Mobile Learning Policy Formulation and Enactment in New Zealand

David Parsons

The Mind Lab by Unitec, Auckland, New Zealand

Abstract   Adoption of mobile learning in New Zealand schools has spread rapidly in recent years as the power and usability of portable devices, along with broadband penetration and speed, have changed the technology landscape. This has major implications for higher education, both because it is tasked with training the future teachers who will work in digitally enabled classrooms, and because the students from these classrooms will be future university undergraduates, bringing with them new expectations about institutional support for mobile learning. Policy both drives and responds to these contextual changes. National policy has driven the construction of broadband infrastructure, but also has to respond to changes enacted locally. Local policy has driven the deliberate integration of mobile devices into teaching and learning, but school and university policies must respond to changes in the expectations made on them by the national provision of broadband infrastructure. Policy is also multi-faceted, as UNESCO's mobile learning policy guidelines make clear. Not only does it need to deal with core delivery issues such as infrastructure provision and teacher training, but it must also address broader social issues such as equity, advocacy and health and safety. This chapter is based on a series of interviews carried out to explore mobile learning policy in New Zealand. The results of this research suggest that policies are evolving rapidly in a rich interaction of top-down and bottom-up initiatives, impacting directly on schools and indirectly on higher education, and may provide an instructive model for others in the Asia-Pacific region.

Introduction

This chapter is based on a study of both national and local policy, as it pertains to mobile learning in New Zealand schools and the subsequent impacts on higher education. New Zealand is worthy of study within the Asia Pacific region as it has

taken a proactive approach to the roll out of broadband infrastructure with a specific emphasis on the use of that infrastructure in schools. The aspects of policy discussed are analysed within the scope of the UNESCO (2013) guidelines for mobile learning. Figure 1 summarises the key ideas in these guidelines, mapped to the Mobile Learning Evaluation Framework (Murphy & Farley, 2012.) This framework provides us with some core categories of evaluation within which the UNESCO guidelines may be contextualised. Whilst these two perspectives on mobile learning have somewhat different concerns (namely, evaluation and policy), it can be seen that the main focus of the policy guidelines from the perspective of pedagogy (learning) evaluation is that of equitable access to learning, while from the pedagogy (teaching) evaluation perspective, the policy focus is on the provision of appropriate resources and teacher skills. The technical issues are focused around infrastructure and devices, but also health and safety, while the organisational aspects feature advocacy and policy.

The following sections provide some discussion around the four areas of the mobile evaluation framework, and how they are evident in the scope of this study. In each case, relationships with the UNESCO guidelines are drawn out.

Pedagogical (Learning) Issues

Student perspectives of learning, and what students expect to gain from education, are no doubt complex and varied. Thus when seeking to justify learning, we often focus on current and intended use, leading us to question what kind of world learners are being prepared for. As technology and society rapidly evolve, we are forced to address fundamental questions about education in the 21st century. Knowledge production and dissemination is now a distributed and interactive activity, mediated by ICTs, entailing a shift from knowledge production to knowledge configuration (Gibbons, 1998.) A greater level of inclusion in education, particularly higher education, has also been seen in many countries, though simply producing more graduates is not itself a solution to the problem of educating for a changing world (Chang, 2010.) Rather, there is a widely perceived need to provide an education that is somewhat more pertinent to the needs of both individuals and society. An important aspect of this concept of pertinence is the articulation between education and work (Altbach & McGill Peterson, 1999) with the world of work itself moving from the large, long lived organisations of the past to small, often self-started, entrepreneurial enterprises (Vessuri, 1998.) A highly relevant feature of mobile learning is that it links to the increasing mobility of the workforce and the mobile tools that are now an integral part of the enterprise (Udell & Woodill, 2015.)

Mobile Learning Evaluation Framework	**UNESCO Mobile Learning Guidelines**
Pedagogical (Learning)	Incentives for mobile learning content including for local groups and languages
Student Perspectives Learning needs and desires Current and intended use Demographic and social context	Gender equality for mobile students
	Strategies developed to provide equal access for all
Pedagogical (Teaching)	Teachers trained to incorporate mobile technologies into pedagogical practice
Educator perspective Beliefs and pedagogies Critical success factors / barriers Context and learning objectives	Curriculum, educational resources and lesson plans available via mobile devices
Technical	Connectivity options expanded and improved while ensuring equity
Processes and policies Organizational barriers Resourcing Technological context	Mobile technology used to improve communication and education management
Organizational	Safe, responsible and healthy use of mobile technologies
Institutional strategy / vision Focus and commitment Leadership support Sector context	Governments create or update policies related to mobile learning
	Awareness of mobile learning is raised

Fig. 1. The Mobile Learning Evaluation Framework (Murphy & Farley, 2012) mapped to the UNESCO mobile learning policy guidelines (UNESCO, 2013.)

Factual knowledge is less important in an information rich environment, but other forms (conceptual, procedural and meta-cognitive knowledge) become thus more important to the learner. The higher levels of the revised Bloom's taxonomy stress the need to analyse, evaluate and create (Krathwohl, 2002) but beyond these cognitive skills today's learners also need cross cultural adaptability (Gibbons, 1998), new media literacies (Partnership for 21st Century Skills, 2011), interpersonal and intrapersonal skills (National Research Council, 2011) and the ability to filter out meaning from the mass of information only recently made available to us (Dede, 2007). Mobile learning tools certainly fit into this context of information richness and subsequent demands on the user.

Even with these ideas about future skills, what opportunities might be on offer for those who graduate from education in the future? What might their future use of mobile learning be? More than 2,000 years ago in 'The Clouds', Aristophanes complained that universities, or "Thinkeries", left students heavily indebted and without practical skills (Roberts & Greteman, 2013.) Perhaps the same issues face graduates today. Furthermore, many of the service sector jobs for average workers in rich countries do not require high levels of education, while technology increasingly automates former skilled service jobs (Chang, 2011.)

In terms of the demographic and social context, like all countries in the Asia Pacific region, New Zealand shares some features in common with other nations, but also has some unique characteristics that reveal how generic policies need to be adapted to local conditions. Cava-Ferreruelaa & Alabau-Muñozc (2006) define the three most important factors for broadband infrastructure availability in a given country (a key enabler for mobile learning) as economic level, level of competition in the telecommunications market and demographic distribution, while Baur, Kim & Wildman (2005) emphasise that state policy also matters. All four factors of demographic and social context impact on issues of equity. Economic level impacts on a nation's ability to fund infrastructure, level of competition impacts on both cost and distribution of infrastructure, while demographic distribution may lead to an imbalance of opportunity between urban and rural learners. These factors vary widely across the Asia-Pacific region, and it is therefore the role of state policy to adapt these factors to the local context.

New Zealand is a developed Organisation for Economic Co-operation and Development (OECD) nation, yet is agrarian and remote, with a small but diverse population that is highly concentrated in a few areas. To service this population, there is an aggressive national programme of ultra-fast broadband rollout currently in progress, and due to be completed by 2019 (Chorus, 2015). The use of this infrastructure within education is an important component of the overall investment, and is a target of state policy. The components of the UNESCO Mobile Learning Policy Guidelines that are mapped in Figure 1 to the pedagogical (learning) aspects of the evaluation framework stress that the most important driver for policy implementation is to ensure equity of access, across all demographics, genders and cultures.

Pedagogical (Teaching) Issues

From the educator's perspective, it has been claimed that high speed internet connections improve collaboration between teachers, parents and students, provide more efficient administration, better assessment tools, and development of sharable e-learning resources, all of which support teachers in meeting their objectives (Crown Fibre Holdings, 2013.) A British Educational Communications and Technology Agency (Becta) study suggested that teachers may see more returns from ICT in planning, preparation and administration than in teaching, though broadband was seen as a major factor in increasing collaboration between teachers, while the wider policy target is to improve pupils' learning, but innovations have to reach a tipping point before benefits accrue (Condie & Munro, 2007.)

One of the main barriers to transforming beliefs and pedagogies towards mobile learning is the capability costs for staff, who have to invest their own time in bringing plans and strategies to fruition to see positive returns from ICT investment (Twining, 2002.) Teachers need to be supported in their training to integrate mobile technologies into their teaching. Indeed, UNESCO (2013) suggests this investment is more important than the investment in the technology platform. Nevertheless, for mobile learning to be viable within a learning environment, there are a number of critical success factors that must be in place to support teachers. There must be access to mobile devices, the support of a suitable wireless broadband infrastructure, appropriate learning content available for mobile platforms, and appropriate skills and procedures in place to support teachers in transitioning their pedagogy. This is further supported in the UNESCO guidelines by the provision of teaching resources made available for mobile devices.

Technical Issues

A major component of ICT investments internationally is educational broadband. For example, the goals of the Digital Agenda for Europe include enhancing digital literacy, skills and inclusion (European Commission, 2013.) In the Asia-Pacific region, Australia has recently engaged in significant debate about the development of broadband. While Australia is a single nation, nevertheless not all policy is from central government, given the roles of state and territory administrations. In both cases, there is concern that these parts of the world are losing their leadership in broadband provision. New Zealand's structure is relatively simple, thus policy may be easier to formulate and enact.

However, processes and policies are still constrained by economic, commercial and geographical challenges. What lessons, then, might other nations in the Asia Pacific region learn from the Australasian experience? Perhaps one aspect is the contrasting political attitude towards broadband rollout evident between Australia

and New Zealand. While New Zealand is well on the way towards a comprehensive broadband nationwide infrastructure based on consensus, the Australian National Broadband Network (NBN) faces a more difficult challenge and political dissent (Coalition, 2013.)

Cava-Ferreruelaa & Alabau-Muñozc (2006) described New Zealand's past strategy as 'soft-intervention', relying mostly on the market, rather than medium-intervention strategies that address potential market failure in reaching rural areas by pricing more publicly funded infrastructure. Some nations have engaged in hard-intervention strategies where broadband provision is state directed. Perhaps one lesson from the New Zealand experience is that a more recent move from soft to medium intervention has seen major progress in educational broadband provision. In terms of the technological context, as part of the general roll out of ultra-fast broadband capability (UFBB), 97.7 per cent of schools and 99.9 per cent of students will receive UFBB, with the remaining 2.3 per cent of schools in remote areas given wireless or satellite services (Ministry of Education [MoE], 2013). Such policies can overcome organisational barriers by supporting a common approach to mobile technologies while providing external resources. In terms of the UNESCO guidelines, they can help ensure equity of connectivity, while providing the mobile tools for communication and education management.

Organisational Issues

Mobile learning policy does not operate within a vacuum but within the broader contexts of national and international education systems and policies. Some countries have focused on lifting participation and/or quality of teaching in science, technology, engineering and mathematics (STEM) education. The direct aim of such policies is a larger STEM workforce, while indirect aims may include increasing relative rankings such as the OECD's Programme for International Student Assessment (PISA.) By such means, institutional strategy and vision is often a reflection of national policy. The injection of ICT into education supposedly holds the promise of a well-educated workforce with relevant, 21st century skills, driving nations towards higher OECD rankings and increased economic growth. Targets such as these can enable focus and commitment to innovative approaches such as mobile learning but, as the UNESCO guidelines point out, this should not be at the expense of the safe, healthy and responsible use of such technologies. In New Zealand, with the support of leadership within the Ministry of Education, government policy is enabling schools to access an increasing range of online tools, services and content to aid the delivery of education, underlining the important role identified by UNESCO of governments creating or updating policies related to mobile learning.

Description of the Study

The study used for this chapter was based on a series of stakeholder interviews with representatives of education policymakers, both national and local, with a role to play in the implementation of mobile learning. The main question addressed in the study was: 'How is mobile learning policy formulated and enacted in New Zealand schools?' A further sub question was: 'What are the likely impacts of school policies on mobile learning in higher education?' In order to address these question, ten stakeholders were interviewed, including representatives of the New Zealand Ministry of Education, ICT professional bodies, service providers, researchers from higher education and schools. Given the high profile given to investment in ICT infrastructure internationally, and common questions about the role of mobile technologies in schools, this chapter should provide insights into how generic policy is adapted to meet local conditions that can be applied in higher education.

Results

The results presented here are based on a content analysis in NVivo of free text data, using an axial, hierarchal coding scheme based on constructs from the Mobile Learning Evaluation Framework and the UNESCO Mobile Learning Policy Guidelines. Repeating ideas within these constructs were grouped into emergent themes as the data was iteratively coded. Table 1 shows the number of responses under each of these themes.

Mobile Learning Evaluation Framework	UNESCO Mobile Learning Guidelines	Themes	Number of repeating ideas
Pedagogical (Learning)	Incentives for mobile learning content including for local groups and languages	Cost	3
		Quality	2
	Gender equality for mobile students.	Gender divides in wider society	4
		Influence of device ownership	2
		Socio-economic context	3
	Strategies developed to provide equal access for all	BYOD Models	3
		Non-BYOD models	3
Pedagogical (Teaching)	Teachers trained to incorporate mobile technologies into pedagogical practice	Digital skills	9
		Institutional change	4
	Curriculum, educational resources and lesson plans available via mobile devices	Sharing mechanisms	8
		Creative rights	2

Technical	Connectivity options expanded and improved while ensuring equity	Equity characteristics	5
		Equity implementation	6
	Mobile technology used to improve communication and education management	Continuity of service in a disaster	3
		Efficient use of mobile services in disaster situations	3
	Safe, responsible and healthy use of mobile technologies	Digital citizenship	6
		Potential health risks	5
Organisational	Governments create or update policies related to mobile learning	Global vs. local policy	2
		Philosophical viewpoints	2
	Awareness of mobile learning is raised	Raising awareness	4
		Advocacy roles	3

Table 1. Number of coded responses in core constructs and themes that emerged from the analysis.

Pedagogical (learning) themes

Incentives to develop learning content

Themes related to incentives for developers to build learning content specifically for mobile devices, including for local groups and languages, centred mainly on the conflicting pressures of cost and quality. The issue of local languages is important in many countries across the Asia Pacific region, not least because of the predominance of English teaching and learning materials in countries where English is not the first language. Fishman (2007) stresses the role of technology in sustaining indigenous languages. New Zealand has three official languages; English, the indigenous Māori language and New Zealand Sign Language. Support for Māori language learning is of strategic importance to education in New Zealand (Māori Language Commission, 2000) and significant efforts have been made to develop mobile learning tools for the Māori language (McKenzie, 2014.)

In their responses, the interviewees highlighted the issues of cost versus quality (including local relevance.) There are clearly a number of forces at play in this area which make for complex decision making. On the one hand, the move towards everyone publishing themselves using social media and Web 2.0 tools has led to a common perception that content should be free.

"People have the mind-set that you can get everything for nothing…it's not that people can't afford it but we become accustomed to thinking it's like air, why would you pay for it?" – School

However, a problem with free resources is that they often lack the quality control processes that would be put in place by a professional publishing house.

"If you look back at the current model of producing resources…what comes out the other end is something that's suitable for lots of people. When you've got an individual producing something…those checks and balances are not in there." – School

Perhaps as a result of the competition between free and purchased content, and the pressures on traditional publishers to compete by migrating their content to digital formats, new online forms of content delivery have become relatively more expensive:

"The school has a $10,000 spend a year, say, on textbooks, where we get five years of use. The model the publishers are talking about at the moment is 'we'll give you access to our textbook for one year and then it disappears', which adds up to a lot more than $10,000, much more expensive." – School

Thus there are competing pressures in the area of content generation, and it is clear that market forces alone may not deliver all that is required. This is particularly true where minority culture and languages need to be sustained and promoted. This may mean that targeted incentives will be required to support digital content in minority languages, if market forces will not deliver these resources.

"From an equity perspective…maybe there needs to be some incentives for content developers and producers to deliver in as many languages as the world thinks is appropriate." – Crown Agency

One role that higher education institutions can provide is in supporting the development of innovative mobile learning tools for indigenous language learning through research projects. There are several such examples from New Zealand that support Maori language learning (e.g. McKenzie, 2014; Crow & Parsons, 2015.)

Gender equality

Three themes emerged under the construct of gender equality; gender divides in wider society, the influence of device ownership and the socio-economic context.

Although there was a recognition that female students were in some contexts out-performing males, gender inequality in wider society once students leave school and enter the workforce was highlighted by some of the interviewees.

> "At a senior management level, the fortune 100 technology companies, less than 12 or 13 CEOs are female, 10% roughly, whereas I know at that level there's got to be women in industry who are capable." – Industry Organisation

This issue is of course not confined to the boardroom; "The lack of women in leadership positions is only a reflection of the low numbers of women in the sector overall" (Henderson, 2014 unpaged.) A study of ICT training in the UK suggested that education alone will not address the masculine norms of the IT industry, and will thus not remove barriers to participation (Gillard, Mitev & Scott, 2007.)

This issue is particularly evident in engineering and science, and higher degrees; "Efforts to increase mathematics and science performance among girls…can promote gender equality even further in education." (OECD, 2012 p.4.)

> "[we need] to make things more open for women to get involved in coding and application software development." – Ministry of Education

One area where perhaps there are indications of progress in these facets of gender inequality is the issue of device ownership. The introduction of BYOD into schools has addressed some aspects of the digital divide through access to ICTs. with some of the interviewees noting the effect in the classroom of each child having their own device, removing any digital access divide that might have previously existed.

> "All the girls having digital device…being in charge" – Local Government Organisation

Ownership of digital devices was also seen as a means of overcoming stereotypes around images of ICT users. Possession of ICT is "not only a matter of material resources but also of the attractiveness of this technology and the necessary skills to use it among people of different age and gender" (van Dijk & Hacker, 2003 p.319). The potential attractiveness and new affordances of mobile technology, specifically to female students, compared to older industrial images of technology, was noted in some of our interviews.

> "It is different with something like mobile technology which is I guess 'cleaner' and maybe lends itself to more visual thinking" - School

Notwithstanding the above, the socio-economic context emerged as an important theme in this construct. A common response from the interviewees was that in New Zealand schools, gender inequality was not a distinct challenge, at least when compared to socio-economic inequalities, which were generally seen as more pressing.

Indeed it is recognised from previous research that gender inequality in information technology in education varies from country to country (Reinen & Plomp, 1997.) Higher education institutions in Asia Pacific nations might usefully apply a similar analysis to their own circumstances.

Strategies developed to provide equal access for all

The themes in this construct, which relate to devices rather than connectivity, split into two clearly demarcated models, the Bring Your Own Device (BYOD) model and alternatives that require some provision by education provider, government or other body. The type of provision of mobile devices will have an effect on the nature of the activities that can be undertaken using them (Wenmouth, 2015.) Thus decisions need to be made about the purpose of a BYOD programme when deciding on what types of device should be allowed, recommended or mandated. Having an open policy may potentially lead to difficulties in effectively delivering the curriculum.

> "You may paint yourself into a corner if you've not got a good enough device. Does that mean that the teaching has to go to the lowest common denominator?" – Commercial Service Provider

However, the main issue of BYOD is an economic one, so schools and universities may feel the need to allow a mix of devices for financial reasons.

> "BYOD has got a bad name …. the schools call it 'device for learning' just because it seems to have got negative connotations…parents have to pay for a device" - Commercial Service Provider

While BYOD approaches come with their own challenges, alternative models, where devices are controlled and managed by the school, may result in a lack of flexibility, and excessive management demands on the school's ICT support infrastructure.

> "You buy the computer from the school, it's a specific model, it gets attached to the domain. That's not BYOD any more, that's a domain computer and it's controlled by the school" - Commercial Service Provider

One positive development as schools group together into larger clusters to negotiate procurement is that some economies of scale or even marketing power may become evident.

> "We purchase more devices per year than [large individual schools] do and we have…Apple come to us saying can we loan you 2 classes of iPads because you're not using our devices" – Educational Trust

The analysis of this theme reveals that there are a number of different access models, and that cost issues may impact on parents, students and teachers in different ways, with no single model providing all the answers. While students in higher education are increasingly likely to have mobile devices of their own, this can raise some negative issues around BYOD in terms of equality of opportunity to perform learning tasks with different types of device. Similar challenges arise when integrating a range of different devices with a single institutional infrastructure.

Pedagogical (Teaching) Themes

Teacher training with mobile technologies

The most immediate impact that moves towards mobile learning in schools have on higher education are the new expectations on teacher training programmes. New teachers have to be trained to teach in classrooms that have been transformed by mobile learning. Otherwise they risk entering the classroom unprepared for what is expected of them by today's students.

> "[students] seriously speak out now about how frustrating it is to have a teacher come in front of them…and not know how to run a digital learning environment for them." – Educational Researcher

Exploring the theme of digital skills of new teachers, common assumptions about them having good digital skills due to being 'digital natives' may be incorrect. In fact, new student teachers are likely to enter (and possibly leave) their professional education with traditional, conservative views of teaching, and poorly developed digital skills, despite their familiarity with social media.

> "You get the new grads who come in and, because they're on Facebook all the time, think they know all there is to know" - Educational Trust.

> "[new teachers are] good at the social media, games that sort of thing, as are all young people that we employ probably, but actually using it in a more constructive way needs training"- School

Teachers now need to know at least some basics of technical problem solving to help their students

"Probably the most important thing if they are actually going to be teaching it is that they actually know how it works on the mobile side of things they become the first line of support" – Commercial Service Provider

However, technical usage alone is not enough for mobile pedagogy. Knowing how to leverage the devices for teaching and learning is even more essential.

"They're not reinventing the wheel, they're trying to make stuff relevant to the way they're teaching, the way they use the devices which, doesn't mean always pick someone else's video" – Commercial Service Provider

The other main theme identified under this construct was institutional change, i.e. higher education institutions beginning to adapt to the new demands of the workplace for their teaching graduates. Some innovations intended to address this were identified.

"We've taken 10 beginning teachers … they are going through a digital immersion programme" - Educational Trust

"The new Masters of Teaching for instance, that this university's just begun as a pilot, one of the underpinning things is about digital literacy" - Educational Researcher

From these concepts, a theme of institutional change emerged to balance the rapid evolution of digital skills requirements in the teaching profession. In particular, it can be seen that new concepts in teacher education are being developed. However, these developments appeared piecemeal from the responses of the interviewees. A more integrated approach would seem to be required to ensure that all higher education institutions tasked with the training of teachers are fully aware of the digital fluency required of newly qualified teachers entering the contemporary classroom.

Baran's (2014) critical review of the literature on mobile learning in teacher education noted areas that need further development include transforming teacher education practices with theoretically sound approaches, going beyond the tools to explore the pedagogical benefits of mobile learning within specific subject areas and developing new models for teachers' professional development using mobile learning.

Educational resources available through mobile devices

Two main themes emerged within the construct that curriculum, educational resources and lesson plans should be made available to teachers via mobile devices.

These were sharing mechanisms and creative rights. Some aspects of sharing were seen as straightforward:

> "The curriculum in New Zealand and educational resources are available already online so that makes them available via mobile devices" - Educational Researcher

However, there were also concerns about whether what was shareable was necessarily relevant. There was also some skepticism of the value of making lesson plans available.

> "A lesson plan is only as good as the teacher teaching it and the class you're teaching it with, so a lesson plan is never a Silver Bullet." – Educational Researcher

The issue of creative rights was also raised. This was seen as important by a number of interviewees to ensure that the correct copyright status was conferred on shared material. This requires an understanding of creative commons licensing by both producers and consumers.

Technical Themes

Connectivity and equity

Discussion around equitable access to connectivity centred on two aspects, First, definitions of what equity actually means (characteristics), and second, how such equity can be implemented. There was a consistent view that access to ICTs is becoming as much of a basic human right as many other aspects of modern societies.

> "Technology should be a right that we are able to extend access to much in the same way as health care and education" – Industry Organisation

Further to that assumption, a definition of equity provided by one of the interviewees was that no-one is left behind

> "all boats rise on the same tide…if we're doing something for someone we're doing it for everyone" – Educational Researcher

There was also awareness that there were several root causes of inequity and that these all need to be taken into account.

"There needs to be a general consciousness around ensuring that a lack of equity doesn't creep in for whatever particular reason that could be geographical it could be demographical" – Crown Agency

The assumption here was that equity needed to be entirely consistent. There was, however, a contrary view when it came to actual implementations that there would always be an element of compromise

"Most of society want to go ahead but you can't because this group haven't got access, stopping everybody" – School

In essence, then, in terms of implementation of connectivity in an equitable manner, the intention is universal coverage.

"No matter where you are you going to get fibre, you going to get your network up-graded, you are going to have a wireless overlay"– Ministry of Education

However as noted earlier there will be some areas with limited connectivity due to geography. It was also noted by more than one interviewee that a number of initiatives that have taken, or are taking, place rely on some kind of short term investment funding.

"Subsidies are unsustainable over the long run" – Local Government Organisation

The themes in this construct suggest that equitable access to connectivity raises questions not only about how equality of access can not only be provided but how it can be sustained over the longer term. Major higher education institutions have tended to be at the forefront of connectivity initiatives. However even if on-campus connectivity for mobile devices is fast and reliable, institutions need also be aware of the ability of their students to make mobile connections when off campus, particularly for those institutions who operate distance learning programmes. Warschauer & Matuchniak (2010) also make the point that access is only part of the equity debate, that the way that devices are used in teaching and learning also contributes to the level of equity in outcomes.

Mobile communication and management

The main themes that emerged in this context, continuity of service in a disaster and efficient use of mobile services in disaster situations, were very much localised to the New Zealand context, but other nations in the Asia Pacific region (Japan, for example) have faced severe natural disasters. In the aftermath of the Christchurch

earthquake in 2011, all schools were temporarily closed, and all the students from nine of the city's 163 schools had to be relocated to other local schools because their own schools were too badly damaged to reopen (Ham, Cathro, Winter & Winter, 2012.) In addition, over 1,000 school students became 'refugees' in the neighboring region of Otago, with others dispersed to even more distant areas of the country (Lewis, 2011.) Many buildings on the University of Canterbury campus were damaged and classes had to be relocated to temporary sites. Fortunately, mobile communication supported continuity. The University, for example, made extensive use of mobile social media (Dabner, 2012.)

> "The continuity of education in Christchurch showed good role models on how some schools managed really well because they did have their work out there on the web, in the cloud, and others didn't" - School

ICT can contribute positively in post-earthquake recovery by enabling civic participation (Mitomo, Otsuka, Jeon & Cheng, 2013.) The same effect is observable in educational participation.

> "Even if the school itself wasn't functional the teacher was functioning" – Local Government Organisation

The message for higher education around mobile communication and management is that institutions need to ensure that they have a robust infrastructure in place, as well as a policy for mobile communications with their students and staff in the event of an emergency.

Safe, responsible and healthy use of mobile technologies

Themes in this construct were primarily issues about digital citizenship, but also some practical issues around health and safety. These themes therefore cover both social and physical concepts of safety. Digital citizenship was defined as being much broader than just issues of on-line safety.

> "Digital citizenship is more than just safe and responsible use. It's actually being deeply critical and aware of what's out there and how other people use these things" - Educational Researcher

In addressing potential health risks, there were frequent references to relying on expert advice on the safety or otherwise of technologies such as Wi-Fi networks. The issue of personal choice was also raised in this context, in that any parent who wished to send their child to a school where they were not exposed to electromagnetic radiation should be free to do so. In one New Zealand school, parents have campaigned successfully to have Wi-Fi removed due to fears about possible cancer

risks (National Business Review, 2013.) However, a number of interviewees raised the inescapable issue of background levels of electromagnetic radiation that would be beyond the control of schools even if they did not install their own wireless networks. These may occur both at home and in the general environment, even in schools where there is no on-site wireless network.

> "Parents have far more dangerous devices going on in their homes than is happening in the schools" - Educational Trust

> "At […] school there is something which affects their wireless and it's just this massive band of frequency … so even if that school had no wireless network, students are still getting it. There's not a lot that they can do." – Commercial Service Provider

Although such controversies have been less visible in higher education, with parental concern being less of a factor, the same health and safety issues still need to be constantly monitored, so that policies and practices can be updated if necessary to respond to any relevant new evidence that may be brought to light.

Organisational Themes

Creating or updating mobile learning policy

The first construct related to governments creating or updating mobile learning policies. The main themes that emerged from this question were differing philosophical viewpoints on policy, and also how global and local forces acted differently on policy. The philosophical debate centred on whether policies like having mobile devices in the classroom should be mandated. However, in practice it seemed that local policies were driving change.

> "That's all been taken out of the hands of government. People are just using things and so I think it's not a government policy … a local policy, perhaps" - School

Local policies are often derived from common templates provided by relevant organisations, giving a national flavour. In New Zealand, NetSafe (2010) has developed a set of policy templates that schools can adapt to their own needs.

> "A lot of schools start their policies off a NetSafe one because they can generate one quite quickly … very generic but it's New Zealand generated." – Commercial Service Provider

As Duncan-Howell & Lee (2007) suggest, in reviewing a number of mobile learning policy initiatives, policy formulation in higher education institutions tends to be on an ad hoc, per institution or even per department basis, but across the sector, they also note that changing roles of both students and teachers, driven by mobile learning technologies, are inevitable.

Advocacy, leadership and dialogue

Within this construct, raising awareness and advocacy roles emerged as the main themes. It is a common belief that governments should promote internet usage by themselves and others (Pélissié du Rausas et al, 2011.) It follows, perhaps, that other organisations, including educational ones, should do likewise in appropriate contexts, such as the use of this infrastructure for mobile learning.

The need for awareness of mobile learning to be raised through advocacy, leadership and dialogue was acknowledged by all of the interviewees. Indeed, many of them saw a major part of their role as addressing this aspect of policy. Perhaps the most important aspect of dialogue highlighted during the interviews was that which takes place between schools and parents.

> "You have to involve parents really early, have to talk to them and meet them and discuss, because all of those questions about policies come up. How are you going to filter the Internet? How are you going to deal with broken devices or stolen devices?" – Commercial Service Provider

One of the most interesting responses that emerged around advocacy and leadership was the way that it is often the students, rather than the staff, who demonstrate this in the classroom:

> "They start sharing with each other, they start helping each other, those different experts arise in the classroom" – Educational Researcher

This is one of the pedagogical impacts of the move towards mobile devices in the classroom, and is one of those that impacts in higher education not only through changing requirements in teacher training but also in how higher education institutions will need to respond to new generations of school leavers, experienced in digital and collaborative learning, entering more traditional university lecture halls with different expectations of teaching and learning than their predecessors.

Conclusion

This chapter has addressed the specifics of New Zealand's experiences of mobile learning policy but mapped it to international policies and frameworks. The main research question was 'How is mobile learning policy formulated and enacted in New Zealand schools?' Key factors identified have been a medium intervention policy to ensure equity of access to educational broadband, various models of device provision depending on context, the ability for local stakeholders to drive forward their own policies and awareness of the institutional changes required to ensure that digital tools can actually lead to improvements in teaching and learning. Issues that may cause particular difficulty in making policy include health and safety concerns around wireless networks and the challenges of ensuring equity across all geographical areas, demographics and cultures within a nation. One particular area of interest that emerged was the use of mobile communications to support learning in disaster situations.

A further sub question was: 'What are the likely impacts of school policies on mobile learning in higher education?' Two major areas of impact were discussed. One was the need for higher education institutions to begin training all teachers to be prepared for mobile learning in the classroom. The other was the need for those same institutions to be pedagogically prepared for the same cohort of students as they progress through the education system into higher education, including having suitable policies in place to ensure equity of access for all students and reliable communication channels during disruptive events such as natural disasters. Despite the major differences between societies in the region, all of these ideas can usefully inform policy at all levels of education in other Asia Pacific nations.

References

Altbach, P. & McGill Peterson, P. (Eds.). (1999). *Higher Education in the 21st Century: Global Challenge and National Response*. Annapolis Junction, MD: IIE Books.

Baran, E. (2014). A Review of Research on Mobile Learning in Teacher Education. *Educational Technology & Society, 17*(4), 17-32.

Bauer, J., Kim, J. & Wildman, S. (2005). An integrated framework for assessing broadband policy options, *Michigan State Law Review, 21*.

Cava-Ferreruela & Alabau-Muñoz. (2006). Broadband policy assessment: A cross-national empirical analysis. *Telecommunications Policy, 30*(8).

Chang, H-J. (2010). 23 Things They Don't Tell You About Capitalism. London: Allen Lane.

Chorus. (2015). About UFB. Retrieved from: https://www.chorus.co.nz/ufb

Coalition. (2013). *The Coalition's Policy for E-Government and the Digital Economy*. Retrieved from: http://www.malcolmturnbull.com.au/assets/Coalitions_Policy_for_E-Government_and_the_Digital_Economy_%282%29.pdf

Condie, R. & Munro, B. (2007). *The impact of ICT in schools – a landscape review*. Becta.

Crow, T. & Parsons D. (2015). A Mobile Game World for Māori Language Learning. In *Proceedings 14th World Conference on Mobile and Contextual Learning (mLearn 2015).* pp. 84-98. Springer.

Crown Fibre Holdings. (2013). *In Education*. Retrieved from: http://www.crownfibre.govt.nz/users-of-ufb/about-education/

Dabner, N. (2012). 'Breaking Ground' in the use of social media: A case study of a university earthquake response to inform educational design with Facebook. The Internet and Higher Education, 15(1), 69–78.

Dede, C. (2007). Transforming Education for the 21st Century: New Pedagogies that Help All Students Attain Sophisticated Learning Outcomes. *NCSU Friday Institute*. Retrieved from: http://thenetwork.typepad.com/files/dede_21stc-skills_semi-final.pdf

Duncan-Howell, J. & Lee, K-T. (2007). M-learning: Finding a place for mobile technologies within tertiary educational settings. In *Proceedings ASCILITE 2007*.

Queensland University of Technology European Commission. (2015). *Digital Agenda for Europe*. Retrieved from http://ec.europa.eu/digital-agenda/

Fishman, J. (2007). What do you lose when you lose your language? In: Cantoni G. (Ed.), *Stabilizing Indigenous Languages*. Northern Arizona University.

Gibbons, M. (1998). *Higher Education Relevance in the 21st Century*. World Bank.

Gillard, H., Mitev, N., & Scott, S. (2007) ICT Inclusion and Gender: Tensions in Narratives of Net-work Engineer Training. *The Information Society, 23*, 19-37

Ham, V., Cathro, G., Winter, M. & Winter J. (2012). Evaluative study of co-located schools established following the Christchurch earthquake. *Education Counts*. Retrieved from: http://www.educationcounts.govt.nz/publications/schooling/115174

Henderson, J. (2014). Is NZ hi-tech industry starting to address gender imbalance? *Techday*. Retrieved from http://techday.com/it-brief/news/is-nz-hi-tech-industry-starting-to-address-gender-imbalance/183082/.

Krathwohl, D. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory into Practice, 41*(4), 212-8.

Lewis, J. (2011). 1010 refugee pupils swell schools' rolls. *Otago Daily Times*. http://www.odt.co.nz/regions/otago/150423/1010-refugee-pupils-swell-schools-rolls.

McKenzie, T. (2014). *The Challenges and Opportunities of Using Mobile Devices to Attain Māori Language Proficiency*. Victoria University of Wellington PhD Thesis. Retrieved from http://researcharchive.vuw.ac.nz/xmlui/bitstream/handle/10063/3291/thesis.pdf

Māori Language Commission. (2000). *Promoting Positive Attitudes to the Māori Language in the Classroom*. Retrieved from: http://www.tetaurawhiri.govt.nz/english/pub_e/classroom/booklet.shtml

Mitomo, H., Otsuka, T., Jeon, S. & Cheng, J. (2013). The role of ICT and mass media in post-disaster restoration and recovery progress: A case of the Great East Japan Earthquake, In: *24th European Regional Conference of the International Telecommunication Society*.

Ministry of Education. (2013). *Ultra-fast Broadband in Schools*. Retrieved from: http://www.minedu.govt.nz/theMinistry/EducationInitiatives/UFBInSchools.aspx

Murphy, A. & Farley, H. (2012). Development of a framework for evaluating the impact and sustainability of mobile learning initiatives in higher education. In M. Brown, M. Hartnett, & T. Stewart (Eds.), *Future Challenges, Sustainable Futures: Proceedings of the 29th ASCILITE Conference* (pp. 678-680). Wellington, New Zealand: ascilite.

National Business Review. (2013). *Manawatu school removes wi-fi over cancer fear*. Retrieved from http://www.nbr.co.nz/article/manawatu-school-removes-wi-fi-over-cancer-fear-ck-150478

National Research Council. (2011). *Assessing 21st Century Skills: Summary of a Workshop*. Committee on the Assessment of 21st Century Skills. Board on Testing and Assessment, Division of Behavioral and Social Sciences and Education. (J.A. Koenig, Rapporteur) Washington, DC: The National Academies Press.

Netsafe. (2010). *Policies and Use Agreemen*ts. Retrieved from http://www.netsafe.org.nz/keeping_safe.php?pageID=81&sectionID=education&menuID=81

Organisation for Economic Co-operation and Development. (2011). *Education Indicators In Focus*. Retrieved from http://www.oecd.org/education/skills-beyond-school/49986459.pdf

Partnership for 21st Century Skills. (2011). Framework for 21st Century Learning. Retrieved from http://www.p21.org/storage/documents/1.__p21_framework_2-pager.pdf

Pélissié du Rausas, M., Manyika, J., Hazan, E., Bughin, J., Chui, M. & Said, R. (2011). Internet matters: The Net's sweeping impact on growth, jobs, and prosperity. *McKinsey Global Institute*. Retrieved from: http://www.mckinsey.com/insights/high_tech_telecoms_internet/internet_matters

Reinen, I. & Plomp, T. (1997). Information Technology and Gender Equality: A Contradiction in Terminis? *Computers & Education, 28*(2), 65-78.

Roberts, D. & Greteman, B. (2013). Complete the digital learning revolution – take to the cloud. *Times Higher Education*. Retrieved from: https://www.timeshighereducation.com/complete-the-digital-learning-revolution-take-to-the-cloud-say-david-roberts-and-blainegreteman/2006498

Twining, P. (2002). Enhancing the Impact of Investments in 'Educational' ICT. *OU Knowledge Network*. Retrieved from http://kn.open.ac.uk/public/document.cfm?documentid=2515

Udell, C. & Woodill, G. (Eds.). (2015). *Mastering Mobile Learning*. Wiley.

UNESCO. (2013). *UNESCO policy guidelines for mobile learning*. Retrieved from: http://unesdoc.unesco.org/images/0021/002196/219641e.pdf

van Dijk, J. & Hacker, K. (2003). The Digital Divide as a Complex and Dynamic Phenomenon. *The Information Society, 19*, 315-326

Vessuri, H. (1998). Pertinence. *Commission I: Relevance for Higher Education Final Report*. UNESCO.

Warschauer, M. & Matuchniak, T. (2010). New Technology and Digital Worlds: Analyzing Evidence of Equity in Access, Use, and Outcomes. *Review of Research in Education. 34*, 179-225

Wenmouth, D. (2015). *Thinking about BYOD*. http://blog.core-ed.org/derek/category/mobile-technologies.