Digital technology and the internet are ubiquitous in the lives of people across the globe. With that reality in mind, school education is required to embrace a number of new learning challenges if it is to meet students’ employment and social needs. Technologies like the internet, support new forms of learning, based on “bottom-up principles of collective exploration, play and innovation” (Selwyn, 2013, p. 198), which encourage learning through authentic activities and interactions. Not only is technology about engagement in teaching and learning in school classrooms, it is changing the way that education occurs. This circumstance is reflected in the Australian Curriculum (AC), which is now more differentiated, more collaborative and more creative because it considers the opportunities for technology in student learning.

So, how is technology relevant to education in these contexts? How are school leaders and teachers responding to these expectations and the demands of change and innovation? Are learners achieving the outcomes they need to be successful in work and in their social lives? Some recent reports like the National Assessment Program – ICT Literacy Years 6 &10 (ACARA, 2015, p. xxvii) reveal a decline since 2011 that requires “further investigation” and the Students Computers and Learning report (OECD, 2015, p. 16) shows that “ICT is better linked to student performance only in certain contexts”. Is this kind of reportage an accurate reflection of the value of technology in education in Australia? Or, is it a function of the way technology is being used in Australian schools?

Schools and school systems, both government and non-government, alongside curriculum bodies like the Australian Curriculum, Assessment and Reporting Authority (ACARA) continue to take a critical and active role in providing the conditions that support the ongoing integration of technology in education. Further afield in a recent interview for EdSurge, after the annual International Society for Technology in Education (ISTE) conference in July, Alan November, a highly respected international education consultant was ’scathing’ when he spoke about the state of technology in schools right now, saying:

“It is a mess and the edtech industry has to come to grips with that – if I walk into a classroom and the school has gone one-to-one and all the kids are taking notes on a laptop then I would call that a $1000 pencil” (November, 2016). Perhaps the hype is over and reality is here?

Role of the teacher in the school context is vital

The interrelationships between the role of the teacher and the context of technology integration requires much closer examination of what Ertmer declares are...
“intrinsic and extrinsic barriers” to a teacher’s technology use (cited in Phillips, 2015, p. 320). We argue, that in spite of the ‘state’ of technology in school education it brings new value to teaching and learning. And, if institutions focus on the influencing conditions, this serves to build ICT literacy and capacity in teachers enabling more productive and appropriate uses in classrooms.

Moreover, according to the latest NMC Horizon report K–12 edition (Johnson, et al., 2015) technology is making an impact on teaching and learning through the sheer availability of tools and services that enhance classroom practices, while at the same time it is changing (perhaps not fast enough) the way that teaching and learning happens. Johnson, et al. (2015) refer to it as “shifting the roles of students from passive consumers of content and knowledge to creators of it” (p. 7). This is important.

Student learning outcomes provide insight into some of the potential impacts of technology. We are not necessarily there yet. The Australian Curriculum ICT Capabilities describe five key areas that apply: investigating; communicating; creating; managing and operating; applying social and ethical protocols and practices with ICT (ACARA, 2016a, p. 1). More specifically, the technologies learning area describes several key ideas including design thinking, system thinking, computational thinking, project management and creating futures "for developing integrated teaching programs that focus on both Technologies subjects and other learning areas" (ACARA, 2016b). This clarification represents a shift towards a more “fundamental understanding of computational science” and the role of technology in learning (Bower, et al., p. 1). Hunter (2015a), on the other hand, describes it as a “retooling of education” that is undoubtedly a “formidable and ongoing challenge for schools” (p. 2).

Education researchers describe this as a move towards more constructivist forms of learning (Bower, et al., 2015; Hunter, 2015a; Tondeur, et al., 2013) where technology enables applied, interactive and enhanced learning experiences. Technology in classrooms supports this constructivist trend. It is not about adding more and more technology, but using it to support students to construct their own knowledge, meaning a focus on learning how to learn – refining metacognitive skills are fundamental.

**Real or imagined?**

So, how exactly are Australian schools performing and what outcomes are being used to measure students’ ICT capabilities? Phillips believes that this is a complex issue and refers to Selwyn's (2008) "state of the actual" (Selwyn, cited in Phillips 2015, p. 319) when describing the difference between the grand narratives about what technology could be for education and what it actually is.

Certainly there has been a lot of hype around technology in education, and all of the previously mentioned reports suggest that this has not brought about “the expected lift in outcomes for students”. For example, according to the OECD report (2015, p. 14): “Resources invested in ICT for education are not linked to improved student achievement in reading, mathematics or science”. The National Assessment Program – ICT Literacy Years 6 &10 (ACARA, 2015, p. 113-4) states, "ICT literacy generally fell across most age groups across 2011-14". Interestingly, this period coincided with the Australian government’s Digital Education Revolution (DER) and the introduction of one to one (1:1) devices for students in the final years of schooling. Collectively, the reports recommend looking at how technology integration is approached in classroom practices, suggesting "the real contributions ICT can make to teaching and learning have yet to be fully realized and exploited" (OECD, 2015, p. 4).

The NMC Horizon report K–12 edition (Johnson, et al., 2015) emphasises the importance of ICT and digital literacy of both teachers and students. This literacy is not yet considered a normal capability and is often confused with skills, rather than thinking and understanding. Snyder & Beale (2012) refer to “literacy practices”, in particular an assertion that those with the “skills and capital” to engage proactively with technology will be greatly advantaged as compared to those who are merely consumers of it (p. 165). Surely it must be about individual agency? Kalantzis and Cope (2012) argue that it is a fundamental responsibility to provide learners with “tools for effective meaning-making” and ICT is no exception. It is essential that we get the application of technology and the literacies that it can develop critically and successfully embedded in classroom practices in more schools.

**Supporting better pedagogical approaches**

Various studies and papers identify the critical role of the institution in supporting technology integration once it is there (ACARA, 2015; Johnson, et al., 2015; OECD, 2015; Sahin & Uluyol, 2016; Vanderlinde, et al., 2015). The extrinsic, contextual barriers to technology integration remain relevant in most Australian schools. To suggest that teachers themselves are the key barriers to the successful integration of technology is an oversimplification of the case.

Hunter (2015a, p. 5) refers to a conception of “contextual accommodations” in the High Possibility Classrooms framework, i.e. in exemplary teachers’ knowledge of technology integration. This teacher knowledge domain remains of prime importance in supporting the teacher's capacity and willingness to succeed with technology. In addition, device and services limitations, like access to the internet, continue to limit too many teachers’ abilities to integrate technology consistently and if they cannot rely on it to “connect every time they will not compromise their own students’ learning” (p. 6).

Access to reliable devices and services are critical to the success of technology integration. This issue has not yet been resolved across all Australian schools; significant inequalities exist in terms of access to reliable internet and hardware devices. Selwyn (2013) labels unequal access to technology as a “major concern in schools” (p. 9). Teachers by themselves can do little to resolve such limitations, so it is incumbent on institutions to prioritise such matters. For example, the DER rollout of 1:1 devices across Australia was not accompanied by sufficient professional learning. Well-resourced professional development must accompany the provision of hardware and technology infrastructure in schools otherwise, as Hunter (2015b) observes: “the expenditure and curriculum goals may well be wasted” (p. 185). This is, perhaps, a more accurate picture of what we are seeing reflected in the reports National Assessment Program – ICT Literacy Years 6 &10 and Students Computers and Learning.

A recent study of 101 teachers over ten years found that teachers respond well to “encouragement, support and opportunity, and this highlights important motivations in the school context” (Sahin & Uluyol, 2016, p. 1). The NMC Horizon report K–12 edition (Johnson, et al., 2015) also examines global trends in technology in education; it emphasises the role of teacher education in...
teaching

building pre-service teachers’ ICT literacy and capacity to integrate technology effectively. Policy and leadership by governments are crucial in recognising and supporting these imperatives.

Factors intrinsic to the teacher

Teachers play a key role in the learning experiences of their students. Their own ICT literacy impacts on their ability to model good technology use. Phillips’ acceptance of Ertmer’s “first order barriers” (cited in Phillips, 2015, p. 320) to technology integration have been resolved suggests that context plays a less important role than the teachers themselves. Undoubtedly beliefs, values and skills play an important role in defining their ability and willingness to apply technology in their classroom practices.

Another study of teachers’ classroom practices (Tondeur, et al., 2013) is congruent with Phillips’ finding that self-directed and ongoing learning about technology enhances the ability of the teacher to apply technology in the classroom. Individual teachers work to build their own understanding and capacity to work with technology. The proposition here however is that although individual teachers may have the capacity to develop their pedagogy, in order to get more consistent and successful outcomes from technology, education institutions must work on the contextual level “to build the communities of practice” that support and encourage it (Phillips, 2015, p. 323).

Although we agree that the agency of teachers to focus on pedagogy is important, the role of the institution is pivotal, not only in supporting individual teachers, but also by creating a culture, and the expectation that teachers will be well supported to integrate technology. This is the kind of ‘retooling of education’ that will take current practices forward. However, without strong contextual management many teachers may not be able or be willing to move towards such goals.

The role of the institution

People, the users of technology, give technology its value. It is the way implementation is approached that creates its impact on teaching and learning. Selwyn (2013) suggests awareness and skills development provides teachers with the opportunity to have agency over this process, otherwise they may become controlled by it, risking what he describes as “unintended consequences”, like the consumerisation of education and other “second order effects” (p. 25). This view aligns with our earlier discussion on the role of ICT literacies in education – emphasising the role institutions play in controlling what we term ‘a cultural agenda’.

The Australian ICT Capabilities and Technologies curriculums, mentioned previously, reflect more constructivist approaches and provide important institutional standards for student learning outcomes. This guidance supports teachers to move towards the revitalisation of their subject-matter knowledge and what others describe as the “institutionalization of ICT in classroom practices”. A study following the impact of a new ICT curriculum in Belgium from 2008 found that introducing an ICT curriculum can positively contribute to the “influencing conditions” supporting ICT integration (Vanderlinde, et al., 2015, p. 1062). However, these authors also identify professional development, leadership and vision at the school level as important for the ability of teachers to successfully apply the curriculum.

Finding time for teachers to work together to share common experiences and ideas as forms of professional development means using the workplace more.

Finding time for teachers to work together to share common experiences and ideas as forms of professional development means using the workplace more. Creating time in regular school meetings to talk about practice and leaving administration matters to an email or online staff bulletin are ways some schools address the perennial ‘not enough time’ factors. There will never be enough time. Teachers in schools use professional learning networks (PLN) and social media to connect and solve personal and professional problems with technology integration. The TeachMeet is another space teachers prioritise to share learning and technology integration practices – such events place teachers in the ‘driver’s seat of their own professional development’.

Will the NISA make a difference?

Released in December 2015, the National Innovation and Science Agenda (NISA) includes investment in Science, Technology, Engineering and Mathematics (STEM) education, the teaching of coding and computational thinking. But there is not nearly enough money allocated for the program and the changes it demands. The funding from Factsheets 18, 19 and 20 amounts to a total of $112 million meaning $12,000 across five years for every Australian school (Hunter, 2016, p. 48).

An analysis of media reportage in 13 major online and print newspapers of more than 250 articles (Hunter & Varadharajan, 2016) since the NISA announcement until the recent federal election was proclaimed, found that the NISA is largely a political agenda. There is little mention of teacher professional learning and building teacher capacity and confidence in technology-enhanced learning and skill development in STEM initiatives.

Further limitations to innovation and change in schools are rendered in restrictions imposed by a subject-based curriculum and assessment models that confine the cross-curriculum or trans-disciplinary approaches required, for example, in effective project based learning (PBL) approaches.

Last thoughts

Technology and the internet bring benefits to the practice of teaching, to student learning outcomes and to organisational processes. However, this reality has not as yet led to widespread improvement in students’ results as focused upon in some recent education and widely publicised reports. Management of technology adoptions at the institutional level are crucial to build and enhance what it could be. Industry and tech companies must assist more in very real ways and not just think about selling schools that next ‘bright and shiny platform’ or ever more tools and applications.

There is a clear need to provide consistent technology experiences for teachers and learners across schools and education systems in order for the desired ‘re-tooling of education’ to succeed. School leaders and teachers are critical to successful pedagogical technology integration approaches. Without institutional encouragement and support, the pace of change and innovation will remain ‘glacial’ and this is especially so in many Australian secondary schools.

Education institutions should champion governments to provide the strategic resources and long-term vision to build all teachers’ ICT literacies and capabilities,
while at the same time developing cultural expectations and collaborative working cultures with all institutions. This action will in turn mean that we are better able to meet the needs of learners, providing them with the necessary skills, awareness and capacities to succeed in society and in the creation of ‘a good life’ (Benjamin, 2016).

It is messy, but it’s very necessary work.

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