BYOT in Secondary Education

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BYOT (Bring Your Own Technology) has become a significant discussion point in secondary education since the Global Financial Crisis of 2009. Seen initially by many educational leaders and administrators as a way for schools to continue to provide technology in the classroom in the face of declining budgets, many early implementations were driven more by fiscal reasons than any potential educational and instructional benefits. However, where BYOT is properly researched, planned, and consideration is given first and foremost to student learning, BYOT can deliver transformational instructional impact and provide a strong platform for differentiated and individualised learning. Furthermore, it can break down the divide between technology use at home and at school, promoting a genuine 24/7 collaborative learning framework amongst all areas of the school community. It also allows students the freedom of choice to choose the technology platform that best enhances their learning.

Teaching and Learning

One of the main concerns about BYOT is that its primary benefit to school community is to offload the cost of the student technology onto the parent body (Stager, 2012). Whilst this is true of some of the initial implementations of BYOT immediately after the Global Financial crisis of 2009 as school's sought ways to provide technology to students with reduced budgets, this concern does not take into consideration the significant research and thinking by educators around the globe in recent times into personalised, authentic enquiry/inquiry based learning and how this is best supported by technology.

Arguenta et al (2011) in their evaluation of six major 1:1 initiatives in the United States concluded that both teachers and students agreed that there was increased student engagement in the classroom and that learning was deeper with greater emphasis on critical thinking and analytical and conceptual learning. This research supports the informal observations of many teachers in their own classroom experience. Despite this, there are in many schools a growing home and school digital divide (Traxler, 2010 & BECTA, 2008) where ubiquitous community and social based practices using digital technologies by students at home are at increasing odds with more restrictive practices at schools. Students continue to report that they have to disconnect from their digital world or "power down" when they are at school (Prensky, 2001a). Even in traditional 1:1 laptop programs, students often view their school provided laptops as the device they use for their schooling, and then use their own personal phone, tablet or laptop for their social interaction and learning outside the curriculum (Green & Hannon, 2007; Chowdry, Crawford & Goodman, 2009).
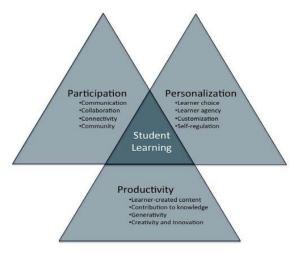
BYOT, where implemented with a focus upon student learning and their role as responsible digital citizens in a digital society, brings a fusion of learning between school and home using the same technological devices. There is no longer a need for individual devices - the bridge between social interaction and formal learning has been built. It promotes authentic home-school collaboration to the school's achievement of the normalised usage of the student's technology, and "provides an excellent bridge between the intensive teaching of schools with the far more informal approach used outside" (Lee & Levins, 2012). Furthermore, it encourages students to utilise the same style of self and peer teaching in school that they prefer and finds works best for their learning style outside of school (Green & Hannon, 2007).

This bridge between home and school enables the whole school community to better address the student's social, emotional and personal-development skills in the framework of their membership in the digital

world as a responsible and ethical digital citizen. This is not to suggest that traditional 1:1 programs cannot effectively underpin an educative platform on digital citizenship, nor to suggest that students in 1:1 programs where the device is mandated by the school don't elect to use their mandated device for home and social digital collaboration. However BYOT implemented effectively ought to provide an advantage by facilitating students to use their own digital technologies more effectively, in planning and organising their lives and learning, and in acquiring skills in determining which technology and software can be utilised the most effectively to demonstrate their understanding of concepts and work required of them; skills that are becoming more and more important in the modern workforce (Lee & Levins, 2012).

BYOT also enhances personalisation of the student learning process, which increases student responsibility and gives them a degree of control in their own learning. This personalisation of the learning process is a foundation for inquiry/enquiry, authentic and project/problem-based learning (Bransford, et al. 2001; Dweck 2006). Where student's interests and preferred learning styles are taken into consideration by teachers and the learning community, students are presented with diverse options in how they present and communicate their understanding of concepts and knowledge learned, which "triggers student interest, motivation and engagement in deep learning" (Alberta, 2012). It also promotes a shift in the role of the student in the learning process by making the learning more student centric by enabling personalisation, participation and productivity in learning (NESTA FutureLab, et al. 2004; Traxler 2010a; Alberta 2012), and makes learning more relevant to the student's life situation (Tinio, 2002).

Perhaps the greatest teaching and learning benefit that BYOT promotes where implemented well is transformational instructional change (Hobson, 2012) because it promotes the teaching of deeper concepts rather than formulaic "click here" as devices are different and the learning concept becomes the focus. It encourages teachers to not teach in a manner where they are asking students to rote learn using a particular piece of software, or to limit students to presenting their work in a particular format of using a particular piece of software. Instead it encourages natural differentiation where teachers empower students to demonstrate their understanding of a concept using a format of their choice, and if the BYOT model supports multiple devices, using the most appropriate device as well (Traxler, 2010a). Research in 10 BYOT schools across Australia, the United Kingdom and the United States revealed that teachers forced to work with a mix of technologies in a BYOT classroom are being "obliged logistically to leave behind the traditional mass teaching and adopt a significantly more personalised approach" (Lee & Levins, 2012). BYOT also encourages the "Four Cs" of education (Creativity and Innovation, Critical Thinking and Problem Solving, Communication and Collaboration) which are recognised as the "lifelong learning skills needed in the information economy" (DETYA, 2000a). Whilst hard to measure with traditional standardised assessment techniques, nevertheless include most of the sought after skillsets by prospective employers. (Alberta, 2012).

Digital Citizenship and Ethics

With the increasing use of technology in education, schools have a growing responsibility to teach digital ethics and cyber safety alongside other personal development topics such as personal safety and hygiene, safe sex and road safety. The expectation is that digital ethics and cyber safety instruction will cover all

aspects of a student's digital footprint. However, in a non BYOT environment where personal devices are not permitted to be used within the school, there is a tendency in the teaching of cyber safety and digital ethics to focus on the appropriate use of school supplied devices (Traxler, 2010a). How do teachers effectively teach the appropriate and ethical use of a students' personal devices which are used daily by the student outside of the school when they are not permitted to be used within the school?

Accepting student personal devices in a BYOT environment introduces complexities with schools ensuring student's personal e-Safety because, unlike a school owned device, the school has limited to no control over the personal device. Whilst control mechanisms such as staff supervision and the promotion of the use of the school's filtered and monitored Internet connection over personal 3/4G connections, there is no way to guarantee that a student doesn't use their device inappropriately whilst on the school campus. Traditional approaches to managing unsuitable material on ICT devices has been to ban or confiscate the device, however it is behaviour that is the core issue, not the device itself which is actually the medium for showing unsuitable material. There are legal limitations in Australia and many other countries upon the authority of the school to confiscate personal items, especially outside of the classroom, where the item is not deemed to be a safety concern to the student or other students, and where the student does not consent. However most school policies allow for disciplinary action where a student doesn't abide by the school policies (Lawstuff, 2009; NSW DEC, 2012).

This highlights the requirement for an increased need for digital citizenship instruction across the entire school community, and banning devices fails to address both student learning needs and the core behavioural issue. It promotes a stronger focus on the appropriate use of all technology with supporting policies, and a requirement by the school to embed digital ethics pervasively throughout the curriculum. It also encourages a stronger partnership between the school and the parents, so that the school is actively involved in the ethics and values that underpin how the student uses their personal technology inside and outside the school. In many circles there is increasing concern about the growing disconnect between what students are doing with technology, what they are doing with it in the school, and what they are doing with it in the home (Ribble, 2011), and the deliberate inclusion of personal devices allowed by BYOT into the teaching of digital ethics and cyber safety within the school helps address such concerns.

BYOT Frameworks and models

The approach taken by schools to implement BYOT has varied greatly between schools, with each approach being determined by the educational, administrative and fiscal goals of the school, and the driving forces promoting BYOT. Dixon and Tierney (2012) promote five potential models, Alberta Education (2012) propose four distinct and one general hybrid model, whereas this paper proposes three general models (each having possible variations), with only one of these models fully allowing for the transformational instructional impact that BYOT encourages.

1. ***School defined single platform (i.e. mandatory iPad or specified laptop model)***

   One of the most common models of BYOT, especially in Australia, is the requirement of every student to bring a device of a particular brand of laptop or tablet so that each student has the same device. The pros for this model are:

   - Allows for teachers to rely on each device being capable of running the same software versions in class
   - Allows students have the same platform and capabilities, ensuring that no student has an inferior device and devices cannot easily be used for social status.

- Allows teachers to only have to learn and support one type of device
- Allows the ICT Department to contend with the one device type, reducing the support requirements for connectivity to the school network
- Allows for standardised accessories (such as docks, chargers, AV leads, etc)
- Allows for the school (end therefore parents) to realise cost benefits by the negotiation of bulk hardware, software and support purchases

In many ways, this model is not much different to a tradition school owned 1:1 model, except that the ownership (and responsibility) of the device has been transferred to parents and students. This has the potential benefit of increasing the student sense of ownership over the device; however this depends very much upon whether the device is one that the student would freely choose if given the choice of device that best suited their learning style both at school and at home. In addition, many implementations of this model do not allow students to use any other personal device in the classroom, only the school mandated device, meaning that students cannot elect to use a potentially more appropriate tool, even if they own it. There is little to no evidence that such a model provides any learning benefits over the traditional 1:1 approach.

2. *No limitations (students can bring any device)*

This model became prevalent in some US School Districts as the impact of the Global Financial Crisis required school leaders and administrators to find new ways of providing students with technology in the classroom with significantly reduced ICT budgets. The pros for this model are:

- Allows students and parents have full choice over device
- Allows financially challenged parents to buy the cheapest possible suitable device
- Encourages teachers to focus on the learning, not the support of the device or the software
- Encourages many digital literacies as students work with multiple types of devices in a collaborative learning environment
- Promotes choice over which device or software is used to convey a student's understanding of a concept or topic
- Promotes understanding about the advantages and disadvantages that each device has in a particular learning situation

This model is pure BYOT, where students and parents have the option to bring to school any device that they choose with minimal restrictions imposed by the school. Whilst the potential benefits for learning are significant (as outlined above), there are some fundamental flaws with this methodology which have been highlighted by BYOT sceptics (Spiers, 2010; Stager, 2012). These issues are:

- Teaching and learning in the classroom can be limited to the weakest device in the classroom. Some device's (mobile phone) capabilities may not match the pedagogical requirements, thus resulting in students with inadequate devices not being able to engage or complete the requirements of the lesson.
- The range of technology in the classroom may be so great as to introduce considerable complexity to lesson planning, resulting in great teacher stress and anxiety
- Can promote inequality, where wealthy students have the latest and most powerful device(s), and students from poorer students have old, inadequate, and unsuitable devices.
- Can result in technology devices being used amongst students for social standing and status
- Is particularly prone to market and consumer forces, which can lead to students bringing a device that is not ideally suited to education.
- Can lead to a narrowing of the learning process where the vast range of devices leads to the basic use of ICT in the classroom, such as research, note-taking and basic communication because this is the only common denominator between devices.

- Can result in significant stress on ICT support and infrastructure due to the requirement to support multiple platforms and devices of varying age, quality, and educational suitability.

Reviewing the problems with this model, it is evident that it is very susceptible to market forces, consumerism and social hijacking. This can create a digital divide within the classroom, and unless implemented very carefully could lead to staff, student and parent frustration and create barriers to learning, instead of enhancing and transforming learning.
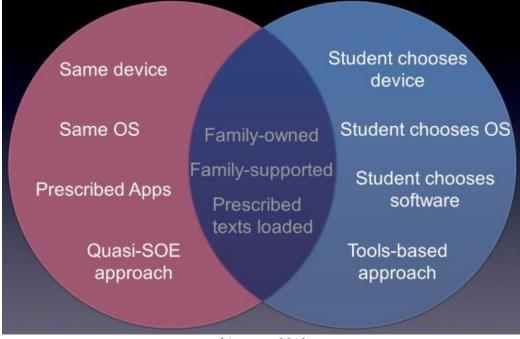
> *"If the rationale for a BYOD initiative is to support the concept that students should be able to select the digital tools they will use for their learning, there needs to also be some alignment within the school vision and mission about who makes the decisions around what, when and how the students learn. . . caution needs to be exercised to ensure that selection is based on pedagogical support rather than other uses (to listen to music or use as a phone) and, most importantly, price." (Dixon & Tierney, 2012)*

3. ***School defined minimum standard based upon hardware or functionality***

A hybrid model that sits between the school mandated and no limitation models is where a minimum hardware or software platform is chosen where students and parents can purchase any device that meets these requirements. Students can also bring additional devices such as a smartphone or tablet to supplement the primary device in most implementations. The pros for this model are:

- Allows students and parents have flexibility and choice over primary device, and full choice over supplementary devices
- Allows financially challenged parents to buy the cheapest possible suitable device
- Encourages teachers to focus on the learning, not the support of the device or the software
- Encourages many digital literacies as students work with multiple types of devices in a collaborative learning environment
- Promotes choice over which device or software is used to convey a student's understanding of a concept or topic
- Promotes understanding about the advantages and disadvantages that each device has in a particular learning situation
- Ensures that students have a device that meets a common standard, allowing teachers to plan lessons around this capability

The primary advantage of this model compared to the previous two is that it provides choice and flexibility of device so that students can choose a device that best suits their learning, yet it specifies either a hardware or functionality minimum standard to ensure that teachers have a dependable platform upon which to base their lessons, thus maximising the potential for the transformational instructional impact that BYOT encourages. There are still notable concerns, namely that students and parents may still choose a device based upon social standing, peer pressure, or non-educational uses. However this can be mitigated by the school constantly providing students and parents the necessary information to make an informed decision. Equity is also a significant concern as some parents; especially in low socio-economic areas may find it hard to provide their children with a suitable device. Interestingly, BYOT case studies conducted by Lee and Levins (2012) that included several schools from low socio-economic areas found that despite significant financial pressures, most parents valued their children's education highly and were able to source an appropriate device as required by the school's BYOT program.

Same device

Same OS

Prescribed Apps

Quasi-SOE
approach

Family-owned

Family-supported

Prescribed
texts loaded

Student chooses
device

Student chooses OS

Student chooses
software

Tools-based
approach

Arruzza, 2012

In determining a baseline specification for this model, it is imperative that the school leadership team clearly understand the learning processes that the technology will be supporting, curriculum requirements, communication expectations and content being accessed and analysed. Whilst many schools employing this model specify minimum hardware standards and not minimum functionality requirements, hardware specifications should be a direct outcome of the known functionality expectations that the technology needs to provide for the student in all subject disciplines.

Ultimately, despite the concerns, a BYOT model where the school specifies minimum hardware or functionality requirements is the only model that provides more authentic learning by increasing student responsibility and giving them a greater degree of control over their own learning, whilst also providing a technology platform that ensures that the minimum device is capable of adequately supporting the student's learning requirements. Successful implementation of this model is dependent upon other factors such as support structures (technological and financial), infrastructure and teacher professional learning which are addressed later in this paper.

Professional Learning

Whilst the benefits that BYOT bring to the design of instruction and learning has been shown to lead to improved student and teacher collaboration in the process of learning (NESTA FutureLab, et al. 2004; McLoughlin & Lee 2008; Traxler 2010a), it does require many educators to change and normalise the use of digital in their teaching for it to be transformational. Teachers need to realise the digital pedagogies of collaboration, personalised learning (giving students control and ownership of their own learning), and how to use ICT as an avenue for enquiry/inquiry based learning and constructing authentic outcomes. Whilst this is not unique to BYOT, the greater focus on student personalised learning and holistic 24/7 learning is a point of differentiation between BYOT and traditional 1:1 programs.

> *"Mobile (and personal) devices are defining and supporting new communities and their aspiration, attitudes and idioms must be understood and addressed if they are to have parity of access to … education. These transient and mobile communities have their own norms that determine what is acceptable. Such norms might govern etiquette, taste, language, values and ethics, and educators must understand these in order to work effectively within these communities"* (Traxler, 2010a).

Any implementation of BYOT requires that there is already in place a movement from a teacher centric and paper based model to a student centric and increasingly digital based environment, and a readiness by teachers to embrace the opportunities, challenges, attitudes and idioms that BYOT brings. Teachers need to understand the educational benefits of student coloration, student/teacher collaboration, and collaboration within the teaching community itself and the culture of learning that it promotes. Critical thinking routines, peer collaboration, team teaching and designing classroom instruction around higher ordered thinking needs to be taught to teachers who have never been exposed to this type of instruction and it should be modelled through Teacher Professional Learning Circles on a regular basis. More practical skills such as how to produce an assessment based on collaboration, designing creative and /or problem solving tasks, and communicating evidence of learning using digital formats are also essential (Dudgeon, 2012).

A detailed look at effective Professional Learning models and strategies is outside the scope of this paper, however due to the critical importance of teachers in the support of digital pedagogies with BYOT it requires a brief mention. In many schools there is common misconception and culture that teachers must be "sent" on Professional Learning or Professional Learning happens during student free days, when research indicates that both methods are often mostly ineffective. Cohen and Hill (2001) argued that the most effective teacher training experiences were when the training was immediately relevant to upcoming classroom instruction. Showers and Joyce (2005) found that the impact of teacher training was substantially higher when the training was just-in-time within small coaching teams and study groups, and Tondeur et al (2011) found that there was increased meaningful use of ICT within the curriculum when professional development focussed on one-to-one to support, role modelling, scaffolding, peer collaboration and peer support. Transformational instruction routines made possible by BYOT requires many schools to rethink their Professional Learning model and subsequently implement a restructure to provide more relevant, authentic and just-in-time training regularly throughout the school year.

Access and Infrastructure

Infrastructure that supports the connectivity of technology is crucial to the effectiveness of any school technology program. It is especially so for a BYOT program where added complications such as lack of control over devices and a multitude of different hardware and software packages increases the complexity in creating an infrastructure to support different student technologies. Each student device has to seamlessly connect to the infrastructure reliably, be able to access digital resources at sufficient speed, and have security protection systems to protect it from other potentially compromised student devices. Consideration for the user experience is critical – it isn't practical for users to have to constantly input usernames and passwords to finally get access to a resource, or have to always change settings between school and home to get Internet access, or make configuration changes to their device to make it work in a way it wasn't designed to just so it will work at school (i.e. proxy settings in an iPhone, iPad or Android device).

The design of the infrastructure needs to be determined first and foremost by the school's vision for learning and desired outcomes. "Schools need a roadmap of where they want to go pedagogically before they can put in the infrastructure to get them there" (Alberta, 2012), and from this emerges not only the school's understanding how personal devices can most effectively be used educationally, but also the learning experience that the school wants the community to have with the personal devices. The infrastructure (both technical and BYOT framework) must account not only for the wide variety of devices currently available to students, but also for emerging technologies. School leaders and ICT teams need to be able to understand and identify emerging technological trends and their potential within education, so

an understanding of megatrends as identified by publications such New Media Consortium's annual Horizon Projects is critical.

Support infrastructure and services offered is also crucial. Whilst the responsibility for the device may rest with the student and parents, effective teaching and learning requires all students to have ubiquitous access to technology in the classroom, so having a student without a device due to hardware or software issues will impact classroom instruction. Schools implementing BYOT effectively must not abrogate their ICT support responsibilities – there needs to be a system and process in place to support students in the event of a problem with their device, and to ensure that students have a device in the classroom if theirs is unavailable due to technical issues, theft, etc.

Refer to Appendix B for infrastructure recommendations to effectively support BYOT in education

Equity

Unlike a school supplied mandatory 1:1 program where the technology device is supplied as part of standard tuition, in a BYOT environment it is the parent's responsibility to provide a device for their child. A major concern for school leaders is the ability of parent's in low socio-economic areas to be able to provide a suitable educational device for their child, despite BYOT case studies that suggest that despite significant financial pressures, most parents value their children's education highly and are able to source an appropriate device as required by the school's BYOT program (Lee & Levins, 2012). In the event that a student is not able to bring a device due to socio-economic issues or parent resistance, the school (or education department) ultimately has the responsibility for each student's education, and the responsibility to have a policy, process and infrastructure to provide adequate resources for disadvantages students. At the very least, this means the provision of school-owned devices on a rental/loan basis at a low to no cost basis for families cannot afford them.

Equity is not limited to access, but can also manifest itself in the type of device and access to the Internet. Students at home with slow, unreliable or no Internet connection will be significantly disadvantaged in 24/7 learning compared to other students, and whilst government initiatives such as the NBN are to be commended in addressing this issue for most Australians, the benefits for many will not be realised for many years until the NBN is complete. There is also inequity in the ability of different students to be able to choose the most appropriate device for their learning, especially in the light of peer pressure, social rivalries, and a lack of understanding of their learning style which for younger students is often related to their underdeveloped ability to think critically (Piaget, 1952).

Conclusion

With both New Media Consortium and Gartner predicting that BYOT will be the technological model for the vast majority of secondary schools within five years, schools need to assess their vision for learning and their adoption of digital pedagogies to ensure their readiness. In doing so, schools need to communicate clearly with all relevant members of the school communities - teachers, students and parents. Doing so will establish a learning platform that makes it possible for "student learning outcomes that are broader, deeper, more relevant, more complex, and more creative than we could ever imagine" (Olsen, 2012) based upon an assumption of trust and not mistrust in students and the wisdom and guidance of teachers.

APPENDIX A: Definitions

BYOT: Bring your own technology (BYOT) is an educational development and a supplementary school technology resourcing model, where the home and the school collaborate in arranging for students' 24/7/365 use of their own digital technology/ies to be extended into the classroom, and in so doing to assist their teaching and learning and the organisation of their schooling and, where relevant, the complementary education outside the classroom (Lee & Levins, 2012).

BYOD vs BYOT: In many cases, these terminologies can be used interchangeably and mean the same thing in everyday use and in research. There is a growing trend that views the 'technology' aspect of BYOT as covering more than just the 'device' of BYOD (for example the software on the device as well as just the hardware). A distinction that has been promoted by some (Fisher, 2001; Lee & Levins, 2012) is that BYOD is more of a focus to provide student technology in schools whereas BYOT focuses more on the use of the student's technology to transform learning in both the home and school.

APPENDIX B: BYOT Infrastructure recommendations

These recommendations are outside of the scope of this paper, yet are frequently asked questions by schools considering implementing BYOT and are therefore included to provide assistance in providing a robust, flexible, seamless and supportive infrastructure. These are high level recommendations, and each school should consider their learning vision, sustainability strategy and available resources in considering these recommendations.

Connectivity and Wireless: A rugged wireless infrastructure is critical in ensuring reliable connection by student devices. A commercial high quality wireless solution that is designed to support large numbers of devices is imperative, and should be supported by a reliable cabled network with the necessary infrastructure to support all of the student devices. To support 24/7, anywhere/anytime learning, as much of the school campus as possible should have wireless coverage.

In order to support all student devices in a classroom, at least one access point is recommended per classroom, and all wireless access points should run both 2.4Ghz (802.11b/g) and 5Ghz (802.11a) to minimise interference. Due to the importance of this infrastructure component, it is highly recommended that schools engage an IT solutions specialist with educational sector experience to design the wireless network and supporting network infrastructure as well. Where possible, the wireless system should be designed to accept the loss of a few access points or wireless controller with minimal impact to access.

Bandwidth: "High bandwidth communication services (are) fundamental to all schools (in) realising the educational, management and administrative benefits of technological change" (MCEETYA, 2003). To support 24/7 learning and cater for the high bandwidth demands of BYOT devices, significant investment should be made by schools into obtaining the highest bandwidth feasible. A recommended minimum for a medium school (600-900 students) is 100Mbps. Compromises in bandwidth will result in slow and unresponsive online applications which will impact classroom instruction and cause student and staff frustration. It will also encourage students to use their own, unmonitored and unfiltered 3G/4G connections instead of the school network.

Access control and monitoring: Regardless of whether schools adopt an open Internet or heavily filtered policy and approach, all schools have a duty "to ensure that reasonable care was taken with respect to the (student's) safety" (Romel El-Sheik v Australian Capital Territory Schools [1999] ACTSC 90 at 91; cited in Bassett, 2001). To ensure a seamless experience, the use of a transparent proxy where student devices require no special configuration is essential. In addition, it is preferable that the student user and/or device is identified to the proxy by a prior authentication mechanism, such as the student's wireless connection to the school network to prevent authentication prompts which can prevent background applications (such as mail notifications) from operating until the student requests a web page at which point authentication is requested.

Security: In a BYOT environment, despite a student's acceptance of an Acceptable Use Policy that requires students to have software and anti-virus systems kept up-to-date, their personal ownership means there is no easy way for the school to enforce this requirement. Student personal devices should be considered as "untrusted", and treated and placed behind a firewall in the same manner as all other traffic originating from the Internet. In addition, student devices should be segregated from other student devices to prevent unauthorised access and hacking from other students or virus or malware outbreaks. Commercial grade wireless solutions have the ability to prevent peer-to-peer communications over wireless (i.e. all devices attached to a wireless access point can only talk to the access point itself and nothing else), and this should be enabled in BYOT for security reasons.

Applications and Cloud Computing: One of the main difficulties in a BYOT environment is the lack of standardised applications that teachers can utilise in classroom to perform specific instructional tasks. Online application platforms such as Google Apps and Microsoft Office 365 provide access to common web based applications across a wide range of student devices. Other technologies such as Virtual and Remote Desktops can allow the school to deliver most school applications virtually over the Internet or school network, allowing teachers to use these for specific learning tasks or allowing students to use choose from a wider variety of software to demonstrate their understanding of a concept. This is also a way of minimising the software licensing costs of parents, as the cost of this software is borne by the school.

Cloud Storage: Schools are able to utilise the online storage services of Google, Microsoft Live, Dropbox and other online providers for free for students and staff. Nearly all of these services provide applications, or have third party applications available, that allow data saved to a local device to be automatically backed up to "the Cloud". Utilisation of these services is an easy way of creating an automatic backup solution for students.

Learning Management Systems and Web delivery of content: An important consideration with BYOT is content delivery across a wide variety of devices. The HTML standard of the Internet is the only way to be able to deliver the same content in a similar format to all devices under a BYOT program. The use of a Learning Management System as the central repository for class and course based material, discussions, online assignments and assessments, maximises the effectiveness of online learning in a BYOT environment.

Technical Support: Technically speaking in a BYOT program, the responsibility for the BYOT devices rests with the student and parents. However, the impact of a student not having a workable device within the classroom or other learning environment is considerable, and schools should implement strategies to ensure that students always have a suitable device for learning. Schools ideally should provide the following support services for students:

- Clear documentation for students and parents informing them of the support services available from the school to assist them with their digital learning
- Technical support to assist with wireless connectivity, and any basic connection issues in getting to online resources.
- Spare devices that meet the minimum requirements. These should be available for students to borrow at short notice in the event that their device has an issue that requires repair and is preventing them from using in class. The loan should be for the period of time required by the student and family to get their device repaired.
- Recommended devices and pre-negotiated deals with school preferred resellers for devices with suitable specifications and service agreements to assist students and parents in buying a suitable device. This should also include advice to assist students in determining the best device for their learning style.
- A service centre at school for school preferred resellers. This allows students who purchased from school preferred resellers to get their laptop repaired onsite at school by authorised technicians organised by the reseller. The student or parent contacts the reseller directly to organise the repair, however the repair is done at school for the student and parent's convenience.
- Whilst any recommended device should have a battery that has a genuine battery life that lasts for a school day (6+ hours), there will always be battery charge issues. Place secure recharging stations in strategic locations around the school to allow students to recharge their batteries during recess, lunch, free periods, or periods where the device is not required. Students would need to either bring their chargers to school, or keep a spare charger in their school locker. Spare devices should be loaned where a student has a flat battery and require ICT access in class.
- All students require secure, lockable lockers to store their devices in when not at class

Equity and Financial Assistance: In a BYOT program, the reality is that some parents will either not have the financial means to supply an appropriate device, or won't value the potential that the ubiquitous technology access will have on their child's learning. In either case, schools and/or education departments should have a pool of suitable school owned devices that can be lent to students where they cannot supply their own device. A comprehensive policy and process needs to encompass this, especially in dealing with parents who have the means to provide a device yet elect not to provide one for their child. In the Independent sector this is somewhat easier to handle, however in government schools there would (in Australia) ideally be a federal government tax levy (like the Medicare levy and passed onto the state governments) for parents with the financial means to provide the appropriate technology for their child's education but elect not to.

True technology integration requires one-to-one access to technology in classroom, and true collaboration does not occur with two students sitting at one laptop. It occurs with students collaborating, connecting, inputting, analysing, discussing, and interacting simultaneously using their own learning devices, not one at a time or with shared resources (Neilson, 2007). Thus it is imperative that in a BYOT model, there is a process in place to ensure that all students have a device and that no child is left behind.

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