. Concepts that are regularly referred to in this literature include flow, interactivity, involvement, and intrinsic motivation. As one facet of motivation, engagement is particularly important to educational technology researchers, practitioners, designers and developers, as it is fundamental to individual students’ relationship with the learning design of learning tasks within digital learning environments. As Rebolledo-Mendez et al. (2011, p.155) noted, "...matching the delivery of learning material to students' motivation (or de-motivation) should improve their experience and, arguably, also their learning."

Within-person engagement is an essential construct for educational technology researchers to understand, as it captures those moments of a student's absorption and concentration with a digital learning task. Moreover, if we are able to better understand within-person engagement, and the conditions under which it occurs, we can potentially design digital learning tasks, and support mechanisms around these tasks, to foster engagement.

A number of educational technology researchers have considered how different types of engagement impact on students' learning processes and outcomes (Kennedy, 2004; Chan & Ahern, 1999; Lepper & Cordova, 1992; Schwier & Misanchuk, 1993; Sims, 2000). These researchers have used a range of terms to refer to 'engagement' in digital learning environments (e.g. flow, interactivity, intrinsic motivation) and there has been little integration between these various models. Moreover, there is surprisingly little empirical research establishing the links between within-person engagement and tangible learning outcomes in digital learning environments (see Shernoff, 2012). In this paper we discuss how various models of *within-person engagement* can be meaningfully and usefully integrated. Drawing on work from organisational psychology, we introduce the term “episodic engagement”, to refer to the deep levels of absorption and involvement that can be exhibited when students interact effectively with digital learning tasks.

Models of within-person engagement

As indicated above, a number or research areas have contributed to our understanding of engagement generally, and students' engagement with digital learning tasks. These include research on episodic engagement, flow, intrinsic motivation and situational interest.

Based in ethnographic studies of employee motivation, Kahn (1990) labelled within-person states of engagement *episodic engagement* due to its transient and discontinuous temporal nature, as individuals moved into and out of *episodes* of engagement on a moment-to-moment basis. Episodic engagement is described as a brief period of time when an individual becomes energised or enlivened, simultaneously employing their cognitive, physical (behavioural), and affective resources to fully inhabit a role in which they perform their part in an authentic expression of their values, beliefs, thoughts, and feelings (Kahn, 1990). These brief periods are often highly productive and intrinsically motivating for the individual (Kahn, 1990).

Flow theory (Csikszentmihalyi, 1990) describes a psychological state of optimal human experience. This theory is closely aligned with the positive psychology movement and has a strong emphasis on promoting psychological health and wellbeing (Seligman & Csikszentmihalyi, 2000). Flow experiences are found to be deeply rewarding, with individuals describing increased intrinsic motivation to engage in an activity (Nakamura & Csikszentmihalyi, 2002), heightened awareness, focus, happiness, productivity, and creativity (Csikszentmihalyi & LeFevre, 1989). Altered perception of time passing is often reported, with people describing several hours going by as if just minutes had passed (Steele & Fullagar, 2009). Educational researchers (Bakker, 2005; Shernoff et al., 2003) have demonstrated the need for a significant task-based *challenge* to be balanced with an individual's requisite *skills*, in order for the flow state to occur in learning activities.

Intrinsic motivation describes the doing of an activity or behaviour for its own sake because it is inherently enjoyable, interesting, or rewarding (Gottfried, Fleming, & Gottfried, 1994). The doing of such an activity fulfils psychological needs of competence, relatedness, and autonomy (Ryan, 2012), and results in feelings of satisfaction, efficacy, and autonomy (Blumenfeld, Kempler, & Krajcik, 2006). Learning environments that promote competence, relatedness, and autonomy are more likely to support intrinsic motivation in learning. Intrinsic motivation represents the processes that drives student behaviours (Yazzie-Mintz & McCormick, 2012) and explains *why* a student behaves in a particular way in learning.

Situational interest has been shown to improve attention, foster persistence, improve learning, and lead to enjoyment in learning tasks (Ainley, Hidi, & Berndorff, 2002). Comprised of affective and cognitive components (Hidi & Harackiewicz, 2000) situational interest promotes positive emotions that are associated with doing an activity (Hidi & Renninger, 2006), and cognition through enhanced perceptions of value and meaning in the content (Hidi & Harackiewicz, 2000). The process through which situational interest develops is important to consider as it plays a significant role in the motivational processes that drive a student toward action in their learning. Like intrinsic motivation, situational interest may play a crucial role in the initiation of engagement in a learning task (de Barba, Ainley, & Kennedy, 2015).

Integrating 'engagement' models

These four approaches to student engagement (episodic engagement, flow, intrinsic motivation, and situational interest) share much in common in terms of understanding students' motivation in learning yet, as can be seen from the descriptions above, they are not synonymous (Yazzie-Mintz & McCormick, 2012). All have shown engagement to be an inherently rewarding connection between a student and learning activity, that promotes attentiveness and involvement in learning activities, and results in beneficial outcomes for the learner. They differ in that intrinsic motivation and situational interest seem to explain *why* students engage in a task, while engagement and flow are more concerned with *what* is happening for the individual during the engaged state, and the nature of the interaction between the student and the task.

Cleary and Zimmerman (2001) differentiated motivation and engagement as intention and action. Engagement implies that the *motivation to act* has been realised and transformed into tangible action. Situational interest describes how interest develops in an individual and also appears to be a factor that necessarily precedes engagement. Engagement is the *what* or *how*, more so than the *why*. It is the active outworking of intrinsic motivation and situational interest, the shifting of the motivated individual *into an active state* (Russel, Ainley, & Frydenberg, 2005).

Flow and episodic engagement describe a similar phenomenon: a psychological state that involves cognitive, behavioural, and affective dimensions. This state is described as a positive experience of absorption, dedication, and vigour in an intrinsically rewarding and energising task; when a person loses track of time, has lowered selfconsciousness and self-awareness, and shows enhanced task performance. Flow and episodic engagement may very well describe the same phenomena, but the underpinning rationale of the two constructs is distinct, as are the outcomes upon which they focus. Flow theory describes moments of peak performance in a task or activity, and looks toward holistic psychological and physiological outcomes for individuals. The broader holistic outcomes (student wellbeing) promoted by a positive psychology approach to flow are important for students in higher education (Steel & Fullagar, 2009), but there may also be utility in a stronger focus on specific performance related outcomes that are a feature of work engagement studies. Episodic engagement highlights the process through which individuals actively engage, but unlike flow, emphasises performance related outcomes. The underlying assumptions of these two perspectives differ in that the point of flow theory is to foster the flow state for its own sake in order to live a happy, fulfilling, and holistic life (Csikszentmihalyi, 1990), where episodic engagement is more interested in tangible performance-related outcomes (Kahn, 1990). In the organisational behaviour literature, productivity gains and intrinsic reward for the employee are considered to be worthwhile outcomes as they have direct and indirect benefits for both individuals and organisations.

These four highly inter-related constructs (see Figure 1) all play a significant role in shaping why and how students in higher education engage in digital learning environments where traditional motivational support is reduced or absent.

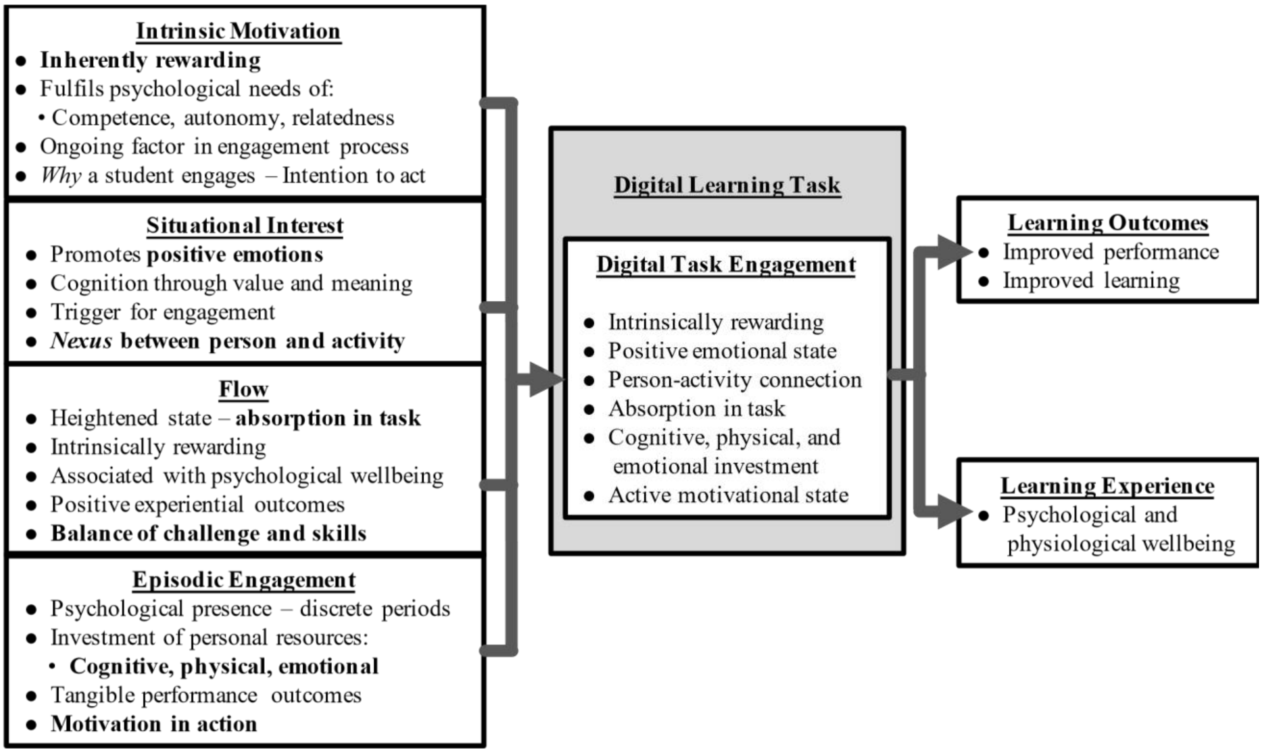

Figure 1: Digital task engagement

The notion of "digital task engagement" may be a unifying construct that is useful in guiding research into, and the design and development of digital learning environments. Digital task engagement refers to a particularly energised or heightened psychological state of engagement while completing a digital learning task. It is the active realisation of the motivating factors that drive a student to be fully present and fully invested – cognitively, behaviourally, and emotionally – in a digital learning task. High levels of digital task engagement may result in both tangible learning outcomes (conceptual change) and improved learning experience (psychological wellbeing). The momentary nature of episodic engagement, as described by Kahn (1990), makes this construct an appropriate tool for investigating the experiences of students as they undertake a digital learning task.

A core challenge for educational technologists is to determine ways to support and facilitate students' ongoing engagement in digital learning tasks. Research of digital task engagement has the potential to improve our understanding of students' learning processes at a task level, and the ways in which students' interact – cognitively, behaviourally, and emotionally – with learning technologies to improve both their learning outcomes and their learning experiences. An improved understanding of factors that promote or inhibit students' engagement in digital learning tasks may not only inform theory, but will also hopefully assist in improving the design and development of digital learning environments, and ultimately teaching and learning practice with digital technologies.

References

Ainley, M. D., Hidi, S., & Berndorff, D. (2002). Interest, learning and the psychological processes that mediate their relationship. *Journal of Educational Psychology, 94,* 1–17.

Bakker, A. B. (2005). Flow among music teachers and their students: The crossover of peak experiences. *Journal of Vocational Behaviour, 66*, 26-44.

Biggs, J. (2012). What the student does: Teaching for enhanced learning. *Higher Education Research &Development*, *31*(1), 39-55

Blumenfeld, P.C., Kempler, T.M., Krajcik, J.S. & Blumenfeld, P. (2006). Motivation and Cognitive Engagement in Learning Environments. In Sawyer, R. K. (Ed.), *The Cambridge handbook of the learning sciences* (pp. 475-488). New York: Cambridge.

Chan, T.S., & Ahern, T.C. (1999). Targeting motivation – Adapting flow theory to instructional design. *Journal of Educational Computing Research, 21*(2), 151-163.

Cleary, T. J., & Zimmerman, B. J. (2001). Self-regulation differences during athletic practice by experts, non experts, and novices. *Journal of Applied Sport Psychology, 13*, 185–206.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper Collins Publishers.

Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal experience in work and leisure. *Journal of Personality and Social Psychology, 56*(5), 815-822.

de Barba P., Ainley, M.D. & Kennedy, G. E. (2015). *The trajectory of situational interest in an online learning session.* Paper presented at the American Educational Research Association Annual Meeting, Chicago, United States of America.

de Barba P., Kennedy, G. E., & Ainley, M.D. (2016). The role of students' motivation and participation in predicting performance in a MOOC. *Journal of Computer Assisted Learning, 32*(3), 218-231.

Fredricks, J. A., Blumenfeld, P., & Paris, A. (2004). School engagement: Potential of the concept, state of theevidence. *Review of Educational Research 74*, 59-109.

Ghani, J. A. (1995). Flow in human-computer interactions: Test of a model. In J. M Carey (Ed.), *Human factorsin information systems: Emerging theoretical bases* (pp. 291-309). Norwood, NJ: Ablex Publishing Corporation.

Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (1994). Role of parental motivational practices in children’s academic intrinsic motivation and achievement. *Journal of Educational Psychology, 86,* 104–113.

Guo, Y. M., & Ro, Y. K. (2008). Capturing flow in the business classroom. *Decision Sciences Journal of Innovative Education, 6*(2), 437-462.

Hidi, S., & Harackiewicz, J. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of Educational Research, 70*, 151–179.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist, 41*(2), 111-127.

Kahn. W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal, 33*(4), 692-724.

Kahu, E. R. (2011). Framing student engagement in higher education. *Studies in Higher Education, 38*(5), 758-773.

Kennedy, G. E. (2004). Promoting cognition in multimedia interactivity research. *Journal of Interactive Learning Research, 15*(1), 43-61.

Kuh, G. D. (2009). The national survey of student engagement: Conceptual and empirical foundations. *NewDirections for Institutional Research 141*, 5–20.

Lepper, M.R., & Cordova, D.I. (1992). A desire to be taught: Instructional consequences of intrinsic motivation. *Motivation and Emotion, 16*, 187-208.

Nakamura, J. & Csikszentmihalyi, M. (2002). The concept of flow. In C.R. Snyder & S. J. Lopez (Eds.). *Handbook of positive psychology* (pp. 89-105). Oxford: Oxford University Press.

Rai, L., & Chunrao, D. (2016). Influencing Factors of Success and Failure in MOOC and General Analysis of Learner Behavior. *International Journal of Information and Education Technology, 6*(4), 262-268.

Rebolledo-Mendez, G., Luckin, R., & du Boulay, B. (2011). Designing adaptive motivational scaffolding for a tutoring system. In R. A. Calvo & S. K. D'Mello (Eds.). New Perspectives on Affect and Learning Technologies (pp. 155-168). New York: Springer.

Rich, B.L., LePine, J A., & Crawford, E. R. (2010). Job engagement: Antecedents and effects on job performance. *Academy of Management Journal, 53*, 617-638.

Russell, V. J., Ainley, M., & Frydenberg, E. (2005). Student motivation and engagement. *Schooling Issue Digest*, 2005/2. Australian Government, Department of Education, Science and Training.
Ryan, R. M. (2012). *The Oxford handbook of human motivation*. Oxford: Oxford University Press.
Schwier, R.A., & Misanchuk, E.R. (1993). *Interactive multimedia instruction.* Englewood Cliffs NJ: Educational Technology Publications.
Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5-14.
Shernoff, D. J. (2012). Engagement and positive youth development: Creating optimal learning environments. In K. Harris, S. Graham, & T. Urdan (Eds.), *APA educational psychology handbook: Vol. 2. Individual differences and cultural and contextual factors* (pp. 195-220). Washington, DC: American Psychological Association.
Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Steele Shernoff, E. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly, 18*(2), 158-176.
Shuck, B. (2011). Four emerging perspectives of employee engagement: An integrative literature review. *Human Resource Development Review*, *10*(3), 304-328.
Sims, R. (2000). An interactive conundrum: Constructs of interactivity and learning theory. *Australian Journal of Educational Technology, 16*(1), 45-57.
Steele, J. P., & Fullagar, C. J. (2009). Facilitators and outcomes of student engagement in a college setting. *The Journal of Psychology*, *143*(1), 5-27.
Yazzie-Mintz, E. & McCormick, K. (2012). Finding the Humanity in the Data: Understanding, Measuring, and Strengthening Student Engagement. In S. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 743-761). New York, NY: Springer.

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Open Education Licensing: A toolkit for achieving openness in the global education market

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The adoption of open education resources (OER) by Australian higher education can enhance innovation, as well as increase access to teaching and learning in the digital environment. But without a clear understanding of the copyright and licensing challenges inherent in adoption of OER, Australian educators will not be able to create education resources, or disseminate them globally. This panel session will explore the potential impact of copyright and licensing decisions on Australia's creation and use of OER and their global reach. It will provide a forum to introduce the audience to a new Open Education Licensing toolkit, developed by the Open Education Licensing project; the project has been funded by the Australian Office for Learning and Teaching. Panel members will deal with four main topics: copyright licensing in Australia, how open licensing can transform education in Australia, the different ways copyright material can be used, and the toolkit developed by the OEL project. Panel members will discuss the research and development process underpinning the OEL toolkit and ask audience members to see the toolkit interface and explore the benefits it can provide for their own activities.

Keywords: Copyright, Open Educational Resources, OER in Australia, Open Education Licensing project, OEL, open licensing

The OEL Project

The Open Education Licensing project is nationally significant because it addresses a critical challenge for the higher education sector – the use of open content. It does this by surveying practitioners around Australia, and building on this work to create a practical, usable toolkit. The toolkit will enable Australian higher education teachers, policy makers and other staff to create a body of open content which will enhance Australian higher education and have a global impact.

There is a rapidly-developing global online education market. Despite our experience in international education, Australia is not well positioned to participate in this market, because we have not addressed unresolved issues of copyright. The move to open practices in higher education is a key strategic change in enhancing learning and teaching. Institutions and individuals implementing OEP in Australia need clear information and practical tools to ensure that best practice open licensing solutions are adopted.

Australian copyright law is not as flexible as that of the United States and other competitor countries (Harris, 2013), and the impact of this on OEP has not been widely analysed. Unlike the US, Australian copyright law does not contain exceptions which would permit even limited open publication of copyright material for educational purposes (Wyburn, 2006). Therefore to include copyright material, such as text, images and audiovisual content, in open course offerings, Australian universities must understand the limitations of existing copyright exceptions. Not only must they be able to source content which meets their needs, but they must make important decisions about how to license their own open courseware for student users and further re-use by other teachers (Butler, 2012). Australia will benefit by maximizing access to open content.

The OEL project aimed to empower Australian universities to understand and implement effective licensing practices for opening accessible educational content. The OEL toolkit provides a practical mechanism for Australian universities on how to deal with copyright within their own OEP initiatives and make business and licensing decisions around the deployment of open course material.

About this panel

This panel will explore key elements of the OEL project, funded by the Australian Government Office of Learning and Teaching. In particular, this panel will present and discuss its main deliverable; the Open Education Licensing toolkit, which is a web based online tool that will enable Australian higher education teachers, instructional designers, educational developers, policy makers and other university staff to create a body of open content which will assist to enhance learning and teaching within higher education in Australia and globally. Importantly, this panel session will be used as a channel to disseminate and formally launch the OEL toolkit.

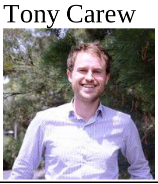
Format of the Session

The panel session will be chaired by Dr Carina Bossu (University of Tasmania) and will include these components:

- A brief introduction to copyright licensing in Australia in the context of higher education (Derek Whitehead).
- The transformational impact of a move to open licensed education resources and policy issues for universities and the way they have underpinned the OEL project (Carina Bossu)
- Using copyright material in education: provisions within the Copyright Act (Robin Wright)
- Demonstration of the OEL toolkit, which provides a straightforward approach to creating and using open resources in education. The toolkit will be in final form by this time. (Tony and Beale)

The audience will be engaged in discussion and activities at different stages of the panel presentation. These discussions will invite participants to critically reflect on their current learning and teaching practices and how the toolkit can be useful to them and their institutions. The panel would like to ask participants to bring their own device to this session.

Biographies of Panel Members

Robin Wright 	Robin Wright is a copyright lawyer with an interest in the intersection of copyright and digital technologies within the education and cultural sectors. She is currently Copyright Manager at Swinburne University of Technology and project Leader of the research project, *Effective open licensing policy and practice for Australian universities: making online education really work.*
Carina Bossu 	Carina is a Lecturer (Learning and Teaching) with the Tasmanian Institute of Learning and Teaching at the University of Tasmania. Dr Bossu current work and research are primarily focused on Open Educational Resources (OER) and Open Educational Practices (OEP) in higher education, more specifically issues related to learning, teaching and professional development
Derek Whitehead 	Derek Whitehead is an Adjunct Professor in the Swinburne Institute for Social Research, at Swinburne University of Technology. His interest in copyright is long standing, and he is currently the chair of the Australian Digital Alliance, a copyright organisation. Derek was previously Director of Information Resources at Swinburne, and Chief Information Officer and Director, IT.
Tony Carew 	Tony Carew designs and develops innovative online teaching and learning offerings. He led the technical development of the University's first Massive Open Online Course (MOOC), Understanding Dementia, from inception to delivery in its first two offerings. Tony is currently developing new ways to deliver online education, building on the knowledge gained from the MOOC experiment.
Beale van der Veer 	Beale van der Veer has spent most of her career working concurrently in visual instructional design roles within creative industries, and as a teacher within educational institutions. She now works as an Educational Designer at TILT, in which she utilises both her unique creative and technical skillset. She has a particular interest in the intersection of accessibility and usability, and designing learning materials which engage visual learners, while adhering to accessibility guidelines.

References

Butler, B. (2012). Massive Open Online Courses: legal and policy issues for research libraries. Retrieved on 1 November, 2012 from http://www.arl.org/bm-doc/issuebrief-mooc-22oct12.pdf

Harris, R. (2013). *Universities Australia Member Update*. (33). Canberra, Universities Australia.

Trounson, A. (2012, 7 November). Copyright fears for online offerings, The Australian. Retrieved from http://www.theaustralian.com.au/higher-education/copyright-fears-for-online-offerings/story-e6frgcjx-1226511715912

Wyburn, M. (2006). Higher education and fair use: a wider copyright defence in the face of the Australia-United States Free Trade Agreement changes. *AIPJ*, 17(3), 181-209.

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Show Me The Learning
Adelaide, Nov 27-30, 2016

Open Education Licensing – making online education really work

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Open education will play an important role in digitally enabled learning for a global society. Resources that are openly available for re-use and re-mix are an important part of digital literacy and will be a key component in the online offerings of Australian higher education institutions in the future. However, one of the most significant issues for educators moving into the open environment is the need to understand those copyright and licensing decisions which must be made in order to make resources open. The Open Education Licensing (OEL) project aims to ensure that online material is available for re-use. It also aims to place open content into an evolving knowledge ecosystem in Australian education. The OEL Toolkit will help Australian educational developers make informed licensing decisions for use of their resources in the open environment.

Keywords: Copyright, Open Educational Resources, OER in Australia, Open Education Licensing project, OEL, open licensing

Licensing for Open Educational Resources

The OEL project is a joint project between Swinburne University of Technology and the University of Tasmania, funded by the Australian Office for Learning and Teaching. The project team is working to identify and analyse the critical copyright and licensing challenges that Australian teachers and policy makers face when using and developing Open Educational Resources (OER). The project is exploring licensing practices for OER in Australia and developing a toolkit. This will help Australian educators working online to match open licensing decisions to their institutions' policies, learning and teaching strategies, and business models. It will help them to participate in the global market for online educational products and services by making decisions on licensing and copyright more straightforward.

OER at Australian Higher Education Institutions

The adoption of OER by Australian higher education institutions has the potential to enhance innovation in teaching and learning in the digital environment. It can 'improve the quality and accessibility of teaching and learning provision' (OECD, 2015, p.11). However, the traditional reliance by teachers in Australia on blanket statutory licences (Copyright Act, 1968) means that there is not a clear understanding of how to deal with copyright and licensing for openly available online content. The statutory licences provide for payment for use of copyright content, but there are limitations on the way in which this can be used. The lack of a Fair Use exception in Australian copyright law means that Australian teachers and educational developers are more constrained than, for example, their US equivalents, in the way they can use copyright material. This is likely to create uncertainty and limit the speed and effectiveness of adoption of OER in Australia.

The OEL project aims to address these concerns, and provide Australian education with greater confidence to use and produce OERs. This will be a significant contribution to shaping Australian higher education in the twenty-first century. During 2015 the project team conducted a survey of managers and policy-makers, educators and educational developers, and information professionals working with OER in Australian universities. The team also conducted a series of interviews with key individuals on their experiences with using and creating OER. This information was analysed; the conclusions led into the development of the content and interface for an online interactive OEL toolkit. The toolkit was developed and disseminated through a national series of workshops for educators, developers, users, policy makers and information professionals interested in OER. The national workshops provided a forum to test the interface design and the content of the toolkit, available in test mode. The process will ensure that the toolkit meets the needs of future users involved in the development and use of open resources.

This poster will outline the process undertaken to collect and analyse data from key stakeholders across the Australian higher education sector and themes arising from the data analysis. It will detail the interface structure and content included in the OEL Toolkit and the national program used to engage with stakeholders and disseminate the toolkit in 2016.

References

Copyright Act 1968 (Cth) Parts VA and VB (Austrl.)

Organisation for Economic Co-operation and Development (OECD) (2015). Open Educational Resources, a Catalyst for Innovation. Retrieved from http://www.oecd-ilibrary.org/education/open-educational-resources_9789264247543-en

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Learning through Video Production - an Instructional Strategy for Promoting Active Learning in a Biology Course

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Videos are widely used in education but the pedagogical potential afforded by student's video productions is largely unexplored. This pilot study used video production as an instructional strategy for promoting active learning in a biology course. Students were instructed to build a 3D model and create a video to explain cell structure and function. They then summarized their project proposal, goal, scientific content and innovation in a report. They were suggested to form teams comprising students from different disciplinary areas, and to incorporate interdisciplinary knowledge into their videos. During the project, three psychological needs including autonomy, competence, and relatedness were supported based on self-determination theory in order to enhance intrinsic motivation. Analysis of the data from student feedback, submissions (models, videos and reports) and final examination revealed enhanced active learning and improved understanding of biological concepts. The results also suggest a need for fostering integrative thinking across disciplines.

Keywords: active learning, cross-disciplinary learning, intrinsic motivation, videos

Background

Recent advance in the digital video technology has enabled non-specialists to produce and distribute videos easily. Videos have been widely used as a powerful teaching and learning tool that enhances information acquisition via both visual and auditory channels. According to a recent survey, 93% of educators and students think it is important to raise the levels of digital and video literacy, and 98% of respondents think the knowledge of video tools and technology is an important part of digital literacy (Kaltura report, 2015). A separate survey shows that 68% of students watch educational video during class and 79% of students watch video to enhance their understanding of a topic (SAGE White Paper 2015). However, although video production and consumption rates are exploding, and students enjoy learning experience via watching videos, it is not necessarily equated with that fact that it is the most effective didactic format. The perceptions of students claiming improved learning should be carefully examined (Kirschner & van Merriënboer, 2013)

In order for video to serve as a productive part of a learning experience, instructors are advised to consider three elements in their video design and implementation: cognitive load, engagement and active learning (Brame 2015). Besides, there are arguments that students might not become critical consumers of mass media unless they experience the media production process themselves (Norton & Hathaway, 2010; Hung et al. 2004). Compared to the wealth of information on how instructors could make and use videos, the pedagogical possibilities in higher education afforded by student's video productions are still largely unrealized.

During years of teaching an elective module, General Biology in the National University of Singapore (NUS), I observed there is low engagement in watching videos related to lectures unless an assessment or assignment task is linked to the videos. Therefore, this study aims to explore a potential instructional strategy using video production for promoting active learning and integrative thinking cross-disciplines. The preliminary data on student engagements, challenges, and learning outcomes through the video production are presented in this report.

Methods

Module information

This study involved an elective module General Biology (LSM1301) in NUS. The module was offered to all university students and comprised of 12 topics taught over 48 contact hours in one semester. Class sizes varied between 300~450 students depending on semesters. The topics included in the video production were cell structure, function and reproduction.

Video production

The video production project included three components: building cell models, creating videos and writing reports. Students used an online forum to form teams, each with 3-4 members. During the project, they were asked to move beyond the biological contents and integrate knowledge from other disciplines. Hence, they were suggested to form teams with members from different faculties. The team will then decide on presentation content and style.

Students were given autonomy to choose the target, either a particular part of cell or an entire cell, to build their cell models. They then used the model with other materials to explain structural and functional contents, record and edit the presentation into a video file no longer than 5 min duration. Finally, they had to write a two-page report to explain the rationale and scientific content of their projects. All videos and reports were uploaded onto The Integrated Virtual Learning Environment (IVLE) for assessment by the module teaching assistants and instructors based on rubrics provided in Table 1.

The teams were given access to technical support and consultations to meet the three psychological needs of autonomy, competence, and relatedness based on self-determination theory (Ryan & Deci 2000) in order to enhance their intrinsic motivation to complete the project.

Table 1: Rubrics for video production project

Scores	Model (4 marks)	Video (4 marks)	Report (4 marks)
3-4	• The target selected with high educational value and strong rationale • The feature of structures and/or dynamics clearly and correctly shown • Models built up with (cross disciplinary) creativities/novelties	• Clearly focused, engaging and strong awareness of audience throughout the presentation • Articulating clearly with good rhythm • The model is fully used and well integrated with images/scripts/other materials	• Explained well why the target is selected and model is built (purpose and rationale) • Compelling and concise use of words to make the content clear and correct • Evidence of integrative thinking across disciplines.
2-3	• The target well selected • The feature of structures and/or dynamics clearly shown • Models built up nicely	• The purpose established early on and the presentation maintained on the topics. • Voice is clear and explanation goes smooth • The model is used for the purpose	• The purpose and rationale is explained to some extent. • Relevant biological contents are included and correctly stated. • There are some ideas, information from other disciplines
1-2	• The target selected without strong rationale • The feature of structures and/or dynamics can be observed with minor defects	• A few lapses in focus, but the purpose is fairly clear. • Explanation is understandable • The model is used at some points, but not really useful.	• The purpose and rationale is explained but not convincing • Key points are included but sometimes meanders and confusing • No evidence of cross disciplinary creativities
0-1	• The model has obvious wrong structures or does not fit the concept • The model is not built up by the group • No model is built	• Difficult to figure out the purpose of the presentation. • Difficult to catch what is said (voice is low or background noise is high) • The model is not helpful for elaborating contents (or no model)	• Lack of explanation of rationale or purpose • Difficult to understand and follow the idea • Information is incomplete, irrelevant, or incorrect. • Does not show any cross-readings

Investigation of student's learning activities and outcomes

Survey and data collection
Students were invited to provide feedback on the project via an anonymous and optional survey. The questionnaire included 12 questions focusing on the costs (labour and financial) of the video production, team collaboration, self-reported learning activities and outcomes as well as their reflections on the project. The respondents answered the questions using a 5-point Likert scale.

Analysis of student work
Each team's work included a model, a video file and a report. The scores of each component were statistically analysed using GraphPad Prism. This analysis helped instructors to understand challenges, learning activities and efficiency during the project. It also served to identify creativities, cross-disciplinary learning, thinking beyond the biology content and access accuracy of understanding,

Analysis of examination results
The video production project was carried out in the Semester II of AY1415 (Academic Year 2014-2015) but not in the Semester II of AY1516, so that the final examination results from the two semesters could be compared in order to provide another layer of evidence of learning outcomes. The two semesters in comparison have exactly the same module synopsis, and the same lecturers carried out the lectures. The enrolment sizes were 383 in AY1415 and 305 in AY1516. The multiple choice questions used for the final exams were set based on Bloom's Taxonomy with similar cognitive levels at our best effort in the two semesters. There were 10 and 8 questions related to the cell topics in AY1415 and AY1516, respectively. The frequencies of correct answers for each question was calculated and compared. P<0.05 was considered as significant difference by two tailed test.

Results

Student's participation and project completion

There were 383 students from 11 faculties enrolled in the class in AY1415. Although 95.8% of students worked in teams, 86% of teams were made up of members from the same faculty even though they were encouraged to seek team members from different faculties. Three groups submitted their project reports late and were penalized with a 50% deduction of the marks earned. Four students did not participate the project work. The completed projects were uploaded onto IVLE before the deadline.

The financial cost for the project was low and did not hinder the completion of the project (data not shown), while time cost on the project was heavy. The Figures 1 and 2 show the time needed to complete the project. The Xaxis represents the number of students, while the information on the Y-axis shows the 5-point Likert scales. The number on the bar is the student number for the particular option. Since this survey was not mandatory for students to complete, the total number of students counted may differ in different questions.

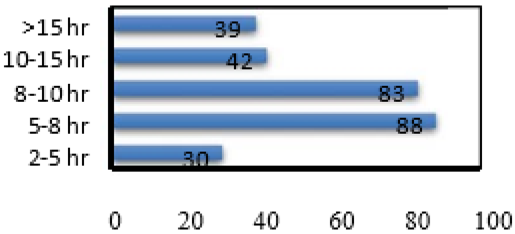

Fig. 1 Hours spent on the project per student

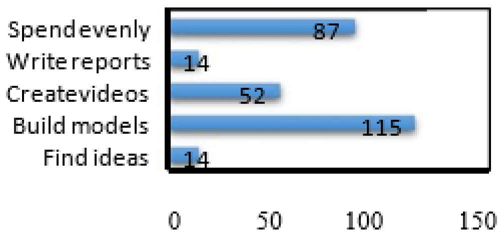

Fig. 2 The section taking most of time to complete

Student’s perception and self-reported learning outcomes

Marking rubrics (Table 1) were explained to students before the start of the project. The students were informed that there has to be a strong rationale (education value) for the model built, and it should facilitate the presentation. In order to achieve a high score, most students were motivated to read broadly (Fig 3). The student’s perception of their own understanding on cellular structure and function suggests that they might have read carefully to achieve the accuracy, which enhanced their understanding in depth (Fig 4). These data also support that students were engaged in active learning.

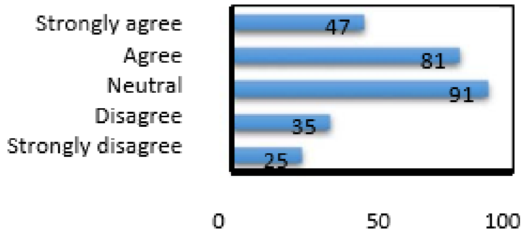

Fig. 5 I prefer this project to the conventional assignment such as a short essay question.

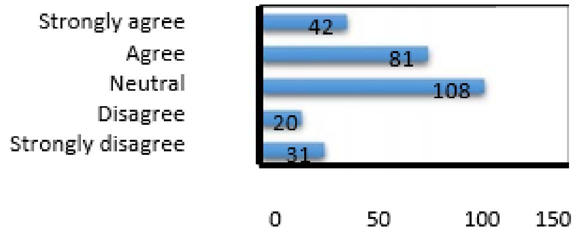

Fig. 6 I am supportive to keep this project for teaching General Bio in future.

However, there was tepid support that this project should replace conventional assignments (such as essay writing) for future cohorts (Fig 5 and 6) even though the current cohort reported improved active learning and learning outcomes (Fig 3 and 4). Through informal conversation with students after the project and analysis of module feedback at the end of semester (data not shown here), some students complained of long hours spent and fierce peer competition, which contributed in part to the dilemma faced by students.

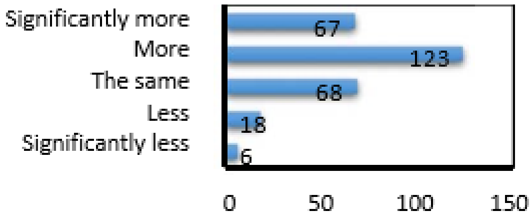

Fig. 3 Reading on the topics of cells compared with reading on other topics in this module

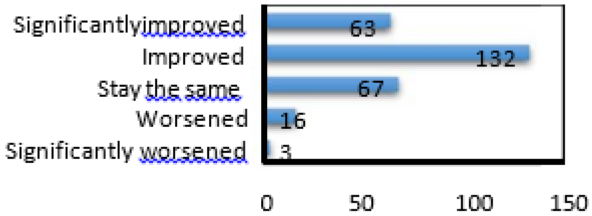

Fig. 4 Learning on the topics of cells compared withlearning on the other topics

Analysis of student work

Each of the three components, i.e. models, videos and reports was graded separately, and each had a maximum score of 4. The average score of entire class (red line) shows the lowest for model building and the highest for report writing. When considered with the survey data (Fig 3), the data suggests that students as a whole encountered difficulties or were not creative enough in model construction.

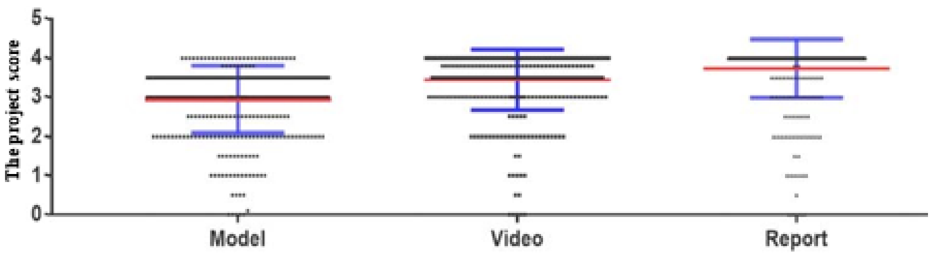

Fig. 7 The distribution of student project scores. Each black dot represents a score from one team; the red line represents average score with standard deviation (blue line)

Analysis of the results of final examination

The two exam results from AY1415 and AY1516 were compared. The overall percentages of correct answers in AY1415 during which the project work was carried out were higher than they in the AY1516 when the project work was not implemented (Fig 8). This result is consistent with the data of student self-reported learning outcomes (Fig 4); they reported better learning outcomes when doing the project. The exam result on all other topics was shown here as negative control (Fig 9). Learning on cell topics is significantly improved when doing the project.

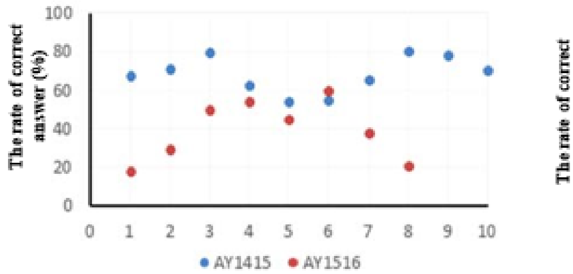

Fig. 8 The frequencies of correct answer (%) of each examination question on the topics of cell in the two semesters with (AY1415) and without (AY1516) the video production project work. There are 10 and 8 MCQs in AY1415 and AY1516, respectively. These questions are arranged randomly in sequences and are independent from each other.

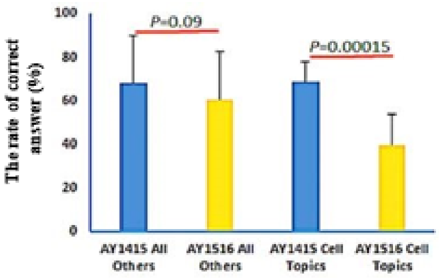

Fig. 9 The average frequencies (%) of correct answer in the final examination in the two semesters with (AY1415) and without (AY1516) the video production project work. It shows no significant difference among all other topics except for the topics about the cell.

Summary

This pilot study explored how video production could promote active learning. An integration of three components, *i.e.* model building, video taking and report writing, and with supports for the three psychological needs makes this project differ from other video projects.

Students were required to select a reasonable target for model construction; and the rationale for the selection had to be addressed in the report. This requires students to read widely, which may have broadened their knowledge. Teams comprising members from different disciplines may also have benefited from cross-disciplinary thinking. Model construction requires students to apply and synthesize knowledge of cellular components and the dynamics of cellular process to create the model in 3-D arrangement. A majority of teams spent their time heavily on this part (Fig 2) when compared to the other two (creating video and writing report). Overall, the video production project is much more time consuming than a conventional assignment. It is worth noting that this trade-off is sometimes ignored when discussing the use of video in learning environments. Future examination of the efficiency of learning through video product should take the time cost into consideration.

Cross-disciplinary work is observed. Some had used their domain-specific knowledge and skills to design and print a 3D cell membrane model and some to show dynamic change using magnetic force. A number of great models was collected and preserved for the future use. Students were happy to know their models become valuable educational assets. The overall quality of videos was higher than expected. Students collaborated in filming and editing of videos and were very satisfied with their team members (survey data not shown). The evidence of strong team spirit and peer learning can also be observed from videos. There was variety in presentation styles; some created songs, some adopted a classroom teaching style, while others presented their models, which they had constructed from food ingredients, on a dinner table. The overall high quality of videos also reflects the inherent competency of college students in digital video technology. The reports consist of the rationale for model construction, scientific contents and self-statements on their creativity across disciplines. Writing provides training on logical thinking, and also opportunities for students to express their idea precisely in words. In addition, the reports also allow examiners to adjust their marking on the models and videos after they read student’s statements in the reports.

In brief, the video production project promotes active learning, evidenced by actively looking for references and the improved examination results. Our data may indicate students' weak hand-on ability and creativity to meet the requirement of model building because they spent most of efforts on it but still got the lowest scores among the three components. So long as the three psychological needs are supported, a vast majority of them could collaborate well and complete high quality project work. Future work may focus on how to boost the cross disciplinary talk among students and how to evaluate a work with cross-disciplinary creativity.

Acknowledgement

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References

A SAGE White Paper (2015). Great Expectations: Students and Video in Higher Education. http://www.sagepub.com/repository/binaries/pdfs/StudentsandVideo.pdf.

Brame, C.J. (2015). Effective educational videos. Retrieved [20 July 2016] from https://cft.vanderbilt.edu/guides-subpages/effective-educational-videos/

Hung, V.H.K., Keppell, M. & Jong, M.S.Y. (2004). Learners as producers: Using project based learning to enhance meaningful learning through digital video production. In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds), Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference (pp. 428-436). Perth, 5-8 December. http://www.ascilite.org/conferences/perth04/procs/hung.html

Kirschner, P. A., & van Merriënboer, J. J. G. (2013). Do learners really know best? Urban legends in education. *Educational Psychologist*, 48(3), 169–183. doi:10.1080/00461520.2013.804395 Norton, P., & Hathaway, D. (2010). Video production as an instructional strategy: Content Learning and teacher practice. *Contemporary Issues in Technology and Teacher Education*, 10(1), 145-166.

Ryan RM & Deci EL (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well being. *American Psychologist* 55, 68–78.

Woolfitt, Z. (2015). The effective use of video in higher education. https://www.inholland.nl/media/10230/the-effective-useof-video-in-higher-education-woolfitt-october-2015.pdf

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