Mobile Phones in the Classroom

A directed study project by
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Abstract

This paper set out to answer how schools and educators might consider using mobile phones to support effective teaching and learning opportunities by reviewing literature which explores both the negative and positive impacts of mobile phone use in the classroom.

The key findings point to a lack of informed decision making by schools on mobile phone policy. Findings suggest a wide variety of opportunities for enhancing classroom learning through the flexibility of time and place in which learning can occur and the ability to offer context based learning opportunities. The use of mobile phones have been found to be effective in building relationships particularly with more non-traditional or disengaged students. Negative aspects of mobile phone use by students include socially unacceptable behaviour, such as the serious nature of 'txt-bullying' as well as being a classroom distraction and having impacts on lowering literacy rates.

Mobile phone use in classrooms may still be largely the focus of research reports rather than mainstream adoption by schools yet if teachers are open-minded and begin to explore the technology that so many of their students are already bring in to the classroom there is huge potential for enabling a variety of effective learning strategies.

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Introduction

Mobile phones are devices that New Zealand teenagers, along with teenagers across the globe, have been quick to adopt as an essential element of their lifestyle. In many cases, these phones are seen as a bane of teachers' classrooms and schools have been forced to create policies to deal with issues created by the mass adoption of the mobile phone by their students. However, as our education system moves towards teaching and learning which is enhanced by use of new technologies, the New Zealand curriculum mandates that "schools should explore not only how ICT can supplement traditional ways of teaching but also how it can open up new and different ways of learning" (Ministry of Education, 2007, p. 36). The mobile phone, a technology that many of our students today already own, is therefore a relevant information communication technology for which to explore the potential within the classroom.

Mobile phone use in the classroom is a topic on which many educators are both vocal and passionate about. In New Zealand, problems caused by student mobile phone use at school have been widely reported; from concerns over unacceptable social behaviours and txt-bulling" to problems with literacy and learning distractions (Reuters, 2008, "I send 260 texts a day", 2008, Taylor & Cook 2008, NZPA, 2008, Lean, 2007). The trend at most New Zealand schools (both primary and secondary) is to ban mobile phones from the classroom (Fielden & Malcom, 2005). Global studies show that New Zealand is not alone in this stance (Prensky, 2004, Sharples, Arnedillo-Sánchez, Milrad & Vavoula 2009). What is interesting however, is that the majority of New Zealand schools have not based their policy on sound statistical data, nor considered in any great depth the potential for the use of mobile phones in the classroom (Fielden & Malcom, 2005). It seems that while schools try to find extra funding to increase student and teacher access to ICT, the tool that many students already have in their pockets is overlooked, and not only overlooked, but its use actively denied through school policy (Sharples et al. 2009).

This review is intended to provide schools and teachers with a review of current literature in order that they might make more informed decisions in regards to mobile phone policy and use. It will discuss rates of adoption of mobile phone technology by New Zealand teenagers and consider the potential impacts - both positive and

negative on students. This review will describe the pedagogy behind the mobile learning movement and explore some potential applications for mobile learning opportunities. It will then consider the reality that 24/7 access to information made possible via the mobile web will have on both students and schools.

My interest in mobile phone use in the classroom arose as a result the successful implementation of eLearning strategies within my own ICT-rich English and Media Studies classroom. I wanted to consider the way that students' own mobile phones could be used to recreate a blended learning environment in those classrooms for which ICT was not so readily accessible. This led to conducting a research project for the New Zealand Ministry of Education in 2008, working with 3 teachers exploring the ways that they could use a class-set of mobile phones to enhance the teaching and learning in their classrooms (Twiss, 2008). The findings of this research project inspired me to further explore the way that other educators are using mobile phones in their teaching programmes, and to consider the way mobile phones in themselves will change the scope of teaching and learning through enabling both content creation and access to vast amounts of information.

This review explores the thesis statement that mobile phones are sophisticated tools which have great potential for enhancing teaching and learning in New Zealand schools.

Trends and Progess

Digital Students and their Digital Tools

Prensky was one of the original proponents for the use of mobile phones in the classroom. Initially, he addressed one of the biggest skepticisms about mobile devices in his article 'But the Screen is Too Small...' (2003) saying that while the screen size of a mobile phone was small, this would not be a problem for digital native students who regularly engage with technologies with equally small screens such as gaming devices. The following year, he produced the article "What Can You Learn From A Cell Phone? – Almost Anything!" (2004) describing "how to use the 1.5 billion computers already in our students' and trainees' pockets to increase learning" (p. 1). It is these pivotal articles, coupled with Prensky's influential coining of the terms 'digital immigrant' and 'digital native' that have largely led the way in further work surrounding the use of mobile phones in the classroom (Mellow, 2005, Valentine, 2004, Ison, Hayes, Robinson & Jamieson, 2004, Ericsson, nd).

At the heart of Prensky's argument is that today's students have grown up immersed in and surrounded by new technologies - of which the mobile phone is only one example. He argues that because of this, students think and work differently to the students before them and therefore have different learning requirements. In 2001, Prensky introduced the concept of today's students as 'digital natives' whose needs are little understood by their 'digital immigrant' teachers (p. 2). Oblinger & Oblinger refer to these students as the 'Net-Gen' (2005).

Prensky argued (2004, p. 6) that mobile devices will fill the place of full-size computers, breaking down barriers currently apparent because of what he refers to as the 'digital divide' (2004, p. 9). Stating that if mobile devices are not standard issue in schools, students will provide their own. He also pointed out that it is the wide capabilities of these devices which makes them so useable in the classroom.

While Prensky has been a great advocate for the use of mobile devices in the classroom, he does make the point that in order for effective teaching and learning to take place, educators will need to consider new or different ways for using the tools, and potentially an approach to learning that might be quite different from the

traditional method may be applied. “Using cell phones as a learning device, whether in or out of school, requires a good deal of rethinking and flexibility on the part of educators” (Prenksy, 2004, p. 3).

Mobile phones for learning fit only part of the education model - they are not the stand-alone classroom tool (Prensky 2003, 2004, Sharples et al., 2009). However, they are available to use as a tool should teachers wish to supplement the learning activities that are already taking place in their classrooms. Prensky says, “fully-featured as they are, it has also been pointed out that cell phones are not powerful enough to be students’ *only* learning tool” (2004 p. 2). The beauty, and also the challenge, of mLearning is to enhance student engagement and learning opportunities using all of the tools available.

The Horizon Report

The Horizon Reports 2004-2009 (Johnson, Levine & Smith) have from the outset predicted the rise of mobile technologies in education and the impact this technology will have on changing educational models in the future. This section of the review will focus on reviewing the trends and progression of mobile phone technology use in education as explored in these reports.

The Horizon Reports are key documents in tracking the progression of new technologies in education. The reports are produced by The New Media Consortium (NMC) who summarise the findings of conversations held between hundreds of technology leaders and educators, along with articles, papers and information available online. Each year, their findings explore trends and challenges related to new technologies in education. They are particularly central to this review as since 2006 they have highlighted the potential impact of mobile technologies are predicted to have on education in the future.

Mobile phones as a specific technology did not feature in the Horizon Report until 2006 with ‘the phones in their pockets’ identified as the technology to watch for the mid-term projection - within two to three years (p. 14). However, technologies of which mobile phones are now capable have featured since the inception of the

Horizon Report. The very first Horizon Report in 2004 highlighted the potential for 'context aware technologies' as potentially impacting the longer term future, and by 2005 this has been expanded to include augmented reality. While at the time the devices through which this technology would be accessed were probably not entirely clear, now in 2009 it is clear that the 'next generation mobile devices' will most likely be the technologies which will deliver these earlier predictions for the future. more recent publications of the Horizon Report have specifically identified the iPhone as having the potential to make a profound impact on the future direction of mobile technologies (Johnson et al., 2008, 2009 & 2008b).

Mobile technologies have been specifically identified in one form or another for the past three editions of the Horizon Report and also in the 2008 Australia and New Zealand Horizon Report (Johnson et al., 2008b). However, it is key to note that while the main Horizon Report is now predicting mobile technologies as having an influence within the very near short term (one to two years), the Australia and New Zealand Report is still considering mobile devices as not coming into their own until the longer term - five years or more. 'Adoption rate and availability of bandwith' are highlighted as 'limiting factors' and it is pointed out that 'once infrastructure is in place and students routinely carry mobile devices, they will be a natural choice for content delivery and even field work and data capture' (Johnson et al., 2008b, p. 28).

Initially, the Horizon Reports identified that mobile technologies would play an important role in the delivery of course content and in fulfilling administrative tasks (Johnson et al., 2006, 2007). By 2008, mobile phones as a stand-alone device were no longer identified as a key trend in themselves. It was no longer seen that the phone itself would be the key function, rather the activities it could enable. 'Grassroots video' was highlighted as a key trend within the very near short term (one to two years) and it was the enablement of this technology through ubiquitous devices such as the mobile phone that was crucial as, "ubiquitous video capture capabilities have literally put the ability to record events in the hands of almost everyone" (Johnson, et al., 2008, p. 12). This coupled with the emergence of the 'data mashup' which is also enabled by the advanced capabilities of the mobile phone show how the focus has moved away from the device itself towards the technological capabilities that it has enabled.

A major turning point was identified in the 2008 Horizon Report with mobile broadband highlighted as a key technology within the medium term - two to three years. The 2009 report went on to further reflect developments - moving the mobile technologies from a medium term projection to the short term. The technology has advanced as such - particularly with the development of the iPhone - that mobile devices are now a truly viable option for replacing larger portable devices such as laptops. “For many users, broadband mobile devices like the iPhone have already begun to assume many tasks that were once the exclusive province of portable computers.” (2009, p. 6) The key factor now is mobiles are truly adopted and embraced by the majority of population “it is apparent that the devices and their new applications have been accepted in the mainstream” (2009, p. 11). However, it is important to bear in mind the New Zealand context which suggests that due to our infrastructure being underdeveloped and costly, that there may be somewhat of a lag between the findings of the main Horizon Report and the reality in New Zealand (Johnson, 2008b).

All of the Horizon Reports that include mobile technologies as a technology to watch, do so because it is a piece of technology that has been so widely adopted by students and teachers alike. The Horizon Reports do not refer to students as digital natives, or as having specific needs that are different from previous generations. Rather that the pervasiveness of the technologies now available mean that these will change the face of education as “the applications of mobile technology to teaching and learning are virtually limitless” (2008b p. 26). The fact that “many students already own and carry mobiles remains a key factor in their potential for education” (2008, p. 19).

Perceived negatives of the use of mobile phones in the classroom

Current school policy

The current practice of most schools both in New Zealand and globally is to ban the use of mobile phones by students due to perceived issues associated with their use. Issues relate to concerns about unacceptable social behaviours, causing a distraction to classroom learning, lowering of literacy standards and, to a lesser extent, the potential detriment to physical health.

Schools across New Zealand have responded to the rise of student ownership of mobile phone technology by introducing school-wide policies to cope with the influx of devices and the resulting changes that have been brought about to school culture. What is interesting however, is the limited research that has gone in to the development of these school-wide policies by the majority of schools. A 2005 study into the way 12 New Zealand schools developed policy for mobile phone use found that for most of the high schools involved in the study, policy was not driven by "technical knowledge" or values of "digital citizenship" (Fielden & Malcom, 2005, p. 6). Rather, it was dictated by "the social constructs of positive attitude, social acceptance, technical acceptance and impact knowledge" (p. 6). Prensky refers to this as a 'knee jerk' reaction to technology (2004), thus demonstrating that it is not just schools in New Zealand who are finding themselves having to deal with student access to technologies of which they (the schools) potentially have little understanding.

It is interesting then to consider how mobile phone use by teenagers has come to have such a reputation that the technology should be so quickly banned from schools. Certainly the media have an effect, with their extensive reporting on text bullying (bullying via SMS messages), but also their often sensationalist reporting on opinion. In June last year, New Zealand news website *Stuff* ran an article declaring a "Call for Total School Mobile Phone Ban" (2008) reporting that parental concerns were prompting a policy to potentially ban mobile phones at school. The article stated, "as well as cellphones distracting from learning, there are also worries that common use of text language can lead to a deterioration of literacy and writing skills".

The media's representation of mobile phones could potentially be seen as generating a form of 'moral panic' (Hall,1978 in Goggin, 2006) surrounding a technology the potential for which is little known. Gerard Goggin adapts the concept of 'moral panic' and refers to the negative representation of mobiles as 'mobile panic'. Goggin refers to three main aspects of the negative representation of the mobile phone; health, manners and use by youth, all areas that will be further explored within this section of the review. It is interesting to consider the way that all of these factors have, to some degree, affected school mobile phone policy.

Unacceptable Social Behaviours

Far from being used as a business device as they are with adults, youth have adopted mobile phone technology to the point that it has become an integral part of their social network development (Raskauskas, 2007). Furthermore, youth have become the early adopters of many new applications of mobile phone use which has then been taken up by adults - in particular 'texting'. Therefore, to some extent, youth can be seen to be leading the way with how this particular technology is embraced by society as a whole (Ito & Daisuke 2002, Prensky, 2004).

It is partly the rapid adoption of the technology by youth and the fact that, particularly in the very early years of adoption, adults did not understand the ways that youth were using their phones that has led people to question the potential erosion of culture and commonly accepted behaviours held by society. Goggin points out that "while they are often given credit for their technical facility and dexterity with mobiles, their association with the technology is often regarded as a social problem" (2006, p. 115).

There has been much research to suggest that mobile phones give people a sense of identify and security (Fox 2001, Kamibeppu & Sugiura, 2005, Ito & Daisuke, 2002, Jamieson, 2004). This has two main implications for education. The first is that students rely on their phones for a sense of security and can use this sense of security as a means to avoid real-world social interaction. The second implication is that students are more likely to engage in risky or inappropriate behaviours than what they might in a face to face situation (Farmer, 2003, Internet Safety Group, 2005,

Carroll-Lind 2009). These factors influence teenagers' relationships with those around them and also the high-level of importance that they place on their mobile phones. The impacts of both of these issues will be covered in the following sections.

Bullying

A new wave of bullying has been brought about by the acquisition of mobile phones by New Zealand teenagers and therefore it is with good reason that schools are proceeding with caution in regards to policy surrounding mobile phone use. The power of the mobile phone to propagate gossip (Fox, 2001) and to allow students to communicate long after the school day has ended, and to communicate with a large number of people, means that bullying using mobile technologies is potentially even more insidious than traditional bullying (Carroll-Lind, 2009, Netsafe, 2008, Raskauskas, 2007). Cyber and text-bullying research suggests that one in five students have been on the receiving end of text or internet bullying, reporting that they had been sent 'nasty or threatening messages by cellphone or the internet' (Adolescent Health Research Group, 2008). However, when one considers that that bullying via mobile phone encompasses much more than sending nasty messages, one would expect the number of students affected by bullying to in-fact be much greater.

Text bullying is incredibly powerful - more so than earlier forms of bullying due to the personal, anonymous and any-time nature of mobile technologies. Text bullying is defined as; messages sent via text message that make a person feel unhappy or uncomfortable (Carroll-Lind 2009, Netsafe, 2008, Raskauskas 2007) The New Zealand Ministry of Education site, Team Up www.teamup.co.nz/ specifically defines the types of mobile phone use that constitutes text bullying as the following:

- nasty or offensive messages – received once or repeatedly
- being bombarded by a large number of messages
- offensive or upsetting photo or video messages
- threatening messages

In the media, text bullying has been highlighted as the 'cowardly' approach to bullying. The Team Up website explains that 'all bullying is serious, but bullying texts can be sent fast and anonymously by lots of people'. The nature of the medium further lends itself to the type of bullying that occurs and the way that bullies are empowered by the fact that they can hide behind the technology.

> Text bullies often use extreme language, because they feel anonymous and safe and their victim is out of sight. It can be very upsetting to be text bullied because texts can be sent after school, at night, and even on weekends (Ministry of Education, 2008b).

Text bullying is prevalent and having an impact on New Zealand teenagers. It has come about due to the 'increased availability of cell-phones [which] has provided new avenues through which adolescents can bully their peers' (Raskauskas, 2007, p 1). Not only is 'texting' a new medium for conducting bullying it is inherently more powerful than traditional forms of bullying due to the personal nature of the student's device, and the reach which extends beyond school hours (Carroll-Lind, 2009). But, mobile phone bullying goes beyond simply sending of offensive text messages to using the mobile phone (in particular SMS messaging) to orchestrate large-scale bullying operations, such as the witnessing of a physical attack by a large group, or using the camera on the mobile phone to capture the event which is then published widely on video sharing and social networking sites.

Online there is a wealth of information about cyber-bullying and in particular, text-bullying available to New Zealand schools, parents and children/adolescents themselves. Research has been conducted by a range of interest groups and information is provided by government agencies and the police, and with good reason. In New Zealand, text bulling has been cited as a contributing reason for some adolescent suicides. The first publicised of these came in 2002 when 16 year old Daniel Gillies took his own life after receiving on going bullying including text messages due to disfiguring of his face due to a degenerative bone disease (Woulfe, 2008). In 2006, 12 year old Alex Teka took her own life after being "bullied relentlessly by a group of girls not much older than her. Her mother Deanne Teka described it as an orchestrated campaign by email and text" (Stuff, 2006, April 11).

Youth have adopted mobile technologies incredibly quickly and, as adults rush to keep up with the new ways that adolescents use their phones, it is crucial to

understand the role that mobile phones play in the lives of teens in their social development. Raskaunskas states that 'one of the central tasks of early adolescence is to find acceptance and belonging in peer relationships and cell-phones can be used to start and maintain relationships with peers' (2007, p. 1). It is this element of the critical role that mobile phones play in teens' social lives that further implicates the problem of text bullying as teens are reluctant to seek help with bullying, often for fear of having their phone taken from them.

There is a growing voice that it is not the device or technology that is the problem, rather its application and, that practices for acceptable use must be taught. In fact some research suggests that more strict prohibition of mobile phones results in higher rather than lower rates of undesirable behaviour (Jose & Kleeb, 2006) and that students have a general attitude that using the banned technology is seen as more rebellious and desirable (Twiss, 2008; Jose & Kleeb, 2006). Fielden and Malcom argue that the more rigorously policy surrounding mobile phone use is applied, the wider the digital divide between the school and their students (2005, p. 6).

Concept of time and place and the ability to switch off

The anytime/anywhere nature of mobile phones means that the boundaries as to when and where people can and do communicate with each other are blurred (Solutions Research Group, 2008, Goggin, 2006). In fact, while mobile phones are convenient due to their portability and prevalence, this in itself "poses considerable challenges for the conduct and regulation of private and public spheres, and the boundaries and relationships" (Goggin, 2006, p. 115).

There is no downtime or alone-time, particularly for teens who feel pressure to respond to text messages within a 'socially accepted' time-frame, encroaching on personal time and providing a distraction when carrying out social activities, driving or when at school. The social pressure to reply to a SMS message in particular is strong with research showing that teens and young adults are twice times as likely to reply to an SMS within an hour as those over thirty (Chow, 2008). A Japanese study in 2002 found that already teenagers were sending twice as many messages from their phones as people in their twenties and almost all students responded that they

viewed a message as soon as it arrived - rather than waiting to check it later (Daisuke and Ito, 2002). Kamibeppu, & Sugiura, also reported similar findings in their 2005 Tokyo based study of the impact of mobile phones on friendships on junior high school students. The findings particularly noted the pressure that students felt to reply to messages within an acceptable timeframe.

The (often strong) feelings of being disconnected from mobile phones or the internet is now a recognised disorder. Disconnect Anxiety refers to “various feelings of disorientation and nervousness experienced when a person is deprived of internet or wireless access for a period of time” (Solutions Research Group, 2008, p. 3). Findings show that the disconnect experience is “panic inducing” amongst youth, saying that “the ubiquitous messaging from friends has reached a new level with the rise of social networking” (p. 6).

As teenagers learn to adapt and experiment with their new found connectivity, mobile phones and their associated capabilities open up a whole new way of experiencing adolescence, in a way that is far more public than ever before. As of last year, news media were reporting the rise of ‘sexting’ which ranges from students storing and sharing erotic pictures on their mobile phones, to using their phones to take sexual images of themselves and share these with others. In Australia this practice led to 32 teenagers being charged with child pornography offences. The article highlighted comments from Detective Sergeant Campbell Davis, of the Victoria Police internet child exploitation team, who said 3G or internet capable mobile phones exacerbated the problem "we need to teach our children how quickly images can be forwarded," this he said (“Sexting - Fears as Teens Targeted”, 2008). This practice highlights the extremely limited nature of control that schools in fact have over students’ mobile phone use, and that at some point, communities need to be taking it upon themselves to equip students with the appropriate skills and knowledge to use their mobile phones in a socially acceptable manner.

Distraction from classroom learning

Teenagers face strong social pressures from their peers concerning their ability to be on contact at all times via their mobile phones (Solutions Research Group, 2008, Daisuke and Ito, 2002, Kamibeppu & Sugiura, 2005, Chow, 2008). Therefore, it

would stand to reason that as schools aim to combat distracting mobile phone use through denying students access to their devices that in fact it is adding to both the anxiety and the pressure that students are already facing, and, as students find new ways to avoid the systems denying them their phones that they are in fact even more distracted than they might be were they allowed access to their phones during school time (Twiss, 2008).

There is however, a need for schools and teachers to balance and control students' use of their mobile phone with scientific evidence pointing to reduced brain function while mobile phones are being used. Research by Dr John Medina suggests that the decision making function of the brain shuts down when using a mobile phone due to the brain function required to cope with understanding that one is communicating with another over a different time and space means that a core decision making section of the brain momentarily turns off (Medina, 2008). The research gives reason to the claims of many teachers that mobile phones and more specifically texting in class is a major distraction to students' ability to learn.

Detriment to physical health

While incredibly popular, mobile phones and their use come under a great deal of scrutiny, particularly in regard to public health. It seems that this is due to sheer speed of adoption of this technology, of which a great deal of research has been done but with little conclusive evidence - largely due to the relatively short life-span of the technology itself.

The potential effects on humans, particularly on the human brain, of radiation emitted by mobile phones and their base stations is both topical and controversial, and it would be foolish not to proceed with caution given the rapid adoption of mobile technologies by such a large proportion of the global population. As stated by the World Health Organisation (WHO) on their website http://www.who.int/en/ "due to the immense number of people who use mobile phones, even a small increase in the incidence of adverse effects on health could have major public health implications" (WHO, 2005). Therefore, it is prudent that potential health effects are studied and that appropriate action should be taken to ensure protection of the population. However, the rapid speed of development of mobile technology is in itself

problematic as there has been very little time to conduct long-term research before mobile devices became mainstream, and this continues to be a cautionary factor in all research conducted to-date.

The general caution is that there is the potential for the radiation emitted by mobile phones and their base stations (or cell towers) to damage cells in the human body leading to tumours and potential cancers. Of particular concern is the location of cell towers situated closely to homes and schools and of radiation to the side of the head due to the close proximity to which mobile phones are held when in use (WHO, 2005, Goggin 2006, "Phone Safety Put to Test" 2000, Independent, 2005, Rohan, 2008, Lean, 2009, Reuters, 2004, "Mobile Phone Safety Trial Begins in Sydney", 2002, The Institution of Engineering and Technology, 2008).

General advice from international government commissioned reports state that while current radiation limits are adhered to there is no evidence to suggest that there is a negative impact on the health (WHO, 2009, IEGMP, 2000). Studies have found that while some effects on brain functions have been observed, there are no indications that these lead to health effects (SCENIHR, 2009). However, that caution should be exercised, especially with children. Advice from The World Health Organisation states that

> Current scientific evidence indicates that exposure to RF fields, such as those emitted by mobile phones and their base stations, is unlikely to induce or promote cancers. Several studies are under way to determine whether the results of some studies on animals have any relevance to cancer in human beings. Recent epidemiological studies have found no convincing evidence of an increased cancer risk or any other disease with mobile phone use (WHO, 2000).

Due to the vast number of articles on the topic, it is clear that the media has a role to play in influencing the wider perception of mobile phones. In many cases, schools are forced to respond to demands from their communities calling to ban mobile phone use resulting in banning the devices, but are often torn by the fact that parents are the very people enabling the technology by providing their children with the means to purchase and maintain mobile phone use. What is interesting to note however, is that only very few researchers in to the practice of mLearning have explored or mentioned the negative aspects of mobile phone use by teens, although some imply it as they develop arguments to counter potential skeptics.

Potential uses of mobile phones in the classroom

mLearning – a definition

The term mobile learning or mLearning has evolved to give a name to the learning that is enabled by and incorporates the use of mobile technologies (Geddes, 2004, Sharples 2000, Sharples, Corlett & Westmancott, 2002, Sharples, Arnedillo-Sánchez, Milrad, & Vavoula (2009), Kukulska-Hulme, Sharples, Arnedillo-Sánchez, Milrad, & Vavoula, 2009, Mellow, 2005). Mobile technologies include any number of the wide range of portable devices "that are designed to provide access to information in any location, or while on the move" (Geddes, 2004, p. 1). More specifically these include but are not limited to; "classroom response systems, laptops and tablets with standard software, text message alerts sent to mobile phones, small-group learning with wireless devices, multimedia museum guides, but these are just the tip of the iceberg" (Walker, 2007, p. 5). The context of this review is specifically concerned with the use of mobile phones to support learning given that these are the tools students are already bringing with them to class and the focus here is to make use of the technology that students already have.

mLearning is seen as the next step on from electronic learning (eLearning) through extending eLearning's portability and mobility. It is most commonly viewed as a convergence of mobile, internet and eLearning (Sharples et al., 2009, Valentine, 2004). The focus of mLearning is on "just-enough, just-in-time, on-location learning support" (Valentine, 2004, p. 31) and is seen by many as one of the key factors in facilitating life-long learning (Kukulska-Hulme et al., 2009, Sharples et al., 2009, Fox, 2001, Valentine, 2004, Jamieson, 2004, Sharples, et al., 2002).

Confidence and interest in the potential for mLearning is strong and gaining momentum in academic circles (Sharples et al., 2009, Geddes, 2004, Valentine, 2004, Kukulska-Hulme et al., 2009). Formal research in to the potential for mLearning as we know it today has been taking place for the past ten years (Kukulska-Hulme et al. 2009) and there are now two well-regarded, international

mLearning conferences mLearn (www.mlearn2009.org) and Hand-held Learning (www.handheldlearning.co.uk). Elizabeth Valentine's (2004) summary report on the proceedings of the 2004 mLearn conference in Rome reports that educators and professors of education are beginning to see that mLearning provides opportunities that cannot be achieved by tethered machines and can provide a true advantage to traditional learning methods. It is this flexibility in location, the way learners can both receive and collect data and how they share information that Valentine points out is of most interest.

As more people become involved in mLearning and the body of research grows, it becomes clear that mLearning covers a broad and wide range of variables - both the range of technologies that are involved in mLearning delivery and the variety of teaching and learning approaches given to each of these technologies. In fact, Winters (2007) points out that due to the incredibly broad range of technologies and learning styles that are covered by the term mLearning it is, at this stage, rather “ill-defined” (p. 7). This means that researchers are finding it difficult to evaluate mLearning as a whole as there are so many variables to take in to consideration (Sharples et al., 2009).

Researchers are commonly finding that the nature of mLearning means that there is often undue focus on the technology and what it can do, rather than the learner and what they need. Sharples et al. (2009) and Kukulska-Hulme et al. (2009) suggest focus on the technology is a critical barrier to the implementation of a successful mLearning programme. Evidence of the initial focus on the technology rather than the learner is also seen in the number of research projects finding that students ended up using their mobile devices to fulfill a different role to what the educators had maybe prepared for, and in fact using the devices in a far less sophisticated way than they had expected (Jamieson 2004). In many cases the content delivery capabilities of the devices came second to a preference for the more “socio-technical support” (Kukulska-Hulme et. al., 2009, p. 2) which other functions of the device allowed for ie. SMS messaging.

mLearning offers the ability to change and enhance current teaching practice. It does not necessarily have its own “over-arching 'theory of mobile learning'” (Lonsdale,

Naismith, Sharples & Vavoula, 2005 p. 19). This report, published by Future Lab stated that educators need to be working towards a "blended integrated approach" and that the power of the mobile phone in an educational context can offer this by "being able to combine different elements in ways that are appropriate to the learning activities to be supported" (p. 19). Aggarwal, Turoff, Legon, Hackbarth and Fowler (2008) agree stating that the 24/7 nature of mobile accessibility will force a change in pedagogy, particularly as mobile networks advance (p. 281).

Strategies and applications involved in mLearning lend themselves to enhancing a constructivist approach to learning. Mobile devices, unlike wired devices, allow learning to take place in authentic environments. "Mobile tools give us a unique opportunity to have learners embedded in a realistic context at the same time as having access to supporting tools" (Lonsdale et al., 2005 p. 12). Therefore, educators are able to make use of the teachable-moments that so often occur outside of normal learning spaces (Mellow, 2005, Winters, 2007, Sharples, 2002, Valentine, 2004).

Opportunities in mLearning, like changes brought about to education through eLearning, will challenge the traditional role of teachers (Lonsdale, 2005, Valentine, 2004, Mellow, 2005, Sharples, 2009). Specifically teaching in a way that is suited to taking advantage of the flexibility that mobile devices offer, enabling learning that is truly student centred. Lonsdale et al. (2005) say, "the challenge for the educators and technology developers of the future will be to find ways to ensure that this new learning is highly situated, personal, collaborative and long term" (p. 36). In summarising the key findings of the mLearn 2004 conference, Valentine backs this up saying;

> The key to this shift is in redefining traditional views of learning for their application in this medium. If we mean personally attending a teacher-lead class or lecture then there's a problem. However if learning also means using a blend of mediums appropriate to enhancing the learning experience, then hand-helds begin to be serious contenders (2004, p. 30).

The use of mLearning strategies is not about replacing laptops. Nor is it about finding a solution to education using the mobile phone as the only device. Incorporating mobile devices in to the classroom facilitates opportunities for learning

beyond teacher led instruction to support, enhance and extend the learning that is already taking place (Beale, 2007, Brown, 2006).

> Being mobile adds a new dimension to the activities that can be supported, both because of the personal and portable nature of the devices themselves and because of the kinds of interactions they can support with other learners and the environment (Lonsdale, et al., 2005, p. 9).

mLearning is a means to enhance the broader learning experience, not (as was predicted for eLearning) as a primary method for delivering courses/distance learning (Valentine, 2004). Sharples (in Walker, 2007) agrees that mLearning is not about cramming current practice on to a small device, it is about using the device to facilitate alternative learning opportunities (p. 7). Prensky goes further to say that far from a simple content delivery platform mobile phones can be used to facilitate all forms of traditional learning processes such as, "listening, observing, imitating, questioning, reflecting, trying, estimating, predicting, "what-if"-ing and practicing" (2004, p. 3). In fact, proceedings from the 2007 mLearn conference held in Sydney show the case for mLearning continuing to evolve to include mobile web connectivity, with papers on mobile blogging (moblogging) and the role of mobile phones in assessment (Norman & Pearce, 2007). More recently there has been a call for mobile learning to move away from the 'anytime, anywhere' model and more towards using the technology to enable learners to do something they couldn't do before (Winters, 2007).

When considering the pedagogy of mLearning, it becomes clear that the technology can not be relied on to 'make the change'. Educators must first explore the potential for the technologies before adapting their teaching programmes in order to harness the learning opportunities which can be supported by the availability of the technology. Brown says, "the ability of educationists to design and develop didactical sound m-learning opportunities and environments that enhances learning is also imperative" (2006, p 2). Jamieson's views support this saying that, "effective m-learning implementation requires the practitioner to look beyond the technology and what it could potentially do for the user" (2004, p. 5).

The case may be that the effective implementation of mobile learning programmes means that educators need to re-think their role in the classroom setting. Often, the

use of mobile learning technologies to deliver learning outcomes may require educators to "take a back seat" (Jamieson, 2004, p, 4). Educators may need to rethink their understanding of the purpose of certain technologies and keep in mind that in the case of mobile learning, mobile devices are "tools in mediating the learning process - rather than a means to an end - or the final product" (Winters, 2007, p. 9).

Flexibility in the time and place learning can occur

As has been pointed out earlier, a key aspect of mobile learning is the ability to connect with learners in a wide range of learning environments. At the core of this is the opportunity for students to access learning opportunities at a time and place that is convenient to them (Mellow, 2005, Jamieson, 2004). While this motivation for using mobile devices with students is now being questioned (Sharples et al., 2009) there is still a valid point to be made that mobile technologies do enable learning to take place in non-traditonal places and times that may be more suited to the learner.

> Students have downtime during their day (waiting for a bus, riding on a train to their institution, waiting for friends to arrive, etc.) where they may not want to engage in traditional study due to the brevity of the time available to them (Mellow, 2005, p. 4).

Much of the early vision for mLearning focused on using students' mobile devices to communicate information to them - a push system which involved sending small bites of information out to students (Mellow 2005, Valentine 2004). Course content was broken into "chunks" (Mellow 2005, p 2) or "nuggets of information" (Valentine, 2004, p 7). This information was sent out to students to be accessed via their mobile phones at a place and time convenient to them. Oblinger & Oblinger finds that "Net Gen students, using a variety of digital devices, can turn almost any space outside the classroom into an informal learning space" (2005, p. 176) and argue that educators must now find ways to incorporate this in to their teaching and learning programmes.

> Learning does not stop once the instructor has left the classroom. Instead, the end of the class meeting marks a transition from one learning mode to another. As a result, institutions must address real and virtual spaces outside the classroom to ensure that they, too, encourage learning (Oblinger & Oblinger, 2005, p. 181).

In New Zealand, Peter Mellow has for a number of years been at the forefront of exploring the potential for mobile learning experiences with both secondary and tertiary level students. While now no longer operating, Mellow launched StudyTXT in 2004 as a means for pushing 'bite sized pieces of information to secondary and tertiary students' mobile phones for them to access where ever and when ever suited them. He described this as being like 'digital flash-cards' (2005, p.2). Mellow refers type of information that is most conducive to 'push' mobile learning strategies as 'chunking' – or the generation of small amounts of information for students to digest and deal with.

> Mobile devices are suited for 'chunking' due to their smaller screen size and storage capacity. The distillation of material into 'knowledge bytes' to be consumed by the learner, offers true flexibility of 'time, place and pace'. The diversity of media that can now be delivered by these devices adds more depth to their application (2005, p. 4).

Mellow does point out that this type of learning is still in the realms of "rote learning" (2005, p. 4) but says out that in the courses in which he was teaching, the students still do require a certain amount of content in order to construct answers that demonstrate higher order thinking skills and application. On moving beyond content based learning Mellow states that other forms of messages can be sent via the SMS server ie. images, sound and video and teachers can move beyond pushing out simple facts to giving students scenarios to which they should apply the learning covered in class earlier.

While 'any time any place' access has benefits for certain types of learners, particularly those based in practical on-location learning situations such as students involved in on the job training (Brown, 2006, Kukulska-Hulme, 2009), there are implications of this for students involved in more traditional education settings. For students currently in compulsory education, learning is not a personal choice or freedom, and therefore, while the capability for anywhere any time learning is available, these students may not be so willing to engage in this type of learning which could potentially be seen as encroaching on their freedom.

> Learning is, for many, what you do in school, and so is not a personal choice or a freedom ... [we need to be consider the] personal needs of people to turn things off, to be out of contact (Beale, 2007, p. 14).

Once again, this raises the issue of technology being placed at the forefront of education, with teaching and learning objectives to follow. Therefore, if educators are going to make the most of the flexibility of locations in which learning can happen as facilitated by the use of mobile phones, the context of the location becomes much more important.

Context based content delivery

Learning through mobile technologies should be dictated by how the technology can contribute to the desired learning objectives. Just because learning can take place in an environment, doesn't necessarily mean that it should, or that this would be particularly beneficial (Beale, 2007). The technical capabilities of mobile technologies mean that "mLearning has the potential to weave itself into the fabric of a learner or worker's study, business and personal activities, when and where they need it" (Valentine, 2004, p. 2) and is this point about technologies fulfilling a need that is key here.

The very nature of mobile devices mean that they can be used to assist learners in authentic learning contexts where "where real life is used to provide stimuli and activity for learning" (Ericsson, nd,, p. 12). The mLibraries study by the Open and Cambridge Universities in the United Kingdom is an example of using mobile technologies to facilitate context based learning opportunities. The key findings of the mLibraries report was that while the technology was capable, students were not ready to make use of a service which placed a large component of a library's resources on a mobile phone. However, what was useful was the potential to teach students to learn their way around the library through providing audio guides accessible via the students' mobile phones. Thus, providing a learning opportunity, facilitated by the mobile phone in order for students to engage with their physical context.

> Audio tours can be produced fairly quickly and inexpensively, so libraries which run inductions throughout the year or have a poor attendance rate at induction sessions for new students may find that tours could reduce the amount of staff time spent helping new users to orient themselves in the library and explaining the facilities available (Mills, 2009, p. 12).

Based on a similar philosophy, the MyArtSpace project (see http://ookl.org.uk) in the United Kingdom has been a successful example of using the basic functions of the mobile phone to encourage students to interact with a specific environment (Sharples, Lonsdale, Meek, Rudman & Vavoula (2008). The purpose of the MyArtSpace project was "to support structured inquiry learning through the design of an integrated technology that connects learning in the classroom with learning in museums and galleries" (Sharples, et al. 2008, p. 4). Children were given a task in class to collect multi-media recordings of specific themes at the museum they visited. The student generated multi-media content was then revisited and utilized in the classroom when the students returned to school after their field trip. The project was successful in linking the learning that occurred in both the classroom and in the museum through students creating their own multi-media evidence from the field-trip which was accessed again in the classroom.

Enabling access

While it is widely regarded that anytime/anywhere access is one of the key advantages of mobile learning, Geddes points out that access extends beyond location and time. The accessibility of mobile technology for people for whom a laptop or computer might otherwise be unattainable means that access to eLearning type strategies can be made "available to people who otherwise could not afford it" (Geddes, 2004, p. 2). Sharples et. al (2009) point out the irony in mainstream schools who are currently banning students from bringing their mobile phones to school, but struggling to provide computers.

The potential for mobile learning is probably going to see the most profound influence in those parts of the world for which access to technology is most limited. In an address to the United Nations in September 2008, the figures were given as this, "today there are more than 3.7 billion mobile subscriptions around the world. In a few years we will pass 5 billion. Ninety percent of new growth will come from emerging economies" (Ericsson, nd, p. 3). For these emerging economies, very many of whom have poor access to both technology and education, mobile devices could serve to be the disruptive technology that is game changing for them. It will be interesting to

witness the impact that these emerging learning strategies, brought about by necessity, will have on the education systems of more developed nations.

> The technology will become successful only if it is allowed to compete against non-consumption, where it surely would be better than nothing. Then bit by bit it could improve and change the way learning takes place in schools (Christensen, Horn, Johnson, 2008, p. 73).

Building relationships with non-traditional learners and disengaged youth

The nature of mobile technologies with communication as their core-functionality, has provided a strong platform on which to engage with less-traditional learners (Mellow, 2005, Jamieson, 2004) and often those who are disengaged from classroom learning situations. A number of mLearning studies, including The Australian Flexible Learning Network's TxtMe (Bateman, 2004 and Jamieson, 2004) and The University of Ulster in Northern Ireland (Ericsson, nd) are using mobile technologies to support 'at-risk' students. Mellow's 'StudyTxt' findings of New Zealand secondary and tertiary students also revealed that mLearning methods used were successful in "scaffolding non-traditional learners" (2005 p. 6). Bateman says of this, that m-learning strategies and mobile phone technology could motivate and support the retention of disengaged youth in "learning programs and the development of life-long learning skills through supporting collaborative, networked learning environments" (2004, p. 4). Valentine agrees and explains that,

> mLearning is a powerful method for engaging learners on their own terms especially for those who could be classed as non-traditional learners or for those groups of students who cannot participate in classroom learning for whatever reason (Valentine, 2004).

A key function that the mobile phone fulfills is facilitating the relationship between the teacher and learner. Bateman says that while students may appear to be disengaged from learning, often it is case of learners whose learning style is "socially based" not having their learning needs met. She says that "for learners in this demographic, the relationship between learner and teacher is a very important part of the learning relationship. It must be based on mutual trust and respect" (2004, p 4). Bateman later adds, "the social connection is the most important connection for Indigenous learners – once they feel socially supported and accepted, they are ready

to learn" (p 16). In an evaluation of the same study by the four educators involved their experience was that

> the use of SMS to communicate with students brings about a new form of teacher/student relationship. Educators now have the ability to be with the student 'from-the-hip', on time and in real time (Ison, et al. 2004, p. 6).

On questioning whether or not students like or appreciate using their own personal mobile device for their learning, The University of Ulster were surprised to find that students did not find receiving messages noting their absenteeism intrusive at all, and in fact wanted the university to expand the service to include other areas, for example reminders about assignment deadlines. The University reported a greater attrition rate as a result of sending out SMS messages to students - particularly in regard to student absenteeism.

Access to the mobile web

The development of, 3G mobile phones means access to the internet is available anywhere with mobile network reception. As noted earlier, the 2006 Horizon Report (Johnson et al.) highlighted mobile broadband as the technology that would have the biggest impact on education in the following two to three years. The mainstream adoption of web capable mobile devices potentially reduces the 'digital-divide' or the gap between those with access to (traditionally expensive) devices for enabling information access.

While students prefer the larger screen afforded by a laptop or personal computer, studies have noted that students have used mobile phones to access information to assist them with their learning through finding information that they can not access at school (often due to overly restrictive proxy settings). Kukulska-Hulme et al. reported that over a third of the 2,200 school students surveyed in their University of Nottingham research had used their mobile to access the internet – despite their phones being banned at school (2009). Research in to the use of the mobile web by secondary schools students in New Zealand, found that students "liked the ability to have personalised access to information that they wanted to look at and use, but secondly, they had access to the full, unfiltered internet" (Twiss, 2008, p. 33).

It is interesting to see that research investigating the use of mobile broadband as a tool for accessing particularly mobile enabled course information has also identified students' perception of when and how they access the internet as being a barrier to implementing effective mLearning strategies. Brusilovsky and Riszzo in evaluation of their research at The University of Pittsburgh, also reveals that students in America are not yet ready for anytime, anywhere access. Their findings showed that "many students are not 'mentally ready' to use mobile devices for educational needs "anytime, anywhere" as the proponents of the technology hope" (2004, p. 65). They found that less than 40% of students considered using the mLearning system in class and even fewer - less than 35% - for using anywhere. They summarised that, "it shows that students are not quite ready for "anytime, anywhere" access. They consider a mobile device more as a different kind of computer and tend to use it in the context where they traditionally use computers (home, lab, library)" p. 63. However, the researchers also pointed out that they felt that, "the student attitude to the use of mobile technology in education is changing as rapidly as the mobile devices are becoming common in everyday life" (2004, p. 63).

Recent developments in the field of mobile technologies mean that the web browsing experience is far more accessible and enjoyable than it was in the early days of 3G developement. The educational potential of the 3G iPhone and its optimised user interface and ubiquitous access to the internet has been highlighted in both the 2007 Horizon Report and the 2008 Australia and New Zealand Horizon Report (Johnson et al.). Both because of the way that it puts the technology in to the hands of the students and because of the potential integration with the mobile web. Development of specifically designed mobile web browsers such as Opera Mini mean the web browsing experience via mobile phone is fully optimised meaning web pages can be viewed fully and interactively and information can be both downloaded and uploaded easily by the user (Opera Software, 2009).

The practicality of anywhere, anytime internet access in New Zealand is currently not from main-stream (Communications Commisson, 2008). Although web capable devices are becoming more prevalent Telecom New Zealand have launched their XT network, enabling 3G access to "97% of where New Zealanders live, work and play"

(Telecom NZ, 2009) and Vodafone New Zealand state that over half of all devices they sell are 3G and therefore webcapable (Vodafone NZ personal communication). However, it is not just the mobile phone that is web capable, with both telecommunications companies offering 3G broadband for use with any laptop, and Vodafone selling the 'netbook' free on a 24 month broadband contract (Vodafone NZ, 2009) - as one would purchase a standard mobile phone, meaning that mobile broadband is on its way to becoming more widely accepted and adopted.

Having the access to so much information is going to have a profound affect on education (Johnson et al. 2006). This is going to bring about heightened importance of the teaching of information literacy skills in order for students to make useful sense of the information they are faced with. This topic is addressed in the following section.

Information Literacy

In his blog "2cents Worth" David Warlick author of Redefining Literacy 2.0, (2008) asks, "What are we going to ask on our tests, when our students are walking in with Google in their pocket?" "Are they going to be better questions than we ask today?" This section of the review will consider what impact access to the mobile web may have on the type of teaching and learning that takes place in classrooms in the future. Specifically, this section will focus on the importance of information literacy skills and will consider where exactly the teaching of these skills fit within the curriculum.

Defining information literacy

While there are numerous definitions for the term information literacy, most can be traced back to an accepted set of skills with which one is able to find, access, process and use information. At its core, information literacy can be seen as a key life skill brought about by our need to communicate effectively. Author of the Australia and New Zealand Information Literacy Framework (ANZIL), Bundy (2004) states that, "information is transmitted between people working together ... therefore communicating ideas and information is integral to information literacy" (p.1).

In all cases, information literacy is described as having a set of skills through which people access, process and make use of the information available to them. The ANZIL framework outlines information literacy as being “an understanding and set of abilities enabling individuals to recognise when information is needed and to have the capacity to locate, evaluate and use effectively the needed information” (Bundy 2004). The Chartered Institute for Library and Information Professionals (CILIP) outline information literacy as “knowing when and why you need information, where to find it and how to evaluate, use and communicate it in an ethical manner” (CILIP, 2008). The American Library Association (ALA) defines an information literate person as one who "must be able to recognise when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (ALA, 2008). It is worth noting that many of the sources of information accessed in this study are library associations, indicating that a key place for schools to begin with when considering information literacy would be with the school librarian.

Gwen Gawith, former National Co-ordinator of Information Studies Programmes, Auckland College of Education, provides a slightly different angle when considering what information literacy means. She says, “to be literate with information means to have the skills not to be obliterated by information – to be able to sort, sift, select, reject and use it with critical discrimination” (2004, par. 6). Gawith says that information is a “living, organic, social literacy, responding to social workplace and education needs as well as the evolving capabilities of ICTs to organise, find and disseminate, produce and communicate information” (2004, par .8.).

According to the ANZIL Framework, information literate people:

- recognise a need for information
- determine the extent of information needed
- access information efficiently
- critically evaluate information and its sources
- classify, store, manipulate and redraft information collected or generated
- incorporate selected information into their knowledge base
- use information effectively to learn, create new knowledge, solve problems and make decisions
- understand economic, legal, social, political and cultural issues in the use of

information

• access and use information ethically and legally

• use information and knowledge for participative citizenship and social responsibility

• experience information literacy as part of independent learning and lifelong learning

(Bundy, 2004)

It is important at this point to reiterate the fact that information literacy is concerned with information available from all sources, not just those accessed through technology (Bundy, 2004; CILIP, 2008). The CILIP definition goes so far as to list potential sources of information, stating that,

> information may come from another person, from a paper-based magazine or book, report or newspaper, from a digital source such as a database, a search engine or an e-book accessed through a computer, or it may come from any other form of media: film, video, DVD, radio, television, etc. The definition and skills or competencies above cross all media (2008, par. 2).

Bundy too gives a definition of information sources saying

> Information is available through community resources, special interest organisations, manufacturers and service providers, media, libraries, and the internet. In addition, information is available through multiple media, including graphical, aural, and textual. These pose special challenges in evaluating, understanding and using information in an ethical and legal manner
> (2004, p. 3).

While all elements of information literacy are important, the point at the forefront of teacher discussion is the ethical and legal use of information, particularly in regard to authenticity of the work that students present teachers. Information literacy can play a key role in promoting an understanding of what constitutes plagiarism and in deterring its practice by promoting integrity and accountability in the use and presentation of information.

Research does suggest that students do understand that it is unethical to pass off information that is not their own without citing the source from which it came. However, they often do so anyway. Reed, Kinder, and Farnum, (2007) studied changes in the information literacy of first year university students over a thirteen week university preparation course developed through collaboration with teaching

faculty and university librarians. They say of their research findings, “our surprise was, in part, due to the fact that many students express this knowledge but do not always show it in their work. For example, they fail to cite sources” (p. 12). The research does not go on to give possible reasons why this might be the case. One might expect that this is due to a lack of understanding as to how to approach citation correctly, but also a lack of understanding of how to approach and use information or perhaps even an authentic context for doing so.

Information Literacy in the New Zealand Curriculum

The revision of the New Zealand Curriculum (Ministry of Education, 2007) has seen a move away from information literacy as being what was referred to as an 'essential skill' within the former New Zealand Curriculum Framework, to a set of skills that are woven implicitly and inextricably through the Values and Key Competencies. The Curriculum outlines a vision which sees young New Zealanders as “confident, connected, actively involved, lifelong learners” (p. 8). Lifelong learning can be defined as “all formal, non-formal and informal learning whether intentional or unanticipated which occurs at any time across the lifespan” (Candy, Crebert and O’Leary, 1994, p. xi). The 'vision' of the New Zealand Curriculum envisages all students as lifelong learners who are “active seekers, users and creators of knowledge” and who become “informed decision makers” (Ministry of Education, p. 8).

Specifically the concept of information literacy fits within both the Key Competencies of 'Thinking' and 'Using Language'. Specific elements that constitute information literacy (such as those which make up the ANZIL framework) come through in the values, particularly those of 'integrity' (for the way in which information is ethically used and shared), 'innovation, inquiry and curiosity' and 'community and participation' (Ministry of Education, p. 10).

Generally, any information literacy standards that have been developed (ie. The ANZIL framework), have been done so for the main purpose of supporting information use in academic institutions, rather than specifically for primary or secondary schools. However, these are available for schools to adapt for their own

use within the curriculum. Generally, schools tend to follow models of information literacy that provide students with a formula or a set of steps for accessing and using information. There are a range of models for teaching information literacy skills from which either individual teachers or whole schools can develop an approach to information a selection of the more well known include;

The Big 6 *(*Eisenberg 2007). This system involves students working through six key steps; Task Definition, Information Seeking Strategies, Location and Accessibility, Use of Information, Synthesis, Evaluation.

Research Cycle (McKenzie 2000) which focuses on getting students to ask "essential questions" before jumping head first in to information gathering.

SAUCE developed by Trevor Bond and is a "process that facilitates pupils into inquiry learning, thinking and information literacy" (Bond, 2009).

3 Doors to InfoLiteracy, (Gawith, 2000) where the three doors each named, Aim, Claim and Frame open to a different set of skills

As many schools move towards a student-centered constructivist pedagogy (Oblinger & Oblinger, 2004) and the 'values' outlined in the revised New Zealand curriculum require the development of students who are "engaged and curious lifelong learners" (Ministry of Education, 2008, p. 10), it cannot be denied that information literacy has an extensive role to play in our education system. However, with the rapid rate of technological change over a very short amount of time, the question has been asked, are educators being given the skills to keep up with teaching students to deal with accessing information that is increasing at an almost incomprehensible rate? (Twiss, 2008) In the early days of mainstream internet access, between 1999 and 2002, it is estimated that the amount of new information stored electronically doubled (Gaunt, Morgan, Somers, Soper & Swain, 2007). If one projects out and adds to this the wide adoption of home broadband and more recently the content generating abilities brought about by the Web 2.0 revolution over

the time since 2002 it can safely be said we are dealing with an ever-changing information landscape.

Increased access to information

An increase in technologies, particularly personal, means that access to and availability of information has changed the nature of accessing information. It is pointed out that, “sheer abundance of information and technology will not in itself create more informed citizens without a complementary understanding and capacity to use information effectively” (Council of Australian University Librarians, 2001, p. 2). While it is easy to automatically relate this to students, teachers also need to be provided with access to professional development opportunities which encourage and teach them to understand and use information effectively within the new information landscape (Twiss, 2008).

The critical change to the information landscape that is prompting a major rethink on the part of teachers is that the rise of Web 2.0 or user generated content freely available on the internet means information now comes unfiltered, raising questions about “authenticity, validity and reliability” (Bundy, 2004 p. 3). In the days before the internet one did not need to consider so much as information was generally peer reviewed and students – particularly in schools more so than universities had a limited selection of texts to choose from, limited to the school or local library (Cuban, Kirkpatrick & Peck, 2001).

Research findings from the PEW Internet and American Life Project and The Graduate School of Library and Information Science now support that, “in general, more people turn to the internet (at home, work, libraries or other places) than any other source of information and support, including experts and family members” (Estabrook, Rainie & Witt, 2007). Add to this the ability to search the internet any where at any time on a device that the majority of the global population now owns, access to information and therefore information literacy becomes essential in a way that previously would never have been imagined possible.

The key characteristic of the post industrial 21st century is that it is information

> abundant and intensive. Information literacy is thus required because of the ongoing proliferation of information resources and the variable methods of access (Bundy, 2004, p. 3).

At this particular point in time, people still tend to view access to the internet as having a particular pre-defined role or purpose in their lives, and accessing the world wide web as being an activity which takes place at or during a specific time of the day or a specific place - for example, at work or school, or in the home. Current trends suggest that - while the telecommunications companies would like consumers to more readily turn to using their personal devices to access the internet at any time, this is not currently mainstream practice (Commerce Commision, 2008). Brusilovsky and Riszzo point out that

> the modern web is the largest treasury of education resource [that] has ever been available... it is currently anticipated that students access these resources from computers at home or at the university labs. This model contradicts with the popular 'anytime, anywhere' slogan of Web-enhanced education. While the web is always present, the students can't yet access it from anywhere (2004, p. 54).

Most agree that information literacy must be institution or school-wide – cross-curricular and taught throughout all levels of formal education (Bundy, 2004, Bruce, 1994, McGuinness, 2007). Bruce (as cited in Bundy, 2004, p. 11) states that, "information literacy cannot be the outcome of any one subject. It is the cumulative experience from and range of subject and learning experiences which creates the information literate person". McGuinness (2007) points out "evidence still suggests that information literacy is treated as an elective skill set on the periphery of the core curriculum in most disciplines" (p. 26). Information literacy should be taught as an integrated part of the curriculum rather than as a separate curriculum.

There is also concern, particularly in higher education circles, that while tasks are being set that require students to access information, the actual skills involved in information literacy are being left for students to access independently (Reed et al., 2007) and, that some of what passes for information literacy is merely a "bibliographic instruction that focuses only on information acquisition" (Badke, 2008).

Information literacy is regarded by all authors consulted for the purposes of this report as the key skill in enabling lifelong learning. CILIP (2008) states that while an

“information literate person should have an ability to be a lifelong learner and to reflect on what they are doing. That is not part of information literacy; rather it is a necessary attitude, as you cannot develop information literacy without it”. The Australian School Library association states that, “information literacy is synonymous with knowing how to learn" (2008, p.1). And finally, Bundy (2004) states “information literacy initiates, sustains and extends lifelong learning through abilities that my use technologies but are ultimately independent of them" (p. 4).

Conclusion

Educators world-wide are grappling with changes to the face of schooling brought about by the role that new technologies, and in particular the internet, play in teaching and learning. Changes to the New Zealand Curriculum (Ministry of Education, 2008) invite and encourage teachers to explore the many new technologies available to them and their students and it would seem that mobile phones should be no less considered as one of these technologies. This review has found that while there are a number of concerns with teenagers and their appropriation of mobile phones, the current system of banning these at school is not addressing or working to solve these issues. In contrast, with the more positively framed new found capabilities of particularly 3G mobile devices, it would appear that there is a wide-scope for working with teenagers to extend their understanding of the way they might make use of the technology.

In-light of some of the ways that educators are choosing to use mobile phones as covered in this review, it becomes very clear that the technology enables a wide-range of variation for the use of these devices within an educational setting. However, in order to make the most of many of these learning opportunities, it is going to require a fundamental rethink of the way teaching and learning happens. Simply using mobile phones to teach using traditional methodologies will not be effective. However, nor will planning teaching and learning episodes solely focused on what the technology is capable of. From the findings of this review, rethinking when and where learning opportunities can take place and how mobile technologies can facilitate this is fundamental to developing sound teaching and learning practice.

There is no denying that the impact of accessing the internet on-demand coupled

with the proliferation of information and resources available (some of which students are creating themselves) is going to have an impact on the skills students need to cope with working and living in a highly-connected society. Schools and individual teachers need to ensure that teaching and learning practice includes providing students with the opportunity to learn these skills, particularly a skill such as information literacy. However, government education bodies, such as New Zealand's Ministry of Education, also must ensure that teachers are themselves provided with the training to develop their own skills in this area also.

While there is a great deal of research in the use of mobile technologies in the education, many studies are small, isolated instances of use, with the extensive research from Nottingham University (Sharples et al.) being a notable exception. Much of the research focuses on a variety of mobile technologies. However, it was the intention of this review to focus solely on the use of mobile phones – due to the fact that many New Zealand school students already own these. Much of the content accessed for this literature review included studies and research particularly related to the tertiary and vocational education settings, many of which highlighted or explored the potential of mobile phones for enabling authentic life-long learning and this is an area with a great-deal of scope for further exploration.

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