

REDEFINING EDUCATION: SUSTAINING 1 TO 1 COMPUTING STRATEGIES IN WESTERN AUSTRALIAN SCHOOLS

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Abstract

In 1993 the first WA private school adopted a 1 to 1 computing strategy and then ten years later the first government school did so. With the advent of the Digital Education Revolution initiative many schools in WA commenced 1 to 1 strategies and it has almost become an expectation in secondary schools. Our Snapshots studies involved two new government schools and a long established elite private school that had a similar vision for learning with digital technologies. The two government schools had 1 to 1 strategies, but had found that their chosen tablet PC was not robust enough, and had concluded that the current policy was not sustainable. They were debating the merits of BYOD or BYOT strategies in the light of constraints and the nature of their clientele. The private school, unlike most of its peers, had not had a 1 to 1 strategy but was planning to do so using iPads. However, it appeared that they already had an informal BYOT strategy. In this paper we discuss the differing situations these schools have found themselves in, the vision they have for learning with digital technologies, and the issues they are debating that will allow them to implement and sustain this vision.

Keywords: 1:1 computing, mobile devices, Leadership, BYOD, Sustainability

Context

Schooling in Western Australia (W.A.), has a long and proud history of initiatives aiming to provide one-to-one (1:1) portable computing. The first whole school programs were at the beginning of the 1990s and with these successes others were encouraged to follow suit; a more detailed account is provided by Newhouse (2014). Australian educators also learned from the experiences of schools in other countries, particularly the U.S.A. and U.K. (e.g. Cox, 2012; Gardner, Morrison, & Jarman, 1993; Sandholtz, Ringstaff, & Dwyer, 1992). It has now become typical for an Australian school, particularly a secondary school, to organize 1:1 portable computing in some form. In the past, this was almost always achieved by either requiring parents to buy or lease a particular portable device, or by the school buying the devices to loan to students. More recently the option of Bring Your Own Device (BYOD) or Technology (BYOT) (Lee, 2012) is being considered, in recognition that many students already have a suitable device and in response to the availability of so many devices that are likely to adequately fulfill the needs of students at school (The Office for Standards in Education, 2011).

Over the past 40 years of research into the use of computers in schools, it has been recognized that the extent to which the potential for positive learning outcomes is realized depends on an array of enablers and barriers (Hew & Brush, 2007; Newhouse, 2014). Two oft cited factors are the leadership in the school, and the organization of the curriculum. In fact Tondeur, Cooper and Newhouse (2010) found that the connection between leadership and the curriculum was a critical factor. While visionary leadership and support of the Principal was necessary, it was the organization of curriculum leadership and its connection with the provision of Information and Communications Technology (ICT) that was important. In particular the role of a curriculum ICT leader was pivotal to success.

Perhaps unsurprisingly, for a decade almost all of the examples of 1:1 portable computing initiatives in Australia were in higher fee-paying private schools with laptops costing around \$2000 and expensive technical support and infrastructure such as networking (Newhouse, 2014). There was always some unease about initiatives that could not provide every student in the school with a device (Narracott, 1995) and therefore only a few government and low fee-paying private schools were involved. However, with the arrival in 2008 of the Australian government Digital Education Revolution (DER) funding, and cheaper mobile devices, many of these schools moved to 1:1 provision. The DER funded secondary schools, or school systems, to provide a computer per student in whatever way they chose; for example, in New South Wales state government schools the system decided these funds would be used to purchase a particular laptop for every student in Years 9 to 12 (Howard & Carceller, 2010). In Western Australia the decision was left to the school and thus in some schools the funds were used for a 1:1 program. As the DER funding ends they are debating how to sustain 1:1 provision whilst ensuring satisfactory levels of equity of access for students.

In this context, research such as the Snapshot Studies is timely (refer to http://edfutures.net/Research_Strategy). Increasingly the questions in schools are not whether to have such a provision but rather, what is the best approach to take for the school's situation. It is likely that there will not be a definitive solution so schools need access to information about a range of options, in the way that the Snapshot Studies set out to provide. The themes and associated questions are important for all schools as they plan to bring a vision to reality.

Methodology

The three cases reported here form part of a series of 13 studies carried out in Australia between September and December 2013, which are referred to as the Snapshot Studies (see http://edfutures.net/Technology_Strategy_Case_Studies#The_Snapshot_Studies). These complement 22 studies carried out in England between September and December 2012, which are referred to as the Vital Studies (see http://edfutures.net/Technology_Strategy_Case_Studies). The Snapshot Study schools were selected based on the researchers' local knowledge of schools that were engaged in the

implementation of mobile device strategies. Table 1 provides a summary of these Snapshot Study schools.

Table 1
Summary of the Snapshot Study schools reported here

	School A	School B	School C
Type	State	State	Independent girls
Phase	Secondary	Secondary	K - 12
Approx. no. students at school	300	250	1100
Digital technology strategy	1:1 Tablet PC	1:1 Tablet PC	BYOT
Year group(s) observed	8	8	9

The Snapshot Studies used a cut down version of the methodology used in the Vital Studies (see http://edfutures.net/Research_Strategy). The Snapshot Studies involved data collection prior to and during one day spent in school by the researchers. The key data collection tools included: questionnaires, semi-structured interviews, an observation with follow up interview, and a focus group with four students. One of the purposes of the questionnaires, which were sent to participants to fill in before the researchers came in to the school, was to ensure they had had time to think about the issues prior to the interviews. As one might expect given the practicalities of doing research in schools, there were minor variations from the standard methodology in each of the Snapshot Study schools. These are summarized in Table 2.

Table 2
Variations in the methodology

School A	No School Leadership Team questionnaire The Principal, Deputy, ICT Coordinator and other staff were interviewed together There was no parent interview
School B	No School Leadership Team or ICT Coordinator questionnaires 3 parent questionnaires (rather than 1) 3 student portfolios (rather than 4) No ICT Coordinator interview (the SLT had led on the digital technology strategy)
School C	No ICT Coordinator questionnaire No student portfolios

Clearly the data collection could only provide a partial glimpse of practice within the school. Nonetheless surprisingly rich pictures of practice emerged from the multiple perspectives of the reports of the principal, ICT coordinator, Teacher, parent, and students, and the researchers' classroom observations.

Data analysis

Emergent Themes Analysis based on Wong and Blandford (2002) was used to identify 'emerging trends' from the 22 Vital Case Studies (Twining, 2014). This analysis was then extended to include the 13 Snapshot Studies in Australia including the three discussed in this paper.

The three schools had different approaches to providing student access to computing. In School A and B there was a 1-to-1 strategy with each student provided with a Samsung Slate, a tablet PC with a removable keyboard, which were supported by a school technician and connected to the school WiFi network. In School C students were permitted to bring any device they owned to school, including some with 3/4G connectivity. Students were provided with usernames and passwords for the school WiFi network. A teacher commented that the student's devices were often better quality than those the school provided; which included hubs of desktop computers in shared areas and sets of laptops on trolleys. Most students preferred to bring their own devices. School C planned to introduce a BYO iPad strategy.

Discussion of results

There were many ways in which the three schools differed with two being new government schools in aspirational suburbs, and the third being a long-established elite private school. All three wanted each student to have their own device and were grappling with different constraints to that provision and its equitable sustainability. The results are now discussed under the main themes emerging from the analysis of the data across the three schools.

Visionary leadership

Each of the three schools had a new Principal who had a strong vision that included student use of computing devices, which they endeavoured to communicate throughout the school. In each school this was connected to curriculum leadership, but in different ways. In School B the Principal had good technical IT skills and knowledge and he had taken responsibility for leading the 1:1 initiative and connecting it with the curriculum. In School A this leadership was delegated to an Associate Principal who had responsibility for all curriculum matters. She had formed a committee to support her that included the network manager and teachers with high levels of technical capability. In School C the Principal had appointed a teacher, new to the school, as the Director of Information and Learning Technologies. This position reported to the Principal, managed the technical support personnel and liaised with the curriculum leadership. We noted in each school that much of the success with the 1:1 strategies was due to the role of the senior curriculum leaders and the enthusiasm and capability of a large proportion of the teachers.

In School A the digital technology vision was to have ‘a computer lab in every classroom’. Thus every student and teacher had access to a Samsung Slate running Windows 8, and most rooms had a large flat screen display. This vision was largely exemplified in a Year 8 Science lesson at the start of a project to design a planet within the solar system, which was observed by the researchers. The teacher started by displaying a topical video from Mars One on the large screen and then demonstrating Spacecraft 3D – an app from NASA that allows you to explore 3D models of spacecraft such as the Mars Lander. Then the students worked in pairs or small groups using a simulation called My Solar System, in conjunction with a paper-based worksheet.

In School B the vision was that the devices would allow for more collaboration and mentoring between staff, leading to a more cross curricular approach to teaching. All students and teachers were initially provided with a Samsung Slate running Windows 8 and each classroom had a large flat screen display. In the observed lesson the teacher and students used an application called Geogebra to work on a number of problems related to graphing linear equations.

In School C the emphasis was on learning, focusing on higher order thinking skills through critical discussion and content creation. The technology was viewed as an essential but invisible tool. The students were encouraged to bring any technology they needed to get the task done. In the lesson viewed by the researchers the students shared video resources that they had created. This generated discussion on how the video techniques were used to convey meaning from the story of Romeo and Juliet. There was no instruction on the technical aspects. It was assumed that as the students had brought their own devices they knew how to use them. The researchers noted some peer-to-peer support on technology use.

Best means of provision

In each school the vision of the leadership needed to be supported by the provision of access to portable computing. In Schools A and B this was through the school providing Samsung Slates. For these schools the two over-riding issues were: the robustness of the devices; and having a financially viable plan, for parents and the school, for providing every student with a device. In School C the strategy was for parents to provide devices and the main issue had become whether to allow any device or require parents to provide a particular device, an iPad.

Robust Devices

In School A the main concern was the inadequacies of the chosen devices, principally that they were too easily damaged. Thus at any one time up to 50% of the devices were being repaired. This had led to a negative cycle of staff not feeling able to use the devices because many students wouldn't have one with them, which reduced the incentive for students to bring the devices into school, which increased the proportion of students who didn't have a working device available in lessons. As a result the school had reverted to providing separate computer labs for those lessons where everyone needed computer access. Similarly, School B had problems with damage to devices, with more than 20% being repaired at any one time. The school maintained an expectation that students would bring their devices to every lesson unless they were broken. Whilst staff couldn't rely on the class having a full set of devices, they still maintained a positive feeling toward the 1:1 strategy and some teachers were implementing more engaging and interactive lessons using the technology.

In the observed lesson in School A only 10 students had slates available and thus they had to work in groups. In School B in the observed lesson 22 of the 26 students had their device with them although a small number had issues with running out of battery charge as the lesson was late in the day. Clearly it is essential to ensure that the devices are robust enough to withstand the normal wear and tear involved in being used in school, including in the playground, as well as being transported to and from home. In both School A and B the student WiFi only provided access to the Internet, because Windows 8 was not supported by the Department of Education (the sites were being used to trial this newer operating system). This meant that student's devices couldn't be connected to the Department's services. School B addressed this problem by using a cloud based virtual learning environment.

These Snapshot Studies raised questions about the most appropriate device for use in schools. The majority of staff and students who we spoke with at School A and B thought that having a physical keyboard was essential, and indeed almost all of the use of the slates that we observed did involve use with the keyboard attached. However, this contrasts with the views of staff and students in other schools (including School C), which have chosen to go down the tablet route. They argue that for 90% of the things students use their devices for in school a physical keyboard is not necessary, and immediate on and long battery life are more important factors. Ultimately it is clear that no single device is suitable for all educational purposes, and that one needs access to a range of devices, suited to different tasks. Thus, for example, you need high specification desktop machines to do sophisticated CAD/CAM work; a physical keyboard is advantageous if writing extended essays; and a tablet is ideal for general use around the classroom, where its form factor, immediate on and long battery life lend themselves to spontaneous use as a natural part of the learning process. This led to the addition of the 'What device' dimension to the 'emerging trends':

What device	Desktop	Laptop	Tablet	Tablet +
Category	Explanation			
Desktop	Desktop machines			
Laptop	Laptops, netbooks, Tablet PCs			
Tablet	Tablets and other devices with a touch screen (but without a physical keyboard)			
Tablet +	Recognition that no one device is suitable for all tasks and students therefore need to have access to different devices for different activities.			

In School C the class observed by the researchers was in a specifically designed building for the middle school. This consisted of a number of classrooms with one glass wall, which faced the shared technology hub. The majority of the students in the observed class had brought their own devices or sharing a device that one of them had brought in. There was a mix of PCs and Apple devices. These

were used for the writing tasks and for editing the video footage that was filmed using a range of handheld video cameras.

BYOD/T or 1:1

The three schools were wrestling with the question about whether students should all have the same device, a 1:1 approach, or should be permitted to bring any device they owned that would do what was needed to support their learning at school and home. Schools A and B had a 1:1 strategy but were considering BYOD, whereas School C had a BYOT approach and was considering 1:1. In essence they had to balance their vision for portable computing supporting learning with the constraints associated with their environments.

In Schools A and B the main constraint was cost and the ability of middle-income parents to pay for devices. It was known that the vast majority of students already had one or more devices at home but these varied in quality, age and operating system. It was thought unlikely that many parents would be happy buying another device specifically for school. However, there was concern that if students brought in a range of devices this would counter the vision because they may not all be able to access the software and services teachers planned for lessons, and teachers would not be able to help them with their devices. School B's Principal believed that it was inevitable that the school would eventually move toward a BYOD strategy, with the school providing laptops that could be borrowed for use in school by students who didn't have their own device.

In School C the main constraints were the power of the parent body and concerns about controlling access to software and online content. The school's aim was to provide a robust, fast WiFi network so that student would choose to connect their own devices to the school network rather than to unfiltered connections available via their smartphones or the free local council network.

The distinction between 1:1 and BYOD/BYOT is not so much to do with who pays as with who specifies what devices can be used from home and whether every student will have a device. So 1:1 requires that every student **MUST** have the same specification of device (e.g. Schools A and B mandated a particular make and model; other schools have a whitelist or specification in terms of Browser/WiFi/Apps). If School C moved to its iPad strategy and required every girl to have one then that too would have fitted better into a 1:1 strategy; if they had said you can bring an iPad if you like then that would be BYO iPad (the distinction here being about whether or not every child would have a device – BYO implies not everyone will have one; 1:1 expects everyone to have one).

Sustainable Plans

All three schools were working on sustainable plans for providing portable computing to support learning. This included concerns for equity of access that in Schools A and B were to do with whether parents could afford the cost, and in School C was whether each student had access to the most appropriate device.

In School A parents were asked to make a voluntary contribution of A\$200 per year towards the cost of the devices. This entitled their child to have a device that they could take home each evening, but would have to return at the end of the year. The small proportion of students whose parents did not pay the A\$200 were able to borrow a slate from the library for a particular lesson or activity, but could not keep it overnight. In School B parents were asked to pay a levey of \$175 per year, however, some parents had refused to pay due to the unreliability of the device. These parents indicated they were supportive of the initiative but not of the particular device.

Due to the inadequacy of the devices the school leadership had begun to debate plans for the following year; whether they should persevere with the current device which cost A\$1400, get cheaper laptops, or allow students to bring their own devices (possibly from a list of acceptable alternatives). The cost of the device had become an issue because with the demise of the DER funding the school could not afford to continue to subsidise the cost of devices. At the same time there was evidence that most students already had a suitable device that they could bring to school; effectively transferring the full

cost to parents, though without requiring them to spend any more money. However, there were questions about how to provide for the student whose parents didn't buy them a device and how to support teachers in coping with a range of devices with varied software. School B was having similar discussions amongst their leadership team and they were planning to move to a model where the devices were not taken home, or a mix between BYOD and school provided machines (that stayed at school). These were seen as the only financially sustainable models.

In School C trolleys of laptops and access to desktop hubs were maintained to guarantee that all students had access to required software and services. In addition students were provided with technical support to connect their own devices to the school network. The school was introducing a 1:1 bring your own iPad policy so that they could focus their technical and pedagogical support, but said that students would still be allowed to bring other devices as well, in recognition that students had multiple devices and different devices were suitable for different activities.

Conclusion

Despite their different contexts, these three schools raised a number of common issues facing any school implementing a mobile technology strategy. They were all grappling with questions about the most appropriate devices and approaches – laptops, Tablet PCs or tablets; 1:1, BYO, or reverting to more traditional models of loan machines for use in school. What was clear from all the schools was they aspired for every student to have their own mobile technology, with the school supplementing provision for those who needed additional support. In government schools financially sustaining a 1:1 program is unlikely to be feasible without at least some parental funding. Schools grappling with this issue should start by finding out the extent to which their students already have mobile devices that they could use in school (using a free service such as Your Own Technology Survey <http://www.yots.org.uk>) because if, as appeared to be the case in School A, most students have at least one laptop or tablet at home they could bring to school then moving towards a BYO approach may be the only viable solution. However, this would need varying levels of pedagogical support for staff and a shift in school system policies in W.A. to facilitate a move towards cloud based solutions to complement the use of students' own mobile devices.

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