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!

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