

## **An investigation into how growing accessibility and interactivity in ICT is being managed in schools both in New Zealand and overseas.**

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### **Acknowledgements**

I would like to thank the following teachers who willingly gave of their time to talk and spend time with me or who pointed me in the right direction for information: Diana Maskill, Max Riley (Nayland College), Mark Quigley (Orewa College), Brian Wynn (Takapuna Grammar School), Mark Osborne (Albany Senior High School), Deidre Shea (Onehunga High School), Helen Jones (Wellington College), Diane Henjyoji (Wellington Girls' College), James Cheeseman (Concord High School), Jayne MacMaster, Steph Ward, Caroline Paget, Russell Varnley (Sydney Secondary College – Leichhardt Campus), Mark Egger (St Ignatius' College), Charles Ealham (Cornwallis Academy).

### **Executive Summary**

My sabbatical was a chance for me to see how other schools use ICTs here and abroad. I had a wide ranging number of issues that I wanted to explore but as I ventured on my journey, I realised more and more that an impending massive change in schooling that can't be ignored is almost upon us. It is impossible to look into the future and not see inevitably that some form of Bring Your Own Technology (BYOT) will be a part of every school, and that the movement away from the paper-based paradigm is occurring at a rapidly increasing rate. Mal Lee and Martin Levins (2012) argue that schools will "normalise the technology's everyday use, begin to genuinely collaborate with students' homes and to start using a form of BYOT as they recognize the wisdom of integrating the approach into their operations." It is a matter of "when it will happen, not if." Many considerations need to be made before a BYOT approach is implemented and I spent time in schools and talked to teachers about the work they were doing and the approach that they were taking, and I found a wide range of results which I have detailed in this report. Complementing this are many interesting approaches that schools have to using the technology and the ever increasing, wide range of tools being integrated into the classroom. I have provided information on some of these tools here. Further, I believe that schools need to abandon their current model of funding ICT and direct money towards BYOT in order to address the inequities inherent in the model. In other words, schools that are on a continuing cycle of upgrading computer labs need to downgrade these (with the exception of specialist labs) and direct the money to ensure there is equity for all. This would mean spending the money to supply technology to students in need as appropriate. Finally, schools need to genuinely collaborate with home and embrace the tools that are naturally being used in the student's environment. This means facilitating school environments that are platform independent, with a range of growing cloud based services and founded in network and wireless technology that is robust and reliable.

This report, by its very nature, cannot be as comprehensive as some of the articles I have referenced but hopefully it may stimulate the reader's interest to investigate some of the references I have made.

## **Rationale and Background Information**

When I applied for my sabbatical my application said that I wanted to investigate the following:

- 1) The growing use of netbooks / laptops and mobile technologies in the classroom. How are they being used and what constitutes 'best practice' in terms of effective use of mobile technologies in the classroom? What are the possibilities?
- 2) Blended learning environments and asynchronous learning environments. What are the implications of internet 'resources' such as khanacademy.org, the range of MIT courses, comprehensive applications such as mathletics, and environments such as the virtual learning network to the modern classroom environment? What is the role of the teacher in such an environment when students can access whole course materials online?
- 3) What role does assessment play in an online environment and what are good models for assessment? This was also in light of a trial of the use of the internet in examinations in Denmark.
- 4) What considerations do I need to make as a school leader in terms of wireless infrastructure?
- 5) Laptops have been given to all students in schools in year 9 in NSW since 2009. This means that every students from year 9 to 12 in NSW schools now has a device that they can use at school every day. What has been their experience and what lessons could be learned?

I haven't been able to answer all of these questions in this report. In approaching each of these questions with the schools that I visited and spoke to I found myself reaching the same conclusion that in some way in every school, each teacher and school leader were readying themselves for BYOT at a future date. In some cases they weren't really aware of this. At the same time, at the ministry level in New Zealand, three significant changes have and are occurring that will facilitate the move to a BYOT approach. These three changes are the New Zealand Curriculum (NZC) formerly adopted by schools in 2010, the Ultra Fast Broadband (UFB) roll out and the National Education Network (NEN) which are both in progress. What follows in this report are my observations of how schools are making the preparations for BYOT and how this has improved my own and my schools' readiness to implement a true BYOT approach to schooling.

## **Methodology**

When I was awarded the sabbatical, the idea of presenting a comprehensive report on the questions above seemed very daunting. I was awarded a term off but I decided to spend whatever opportunities I had during the year to collect information, visiting schools when I could, conversing with school leaders and teachers who use technology (and some who don't), taking advantage of the PD opportunities that were available to me, and reading. Obviously, this is a broad area

and one in which a lot of 'just in time' learning is occurring all over the country. To compile this report I undertook the activities outlined below.

### **Professional Readings**

The focus of my professional readings has been one-to-one computing, Bring Your Own Technology, and tools to improve student engagement.

### **At the coalface**

New Zealand provided me with opportunities to visit and converse with teachers and school leaders from the following schools: Nayland College, Orewa College, Takapuna Grammar School, Albany Senior High School, Epsom Girls Grammar School, Onehunga High School, Wellington College, Queen Margaret College, Wellesley College. I was also able to visit and converse with teachers in the following Australian schools: Concord High School, Sydney Secondary College (Leichhardt campus), and St Ignatius' College, all in Sydney. In addition, I spent time in England where I was able to visit Cornwallis Academy in Kent and South Thames College in Wandsworth.

### **PD Opportunities**

During the year I attended the following courses:

- Torque IP BYOD seminar – February 22
- Powering the Digital Classroom - March 29 online seminar
- Interface Xpo – May 18
- Wellington Loop ICT Leaders event – June 7

## **Findings and Implications**

### **Professional Readings**

I have included some of my readings at the end of this report but 3 key readings and a brief summary are included here.

#### **Bring Your Own Technology – The BYOT Guide for Schools and Families – Mal Lee and Martin Levins. First Published 2012 by ACER Press, [www.acerpress.com.au](http://www.acerpress.com.au).**

I believe that the term BYOT, Bring Your Own Technology, may have been coined by Mal Lee and Martin Levins in their extensive guide. They use the term BYOT to include laptops, netbooks, tablets and mobile technology. "Bring Your Own Technology" is a guide for schools and families and is essential reading for all school leaders. Lee and Levins profile various schools in Australia, England and the US and their journey towards BYOT. Lee and Levins offer the following definition of 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 and Levins recognise that " the in-school use of the students' digital technology is an extension, a flow-on development from their existing use of that technology to

assist their self-teaching and learning". Students already surround themselves with so much technology and schools will not be able to continue to shut out "the real, networked world". Additionally, "developed nations have never had such an educated cohort of parents or one that has largely normalised the use of the digital in their lives." They also propose that schools allow parents to determine the personal technology that each student will use rather than dictate a particular model. Doing so is putting trust in the parents and students helping build the relationship between the school and home and allowing the student to use the technology they are already using at home. For schools to be ready to implement BYOT, they identify five "key readiness factors:

- Normalised use of the digital (at home and at school)
- Genuine home-school collaboration
- Principal's leadership
- Appropriate infrastructure
- Champions."

**One-to-one computing programs only as effective as their teachers by Meris Stansbury - February 16, 2010 (7:27 am) in eSchool News**

<http://www.eschoolnews.com/2010/02/16/11-programs-only-as-good-as-their-teachers/>

The title of this article is probably common sense but this article includes studies in US schools and commentary from a German school teacher. The article suggests that a BYOT programme will only be as "successful as the teachers' 21st-century classroom practices" and emphasises project based learning, something I was very impressed with at Leichhardt (see below). I appreciated the words of Pamela Livingston, the author of "1-to-1 Learning: Laptop Programs That Work" and an education technology analyst for Edison Learning and adjunct professor at Chestnut Hill College in Philadelphia and the University of Massachusetts-Boston. She says the key to programmes that work is that "they have nearly all given laptops to teachers first, sometimes a full year ahead, so teachers can use the laptops and begin developing curricular possibilities. They have done a serious look at issues of infrastructure (network, electricity, wireless plan) and considered logistical issues (carrying cases, insurance) and formulated good policies and procedures." Finally, the article makes reference to an online readiness tool developed by an IT Solutions provider called CDW-G which can be found at

[http://www.surveymonkey.com/s.aspx?sm=ayLSzFXibo3dw\\_2fozq9qwbA\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=ayLSzFXibo3dw_2fozq9qwbA_3d_3d).

Perhaps something similar could be developed for New Zealand schools. In the words of the article "the online tool helps school leaders assess the technical and cultural readiness of their school's environment for a 1-to-1 program, helps them identify critical success factors they might not have considered, and provides specific, next-step recommendations to reduce risk and time-to-launch."

**Does digital immersion improve students' digital literacy skills? By Jacqui Land (2012) in Computers in New Zealand Schools Vol 24 No 1 and at ,**

<http://education2x.otago.ac.nz/cinzs/mod/resource/view.php?id=272>

This is a home grown article that compares two groups of year 9 students, one immersed in a 1-1 technology model using a tablet and the other with standard pen and paper methods. Jacqui makes some interesting comparisons between the two

groups but concludes with offering findings that concur with another study that suggests that “parents and educators should encourage children to use technology in an active way through creation and communication, and moderate the amount of consumption behaviour to a minimum”.

### **At the coalface**

**Nayland College** – Diana Maskill (e-learning facilitator), Max Riley (Mathematics)

In 2012 Nayland trialled a BYOT class at year 9 representing about 25 students out of a roll at year 9 of 200. Minimum specifications were issued and students were invited to bring in either a netbook/laptop/tablet. Four core teachers of English, Mathematics, Science and Social Science were chosen in 2011 and some PD was supplied. Their approach to PD was a self described “trying, failing approach” and in hindsight they would have liked more help with “how the technology will affect the teaching practice”. Filtering and monitoring internet traffic is a problem at this stage as students go straight out to the internet without any monitoring but there is a plan to manage what students access. They describe messaging and Facebook as a problem. They use Moodle as their LMS (although this is not yet school wide) and the google apps environment. Other applications include [cool.school.nz](http://cool.school.nz), and a home grown mathematics site <http://maths.nayland.school.nz> that has enormous potential as an online, free, truly collaborative site that is a credit to its creator, Max Riley. One would describe Nayland at the early stages of BYOT and in terms of Lee and Levins’ 5 key readiness factors they are meeting aspects of all of them with the normalising of technology at home and at school, a level of home-school collaboration, leadership from the top that supports BYOT, infrastructure that is coping at present, and definite champions of the initiative.

**Takapuna Grammar School** - Brian Wynn (Deputy Principal), Steven Mouldey (Social Sciences)

Students are invited to bring in their own device and connect to the wireless network. Ruckus wireless is installed throughout the school and roughly 375 students out of 1600 connect on their own devices. In addition, 75 more students do so through CoWs. They expect these numbers to grow. Their LMS is KnowledgeNet and students can access a range of applications using SSO such as google docs, YouTube, eTV and a local video conferencing solution called FaceMe. FaceMe allows the school to employ a teacher in Perth who mentors maori students and is also used to communicate with school children in Korea.

Takapuna Grammar are part of the NEAL loop and successfully applied for \$300,000 for PD which takes place on a Wednesday morning and is an integral part of their journey. They have implemented a VOIP solution where all staff have been issued with headsets that are connected to their computers (“we are in the business of communicating”) which has brought a significant cost reduction. Takapuna share server capacity with Belmont Intermediate and are a cross platform school hosting 100 TELA laptops of which half are HPs and half are Macs. When I spoke to Brian he interestingly said that the school had a background of an IT administrator who had controlled everything. Brian had wrested this power from him – one of the necessary changes that needs to occur for a BYOT approach to be realised.

Takapuna are forging ahead with BYOT and expect the uptake of the technology to increase hugely over the next few years. They are installing technology that will allow every student in the school to connect wirelessly and they seem well placed with strong leadership from Brian.

**Albany Senior High School** – Mark Osborne (Deputy Principal), Mike Nahu (Social Sciences)

Anyone who has visited ASHS would know that its architecture doesn't support the old school model where a classroom is a separate domain. The school has a very open learning environment so a traditional model of network infrastructure doesn't work. However, the school still has 280 hardwired computers which are linked to 3 physical onsite servers which are virtualised. In addition, traipse wireless is installed campus wide to cater for the approximately 1/3 of students (250-300) that are currently bringing in their own technology. Devices are used "when needed depending on the content or topic". The physical environment and the teaching and learning environment enable a high degree of collaboration in the "classroom" and google docs is highly used. The high degree of collaboration also means there is a large amount of informal teacher learning and PRTs feel particularly supported through high levels of passive supervision which are not apparent in the classroom silo model.

ASHS's attitude to the technical environment is that if "something doesn't need to be on site then it isn't". Teachers and students connect to two separate wireless networks and little is blocked although the student network is locked down for P2P file sharing. ASHS embraces a large suite of open source software such as Google apps, Moodle, My Portfolio, Koha library management system and Wiki Educator which are all hosted off site. They have their own video server (OurTube) and a print server on site although students do not print from the wireless network. In a place that has clearly embraced the technical environment that is needed to enable 21<sup>st</sup> century learning, Mark emphasised the importance of writing. To this end, ASHS provides assessment weeks throughout the year when students "...write until it hurts". This is a skill that needs to be built and "not to be confused with learning". ASHS are a part of the NEAL loop which has provided "good PD and cheaper internet". Interestingly, the school has no Deans as learning communities with a tutorial and pastoral focus prevail.

ASHS are also embracing a true BYOT approach and although they haven't mandated it, are well placed for all students to be connected in this way in the next few years.

**Onehunga High School** – Deidre Shea (Principal)

Onehunga is a large school of 1500 students. Their network size is about 300 PCs with no Macs and every teacher has a laptop. Hard wired computers are generally organised into 'pods' (eg Science has a pod of 15, Art has a pod of 25, etc). There are small wireless clumps and there is no BYOT plan at this stage. They are "thinking about BYOT" but Deidre says it is a "difficult decision" as she is concerned about "the equitable provision of devices for all students". Deidre identifies Science as high performing in the area of technology and says there is a core group creating communities of influence within the school. Onehunga have recently adopted Ultrahub as their LMS and one of the Associate Principals is leading a curriculum

group charged with the implementation of the Ultranet roll out. Deidre identified to me that three of the SMT are strong drivers of ICT within the school. Onehunga cite the problem of equity as a barrier for a BYOT model at this stage, yet they support the idea of BYOT. It would seem to me that the sheer cost of upgrading a network with 300 PCs is money that could be used to address the equity problem with a consequent 'downgrading' of labs. However, community consultation will need to take place and a clear plan needs to be established as to how the college wishes to proceed in this area.

**Orewa College** – Mark Quigley (Deputy Principal)

Much has already been written in the public domain about Orewa's ICT philosophy, some of it incorrect. Orewa started a BYOT programme in 2012 requiring all their incoming year 9 students to bring a device. Out of a year 9 roll of 320 students, 22 bought android tablets, 40 bought netbooks or laptops, 6 were issued with a school owned netbook and the balance have iPads. On any given day, approximately 650 devices connect to the student wireless VLAN (again, teachers connect to their own wireless network). Orewa monitor the wireless traffic and cripple wireless speeds for students who get off task (I quite like this idea!).

Orewa have embraced the concept of BYOT at year 9 in 2012 and implemented it in its truest form 'normalising' the use of the same technology at home and at school.

**Wellington College** - Helen Jones (IT Services Manager)

Wellington College have been busy in 2012 putting in infrastructure to support students who wish to bring in their own device in 2013 and training teachers. Helen said that teachers felt "ready" and staff themselves bring in lots of different devices. WC have been using Websense to monitor and filter internet traffic but have recently moved to Sonicwall and this has made a huge difference to connection speeds. Helen would like to see BYOT embraced in 2013 and feels one way of doing this is downgrading existing computer labs, in a sense, forcing the issue. Wellington College belong to the Wellington loop and Helen also suggested that a well coordinated programme of PD around BYOT would be very useful for all the schools on the Wellington loop (and several are currently moving to BYOT models).

**Wellesley College** - Ross Hampton (Head of E-Learning)

Wellesley College is a private school catering for students from new entrants through to year 8. They decided to implement a 1-1 computing programme in 2012 at years 6, 7 and 8. There was plenty of thought put into the device to be chosen and the main factor was that they wanted something small that would be able to be transported home. The iPad was rejected because of problems running flash (which was required for mathematics – although this has since been rectified with a mathematics app). Android tablets were chosen with a cover and a keyboard connecting by USB. Options were available to purchase or lease and most were purchased. The cost was about \$1,000 and there was 100% buy in. I know as a follow up to this that Wellesley are looking at what other alternatives they can offer parents as they are not 100% happy with the android tablets that they recommended. Perhaps they will put the power back into the hands of the parents and students and engage their involvement in the decision making process.

**Concord High School, Sydney** – James Cheeseman (Head of English)

Concord High School is a coeducational high school in the inner west of Sydney catering for about 850 students from years 7 to 12. All students from year 9 to year 12 have a laptop under the New South Wales (NSW) government scheme that was introduced in 2009. The school is fitted out with Aruba wireless throughout the campus as this was also a part of the roll out as was the provision of a technician with responsibility for the network. Next year will be the last year of the laptop roll out and they are not sure what they will do after that. Laptops were mainly used for research purposes but James liked the Adobe Captivate tool.

James told me an interesting story about the roll out of the laptops and the PD that was associated with the roll out. He said that a lot of good PD was offered with Adobe Creative Suite a particular focus but when the Lenovo 11.6" netbooks arrived they weren't powerful enough to run programmes such as Photoshop. The machines that students have now are better but still struggle with more sophisticated programmes.

**Sydney Secondary College Leichhardt Campus, Sydney** - Jayne MacMaster (Head of Teaching and Learning), Dave (computer technician), Caroline Paget (Science Teacher), Russell Darnley (Computer Coordinator, Social Sciences), Steph Ward (English)

The Sydney Secondary College at Leichhardt is a coeducational school that accommodates students from years 7 to 10. Like Concord High School, there has been a laptop programme in place in New South Wales since 2009 so all students in years 9 and 10 have laptops. Aruba again provided the wireless which involves 50 Access Points (APs) and extensive reporting. All connections to wireless are at 5GHz which means there is no interference and no drop outs (which can much easier result from 2.4 GHz connections). All internet traffic statewide goes through Department of Education and Training (DET) servers so filtering and monitoring is done at that level and schools have no control (the Department of Education and Training is our equivalent to the Ministry of Education). Therefore speeds are not as fast as they could be and students complain of speeds being much slower than home. Leichhardt use moodle as their Learning Management System although a few of the people I spoke to spoke of its one dimensionality and the 'clunkiness' of use. The use of moodle has diminished as other programmes such as edmodo increase in use. I was really impressed by an emphasis on creativity pervading all the work that teachers were doing with students at Leichhardt. For example, one teacher was using audacity for students to record voice overs for a mini documentary on coral reefs that they had been studying. Another group of teachers had set up an edmodo group for a project called Epic Adventures which was a cross curricular project involving English, Science and Social Science attempting to address engagement and literacy concerns. Students were given a book 'Epic Adventures' to read and then plan a news story. Students were then required to storyboard their story with a script and hopefully film the news story (although time constraints had meant that they were unable to film it). A neat tool for generating the storyboard is [generator.acmi.net.au/storyboard](http://generator.acmi.net.au/storyboard). Edmodo was also used in creating class groups and sharing resources of a collaborative nature. For example, mind mapping software was used to tease out a perfect response to a an essay type assignment



with the students in a whole class setting then made available for download through edmodo.

Leichhardt have learned to work with the limitations inherent in the devices students have and have sought as many web based software applications as possible.

**St Ignatius' College, Sydney** – Mark Egger (teacher of English and Drama)

St Ignatius' College is a private catholic boys school located on Sydney's north side catering for students from years 5 to 12. All their students from years 9 to 12 have a laptop and the laptops are widely used. Mark was enthusiastic about the use of the laptops and the benefits they had provided for his teaching. For example, in Drama the laptops were good for improvisation ideas while in English they were a good tool for peer assessment. Mark also found he was setting homework (readings, etc that previously would have been done in class) in anticipation of the next day's work freeing up class time for discussion. I had spoken to Mark a few years ago and he had mentioned a member of the IT staff who was quite obstructive and myopic in his vision for ICT – a potential pitfall for a school pursuing BYOT.

All of the Sydney schools face the same problems in terms of BYOT in that a central body (the Department of Education and Training) control the purchase of machines, infrastructure, PD and monitor and filter all internet traffic. Although such a solution is well meaning it also has obvious problems as outlined by the PD story related to me by James at Concord High. The three schools weren't clear on the future direction of BYOT in NSW schools as next year was to be the last year of laptop roll outs. Perhaps the DET have been reading Lee and Levins and have decided to devolve more power to schools in making these decisions from 2014 onwards.

**Cornwallis academy, Kent, England** - Charles Ealham (Director of New Technologies)

Cornwallis academy is a coeducational non denominational school located in the Kent countryside catering for about 1700 pupils aged 11 to 19. Every student in the school has a laptop (Lenovo X220) which means that roughly 1800 laptops connect each day to the wireless network that is throughout the campus. In addition, there are 250 other network machines (Dell) hard wired in classrooms. All student laptops are imaged before the students receive them and they work in a very controlled environment with no access to social networking sites and YouTube. However, all students can access one school YouTube channel where teachers upload videos that they wish students to be able to access. The main use of the laptops is for applications such as Word and Excel and there is little collaborative learning through software use. The school underwent extensive renovations a few years back and each classroom is equipped with impressive AV equipment including projectors, large screen TVs and interactive whiteboards. There is no school library and research is done through 'google' with Wikipedia entries a common source. Interestingly, a new school building opened in July 2011 with learning plazas and open planning. Most notes in class are still done in books so there is no eportfolio software being used. The school does use Microsoft Sharepoint to store attendance, behaviour and achievement points for every student. Students and staff have accounts and work is being done to make this available to parents. Work is also being done to use

Sharepoint to make assignments available online and the school is looking at doing reports online in the future. Charles provided me with an extensive list of software applications that the school is currently using and these included a lot of software geared towards GCSE and A levels, much of it platform dependent, but also free applications such as Audacity, Scratch, Geogebra, Google Earth, Google Sketch Up, and Serif.

Cornwallis operate a very low trust, locked down model of BYOT. Rather than engaging with home on what machine would be most appropriate, they find themselves locked into a one for all model with multiple software agreements which are platform dependent. This raises the distinct and absurd possibility that many students are using a technology at school that is quite different to what they are using at home. So much for integrating the two and making education at home and at school a seamless transition!

### **PD opportunities**

#### **Torque IP seminar**

This was an opportunity to hear Sam Glikzman, who is a Director of Education Technology from Los Angeles, California, speak. I have included my notes from this session as it has been important in the crystallisation of my ideas in relation to BYOT (although Glikzman referred to it as BYOD). Glikzman spoke about the goals and challenges of 21<sup>st</sup> century learning environments starting from the breath taking statistics of 7 billion people and 5 billion cell phone plans (30% of these in the US being smart phone plans), that one out of every 8 people in the world has a Facebook account, and that kids spend on average 50 hours a week with technology. In addition, about 40% of younger teens (12-17) in the USA have smartphones, and 11% of the US population have a tablet computer. Supporting the views of Lee and Levins, Glikzman stated that real learning is happening anywhere, anytime through tools such as motutu, khan academy, Skype in the classroom, and ePals and one of our challenges is the critical thinking required to discern where to find information, how to know it's accurate, who wrote it and how to organise and categorise content. Glikzman stressed the importance of teaching critical thinking and making learning student-centred and experiential. He quoted Alan November, a leader in education technology, who wrote that "training teachers to use technology isn't the problem. The hard part is getting them to give up control."

Glikzman also challenged the notion of schools being the guardians of the technology used citing the following statistics:

- it took 22 years to sell 55 million Macs
- it took 5 years to sell 55 million ipods
- it took less than 2 years to sell 55 million iPads

then asking the question "how long will your equipment be relevant?"

Glikzman's preferred model of technology access is through BYOT citing the advantages of cost effectiveness, no repairs or maintenance, more engaged and motivated students, technology that is more robust, up to date and personalised and the greater accountability that comes with a learner bringing their own technology. Glikzman also stressed the need for BYOT programmes to be platform independent utilising tools that span different formats. The list I have created below are tools that Glikzman recommended that have a web presence and also a mobile app such as:

google docs/forms etc, Diigo (for data organisation), edmodo (a blended learning tool), posterous, edublogs, blogger (blogging), QR codes (for book reviews), Dropbox, cx.com and mozy (storage solutions), flickr (photo storage/organisation), pixlr (online photo editing), Evernote (presentation tool).

Gliksman's work supports the work of Lee and Levins in moving towards a model of BYOT that is platform independent and using software that translates across many different operating systems.

### **Powering the digital classroom**

This was an online seminar looking at one-to-one computing in the context of Project RED (<http://www.projectred.org>), a US programme looking at how technology can revolutionise education. The work being done here stresses the not surprising but crucial part that leadership plays in change and interviewed Barbara Rudolph, the Principal of Davis Intermediate school near Dallas, Texas who at the start of 2012 introduced a BYOD programme focused on 1 grade level. They decided to replace the school supply list with web 2.0 tools and currently have 30% of students using BYOD. She felt that there were 9 key implementation factors for a BYOD programme:

- 1) technology is integrated into intervention classes every period (my understanding of intervention classes are that they are normally for students falling down on basic skills eg reading, writing, numeracy)
- 2) change management leadership is by the Principal
- 3) students should be collaborating online daily
- 4) technology should be integrated into core subjects at least weekly
- 5) online formative assessments should be done at least weekly
- 6) a 1:1 student-computer ratio
- 7) virtual field trips at least monthly
- 8) students use search engines at least daily
- 9) Principals receive formal training in change leadership

### **Interface Xpo**

I attended many workshops at the Interface Xpo but the most useful of these was a session which explained wireless technology. The idea was proposed that in the future, all pervasive wireless networks will allow for wireless connections to follow from the home. My notes in relation to wireless networks are below.

Wireless networks have slower speeds than cable connections and are a shared service in that a wireless access point can only talk to one device at a time. The further away someone is from an access point, the weaker the signal and the slower the speed of data. Wireless networks operate on 2 wireless frequencies or bands: 2.4GHz and 5GHz. 2.4GHz is a frequency that is also shared with a multitude of devices such as microwaves, Bluetooth devices, remote control cars/boats etc, wireless home telephones, security cameras, school printers and CCTV cameras, to name some. Therefore, there is a lot more interference than at 5GHz. However, 2.4GHz has a longer range than 5GHz which can be a factor. Band steering on a wireless network will force some devices to connect to 5GHz if they are capable to improve the performance and balance the load on 2.4 and 5.

The next consideration is coverage. If coverage is poor, all users are affected, not just

those that are far from the access point. In fact, a lot of users connecting to low speed connections can seriously affect all the other users on the network. Therefore access points need to be strategically placed to give all users a similar experience and improve throughput for all. Considerations also need to be made for building materials in the placement of the APs.

In terms of the device, wireless standards are in place and the most recent of these is 802.11n which allows for connections at 2.4GHz and 5GHz with higher ranges and data rates than previous standards. Wireless standards inform the user about the speed of connection and the range that is possible. 802.11a connecting at 5GHz had a higher data rate stream than 802.11b (connecting at 2.4GHz) but lower range. 802.11g (connecting at 2.4GHz) had an equivalent data rate stream to 'a' and improved range on 'a' and 'b'. 802.11n is an improvement on the previous standards and the next standard 802.11x will allow for connections at 2.4GHz, 3.6GHz and 5GHz.

The next factor is spatial streams which are 'pipes' transferring data from the access point to the device. Each spatial stream can transfer data at 150 Mb/sec and enterprise access points are capable of 2 to 3 streams per radio. Therefore a dual radio AP with 3 spatial streams can transfer data at  $2 \times 3 \times 150\text{Mb/s}$  which is 900 Mb/s. The 802.11n standard allows for 4 spatial streams. Note that not all notebooks support multiple spatial streams.

MIMO is Multiple In Multiple Out and refers to the use of multiple antennae at both the transmitter and the receiver to improve throughput and range. Multiple antennae will improve the ability of the AP to get around corners. A problem with some Smart phones and iPads and other tablets is that to increase battery life they use low powered radios and due to lack of space, small antennae. This is one of the problems with the iPhone as the antennae wrap around the outside of the device and are therefore affected by the aesthetically pleasing metal rim that was a design consideration. Interestingly, this was argued about when the iPhone was designed but Jobs opted for aesthetics over practicality. Another consideration here is that aerials in notebooks and netbooks are optimised when the device is opened and the screen lid is facing upwards. This is more difficult with a tablet which will be in various orientations sometimes affecting radio performance and particularly so with smart phones which are put in pockets blocking radio signals.

All of this presents numerous challenges to school leaders in planning to install a wireless network meaning that in a true BYOT environment all of these considerations need to be taken into account. And all of this is before considerations are made about operating systems and internet browsers!

## **Conclusion**

An investigation into growing accessibility and interactivity in ICT led me to an investigation into one-to-one computing models and the transition to BYOT. It seems to me that schools are increasingly "normalising" the use of digital technologies in the classroom and beginning to fall into line with technology-rich home environments. But some have a long way to go! To move to a model of BYOT requires a substantial shift in thinking and resourcing. It is absurd that students can live high-tech lives at home and low-tech lives at school. Schools need to recognise

that students' use of technology at school can be, in the words of Lee and Levins and quoted previously, "an extension, a flow-on development from their existing use of that technology to assist their self-teaching and learning". New Zealand schools have a distinct advantage over Australian schools as they are self managed and therefore have the ability to control the decisions made in relation to BYOT which means that decisions can more aptly reflect the genuine needs of the school community. In addition, decisions about PD, wireless infrastructure, internet filtering and monitoring, devices and financial resourcing can be made at the school level. The convergence of the spread of UFB and the introduction of the NEN, combined with a global shift to cloud based computing services and an increasing number of students who are highly digitally operative and educative mean that BYOT is not a matter of if but when.

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Additionally,

- Rangitoto College “Going Digital Booklet”:  
<http://www.vln.school.nz/pg/resources/jenbates/read/159472/rangitoto-college-going-digital-booklet>
- Selwyn Ridge School ipad resource: <http://www.selwynridge.school.nz/ipad/>
- <http://ipadeducators.ning.com> - a link to a network set up by Sam Glikzman with discussion pages and essential iPad apps.
- [http://www.vln.school.nz/search/?q=byod&search\\_type=tags](http://www.vln.school.nz/search/?q=byod&search_type=tags) - this is a link to many discussions and articles on BYOT (or BYOD as it is generally referred to in New Zealand) on our very own Virtual Learning Network (VLN).