

M-learning: Finding a place for mobile technologies within tertiary educational settings



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Today's students have grown up with enormous access to digital technology in the last decades of the 20th century. As educators we are left to grapple with what *form and shape* learning will look like in tertiary settings in the next few decades? The use of M-Learning tools themselves does not guarantee their potential being realised. The key to success is the ability of educators to design and develop pedagogically sound opportunities and environments that enhances learning. This presentation will provide an overview of what is currently happening regarding M-Learning in tertiary institutions and it will look at the conclusions of these initiatives. It will highlight the challenges and issues confronting tertiary educators when planning and catering for the needs, preferences, attitudes and habits of young Generation C mobile technology users and look at the potential applications or uses of M-Learning in the tertiary context. It will present a brief description of M-Learning initiatives currently being trialed at Queensland University of Technology. The paper will conclude with a brief examination of educational policy developments regarding M-Learning around the world and a summary of the changes facing tertiary educational settings.

Keywords: mlearning, learning design, tertiary education, mlearning policy

Today's students: Digital natives and the educational implications

As Mark Prensky (2001) has suggested, today's students are no longer the people the current educational systems have been designed to teach. Today's students have enormous access to digital technology and display characteristics such as digital fluency and familiarity with new technologies never before imagined, they are digital natives (Prensky, 2001). They are the speakers of the digital language of computers, mobile telephones, the Internet and other associated technologies, they are Generation C. Generation C typically produce and share digital content (Tribe, 2004), such as blogs, digital images, digital audio or video files and SMS messages. As educators, we are faced with the task to educate, engage and challenge these students. However, what is clear is that their digital literacy and their digital expectancy needs to be incorporated within meaningful learning scenarios. Thus we are left to ask, what form and shape will learning in tertiary settings acquire in the next few decades?

Generation C have grown up in a world dominated by mobile telephones. Mobile telephones have perhaps been the fastest growing technology in recent years. In a world population of 6 billion, there are 1.5 billion mobile phones (Keegan, 2004, p.3). Mobile device adoption continues to rise, for example, in the U.S. in 2004, there were 181.1 million mobile users, which surpassed the number of land-based lines, 177.9 million (Wagner & Wilson, 2005, p.40). In China there are 358 million mobile phones and this figure grows by 160,000 per day (Keegan, 2004, p.3). The global sales of smartphones or internet-enabled pc-capability telephones, in 2003, overtook sales of PDAs and by the year 2010 it is estimated that the global sales of smartphones will reach 170million (Attewell, 2005, p.2). The mobile telephone provides users with access to communication channels, video and audio technologies, Internet access and text messages. The number of users engaging with these capabilities are reflected, for example, in statistics such as those from America where in June 2005, approximately 5 billion text messages were sent (Industry Resources, 2006, para. 7).

The potential application of mobile technologies or Wireless Mobile Devices (WMDs) (Cochrane, 2006) to learning scenarios has attracted a growing body of research. Here is a new technology that for the first time is more widely accessed by a broader group of users. It is not a technology that is limited due to financial constraints, thereby avoiding the digital divide. It presents as an approach to learning that potentially is effective in engaging and motivating today's students. As Attewell (2005) concluded learners who participated in research projects that examined the use of WMDs were mostly enthusiastic about mobile learning and 62% reported that they felt motivated to take part in future learning after trying

mobile learning. They also present technology in a more convenient form, easier to carry and often with a longer battery life than laptops (Cochrane, 2005).

Today's students are digitally fluent and interact with Internet-based technologies in a variety of ways. As reported by a survey conducted in America on 625 youths aged between 10 to 17 years;

- 71% used the Internet to get news or information
- 68% used their computers to send and receive emails
- 56% to get information about sports, entertainment and hobbies
- 54% to talk in chat rooms
- 17% to get health or medical information
- 17% to shop (Youth Facts, 2006, para.11)

These findings are indicative of worldwide trends, as 79% of youths reported having access to a home computer, 48% reported frequently using it for word processing and 55% reported using the Internet for information (OECD, 2005). Thus we can see by this brief examination of the characteristics of digital technologies in today's society that Generation C are well described as digital natives (Prensky, 2001). Our current education systems have been designed with a different student in mind. As teaching professionals we need to consider the experiences and capabilities of our students and incorporate new technologies in a meaningful way within the tertiary context. This consideration is not only designed to motivate and engage the learners, but will also help prepare our students to be significant members of society. New technologies will continue to improve and have an impact on our teaching and learning.

Hence we are reaching an understanding of what characterises are future students, Generation C but we need to clarify what are we describing when we use the term M-learning? There has been some debate over the definition of M-Learning, whether it refers to the devices being used or the learner who uses them. Mobile would generally infer that the learning is "personal and portable" (Naismith, et al, 2004). Early research 2000–2002 focused on such mobile learners. These were learners who were not part of traditional learning environments, but who had perhaps been identified as distance learners previously. More recent research has seen the definition shift to focus on the mobile devices themselves and more particularly on the characteristics of the learning experience they facilitate and the learners who interact with them. Keegan (2004) proposed that the focus of the definition should be on mobility devices, and defined it as "the provision of education and training on PDAs/palmtops/handhelds, smartphones and mobile phones" (p.3).

An overview: Current M-learning initiatives in tertiary settings

There have been relatively few projects conducted on M-Learning initiatives in tertiary settings considering the impact of WMDs on our lives. This is an area that is in its infancy with regard to educational applications and the majority of research have been conducted on disengaged youths (Attewell, 2005), primary students (Sharples, Corlett & Westmancott, 2002; Silander, Sutinen & Tarhio, 2004; Wang, Liu, Chou, Liang, Chan & Tang, 2004; Zurita & Nussbaum, 2004) and tertiary students (see below). Tertiary initiatives have been largely University based, with few projects conducted in vocational educational settings. There have been a small number of projects conducted in SE Asia, one in Taiwan, four projects conducted in China and one in Korea however these have not focused on education or pedagogy and hence have been omitted from this overview.

The United Kingdom and Europe

- A 10 month trial of a mobile learning organiser with 17 Master of Science students at the University of Birmingham (Corlett, Sharples, Bull & Chan, 2005). The organisers were used to deliver course materials, messages, submissions and facilitate collaborative communication. *Findings:* Generally positive feedback, but only 30% were using the device everyday by the end of the trial. Some technical problems were mentioned, plus some perceived limitations.
- Uniwap II: Students in a teacher training course at University of Helsinki used mobile devices to discuss teaching methods collaboratively with teachers and other students whilst on teaching pracs (Seppala & Alamaki, 2002). They also used SMS and digital images as a part of supervision. *Findings:* Heavy use of the program Uniwap II indicates that students engaged with the project and it succeeded in creating flexible teaching solutions.
- Alumni of The Open University's Masters in Online and Distance Education were surveyed to examine how far mobile devices were embedded in their personal and professional lives (Pettit &

Kukulska-Hulme, 2006). *Findings*: Use-patterns have implications for educational use and further details are needed on how WMDs are used and by which groups.

- The use of Podcasts by Universities in the UK and Europe to deliver educational content: Bath University, the Open University, Warwick University, Nottingham University and Ulster University

South Africa, Australia and Asia

- M-Learning and vocational education: This project describes mobile innovations in four TAFEs within Australia. The mobile devices were used in the delivery of learning to workplaces, to deliver self-induction offsite and to deliver creative learning initiatives (Ragus, Meredith, Dacey, Richter, Paterson & Hayes, 2005). *Findings*: Findings from each initiative are generally positive. There is evidence that these programs have been ongoing for a period of time and have been evaluated and changed.
- This project describes how English language lessons were delivered 3 times per day to university students via SMS at Kinjo Gakuin University, Japan (Thornton & Houser, 2004). *Findings*: Tests between the students involved in the M-Learning and traditional students showed that they performed better in language tests.
- The use of SMS to create channels of communication between lecturer/tutor with first year undergraduate students at Griffith University (Horstmanshof, 2004). The project was aimed at providing support and encouragement to students in order to help them with persisting in their studies. *Findings*: SMS provided students with connection and community between themselves and their tutors and this had a positive influence on persistence.
- The use of SMS in microeconomics experiments at the University of Sydney (Cheung, 2004). SMS messaging was used as a response mechanism for problem-solving experiments. *Findings*: SMS help to overcome logistical problems.
- The potential use of WMDs at Deakin University has been explored by Armatas, Holt and Rice (2005). *Findings*: Mobile technologies have the ability to push information to students and support the existing online learning platforms.
- The use of SMS with students enrolled in 3 university programs at the University of Pretoria, South Africa. This project describes how the WMDs were used to provide learning opportunities to learners without access to learning or who continually moving (Brown, 2005). *Findings*: M-Learning in Africa reaches more people than online learning due to the proliferation of mobile networks.
- The use of Podcasts by Australian Universities to deliver educational content: Queensland University of Technology, Curtin University, University of Sydney and Melbourne University

Canada and the USA

- The M-Library project at Athabasca University (Coa, Tin, McGreal, Ally & Coffey, 2006). A mobile university library website was established that was available to all students. *Findings*: This project acknowledges that improvements need to be made to the delivery of the learning platforms but positive feedback from users encourages further developments.
- M-Learning applications that were linked to existing course websites were piloted on undergraduate and postgraduate students at the Lowell College of Management, University of Massachusetts (Motiwala, 2005). *Findings*: Perceived by students as an effective tool or aid to enable flexible learning.
- The *ActiveCampus* Project at the University of California, explored wireless context-aware computing as a means of creating a learning community (Griswold, et al, 2004). *Findings*: Mobile technologies support classroom activities.
- The use of Podcasts by Universities in the USA and Canada to deliver educational content: Harvard, Yale, John Hopkins University, University of Wisconsin, Penn State University, Brock University and University of Western Ontario

The challenges and issues facing tertiary institutions

What appears to distinguish m-learning from more traditional forms of learning is the potential audience it has access to. As Brown (2005) states it “has the potential to make learning even more widely available and accessible than we are used to in existing e-learning environments” (p.299). It would appear to have the potential to access learners regardless of age, gender, national identity, or socio-economic status (Wagner & Wilson, 2005, p.40).

As mentioned above, much research has been conducted on disengaged youths, 16-24 year olds, not in full-time education or training (Attewell, 2005) who have also been described as “hard-to-reach” learners (Stead, 2005) and disenfranchised learners or those most at risk of social exclusion (Attewell & Gustafsson, 2002; Naish, 2005). What they appear to have in common is that they were not accessible by traditional learning methods and m-learning was seen as a tool to increase their motivation and engagement in learning. Initial research using these groups of learners were motivated by falling rates in basic literacy and numeracy skills (Attewell & Gustafsson, 2002) and the desire to try and bring these groups back into a learning environment. These early trials were also exploring if the enthusiasm young adults had for mobile phones could be harnessed to encourage participation in education or training (Attewell, 2005). Research has also suggested that m-learning has created a new landscape of situated and life-long learning (Sharples, Corlett & Westmancott, 2002). It would appear to encourage learning outside formal education and may be a useful tool in the field of workplace learning.

This research has great potential for tertiary settings:

1. Tertiary institutions may be able to access a new audience, learners who traditionally have been excluded from tertiary education. Tertiary institutions would be well-placed to develop learning scenarios that would re-engage these learners who may then continue on into more traditional university courses later.
2. WMDs may be a tool for increasing student motivation and engagement in tertiary learning.
3. WMDs will allow tertiary institutions access to workplace-based learners who would traditionally not be viewed as potential students due to barriers such as time and accessibility.
4. In the current educational climate, competition for tertiary enrolments is highly competitive. Tertiary institutions that offer new technologies and tools commonly used by Generation C may attract higher enrolments.

The potential application of M-learning technologies in tertiary settings

If we accept that our future students, Generation C, have particular digital capabilities and expectations, and that WMDs will create new types of potential students, disengaged youths and workplace-based learners, how can M-Learning be incorporated within traditional-tertiary settings? Research has concluded that m-learning works best when used as part of a blend (Brown, 2005; Johnson, McHugo & Hall, 2006; Stead, Sharpe, Anderson, Cych, & Philpott, 2006). For example, as a supplementary tool that is used in combination with traditional methods, such as paper-based materials, lectures and other ICT tools. As Stead et al. (2006) concluded “learning worked best for learners and tutors when it went beyond the mobile device, and incorporated other media or experiences” (p.13).

The characteristic of ‘mobility’ also offers new applications, as it “enables a transition from the occasional, supplemental use associated with computer labs, to frequent and integral use of portable computational technology” (Rochelle, 2003, p.260). It can also bridge formal and informal learning experiences (Wagner & Wilson, 2005). Perhaps, importantly the combination of WMDs with increasingly common WiFi hotspots is the potential to create a virtual collaborative learning community between tutors and students (Cochrane, 2005; Griswold, et al., 2004). Thus creating opportunities for more collaboration and communication amongst staff and students than currently available.

The types teaching resources they can offer:

- SMS (text messaging)
- Audio-based learning (MP3 players, podcasting)
- Java quizzes
- Specifically designed learning modules using m-learning software
- Media collection via camera-phones
- Online publishing and blogging via SMS, MMS, cameras, email or web browsers
- Field trips using GPS positional tools
- Concept maps via SMS (Silander, Sutinen & Tarhio, 2004)

The use of M-learning technologies in tertiary settings: Queensland University of Technology

Queensland University of Technology (QUT) is located in Brisbane, Queensland and has a student body of 40,000 students with a considerable proportion from overseas (12%). The university offers a broad range of undergraduate and postgraduate degrees and is the largest provider of bachelor degree graduates into full-time employment in Australia each year. Several faculties have adopted mlearning strategies, notably the Faculties of Business, Creative Industries, Education and Built Environment and Engineering. QUT provides free wireless access to its IT services, QUT Virtual, WebMail and Blackboard for students within designated wireless zones. Hence the infrastructure for the adoption of WMDs is in place. It is common to see students use laptops, PDAs and smartphones in lectures, in the library and in group study rooms. Recognising the popularity of these devices and their potential within the university has not been part of a formal policy, but has been the response of individual faculties.

The Faculty of Business has pioneered the use of podcasts within the university developing **QUT iBiz Podcasts** to deliver lecture audio files in a format students would be able to both utilise and are motivated to engage with. Built on the back of this success, The Centre of Philanthropy and Nonprofit Studies has produced **QUT CPNS Nonprofit Podcasts**. This series discusses key nonprofit issues of the day including recent research, legislation and policy. These programs are 10-20 minutes in length and are posted monthly on the first business day of each month and are aimed at the staff and local business community. The Faculty of Built Environment and Engineering has been working on developing robust systems for mobile communications using advanced signal processing, in an attempt to ensure better connectivity.

Doctoral research at QUT has also embraced mlearning. Three doctoral students from the Faculty of Information Technology have designed a program that permits students to receive lectures via their mobile phones or PDAs. The system, **QAT** (Question Answer Technology) allows lecture notes to be downloaded onto the mobile device for offline use, such as pausing the information and asking questions via speaking to their device. This is then linked into a community platform where fellow students or the lecturer may answer or contribute suggestions. Hence taking the portability of mobile devices and combining them with the interactions they facilitate for educational purposes.

The Creative Industries Faculty and the Australasian CRC for Interaction Design (ACID) have developed a mobile interface software program (MiLK) which sought to provide educators with a software interface that allowed them to create learning scenarios with WMDs. This program was trialed, in partnership with the Faculty of Education in April 2007. The MiLK program was trialed with secondary school teachers, of whom 83.33% reported a foreseeable use for mobile devices in their classroom upon the completion of the workshop (Lloyd, 2007). The MiLK program sought to create opportunities for students to use SMS messaging for complex problem-solving. The number of teachers who responded positively (83.33%) regarding recommending the use of mobile phones (Lloyd, 2007) would indicate that the program potentially bridges the gap between educators, learning goals and the learner. The MiLK program was built on the success of earlier work on creating mobile software programs that provide easy to use interfaces for educators. *Cipher Cities*, was a toolkit developed for building creative social networks used to organise and deliver mobile content to users in multiple contexts (Jacobs & Polson, 2006). *SCOOT* was a mobile location-based game designed for the museum spaces of Federation Square. Mobile devices were used to interact with the public displays around the site (Jacobs & Polson, 2006).

The potential of M-Learning is largely dependent on the pervasive connectedness of the tools being used and harnessing the features of those tools, such as podcasts (Campbell, 2005; Maag, 2006). Wagner and Wilson (2005) identified several advantages of this; equal opportunity of access, ubiquitous connectivity, multigenerational use and users, services for the mobile worker and learner (p.42-43). The use of M-Learning tools themselves does not guarantee its potential being realised. As Brown (2005) warned “the ability of educators to design and develop pedagogically sound m-learning opportunities and environments that enhances learning is also imperative” (p.299). As a result a number of research projects have been aimed at developing pedagogically sound software programs to facilitate these opportunities (Keegan, 2002). Most of the research has mentioned the limitations that the small screen size and keyboard have on learning activities (Brown, 2005; Sharples, Corlett & Westmancott, 2002; Wagner, 2005). Hence when designing learning activities for m-learning tools, Uther (2002) proposed the following principles should be used as guidelines; only relevant information be used, consider the variations in context of the learners, the display size is limited and navigation devices need to be consistent (p.174-175).

A synopsis of the learning potential of mobile technologies

- It reaches places traditional learning cannot (Attewell, 2005; Sharples, 2005; Sharples, Taylor & Vavoula, 2005; Stead, 2005, Stead et al., 2006)
- Learning is more user-centred (Roschelle, 2003; Sharples, Taylor & Vavoula, 2005; Taylor & Evans, 2005)
- It works best as part of a blend of approaches (Attewell, 2005; Stead, 2005)
- It works best if perceived as another tool that can be used to fit a learning need (Sharples, 2005; Stead, 2005)
- Can be used to remove some of the formality which non-traditional learners may find unattractive (Attewell, 2005)
- It can increase motivation and engagement with learning (Stead et al, 2006)
- M-learning is ideal for facilitating collaboration and communication (Farooq, Schafer, Rosson & Carroll, 2002; Stead, 2005; Zurita & Nussbaum, 2004).
- Mobile technology can enhance the growing shift from an instructor centred classroom teaching to constructivist learner centred educational settings (Holzinger, Nischelwitzer & Meisenberger, 2005)
- Makes the learning process quicker, easier, more attractive and more acceptable to disenfranchised learners (Attewell & Gustafsson, 2002)

Developments in educational policy

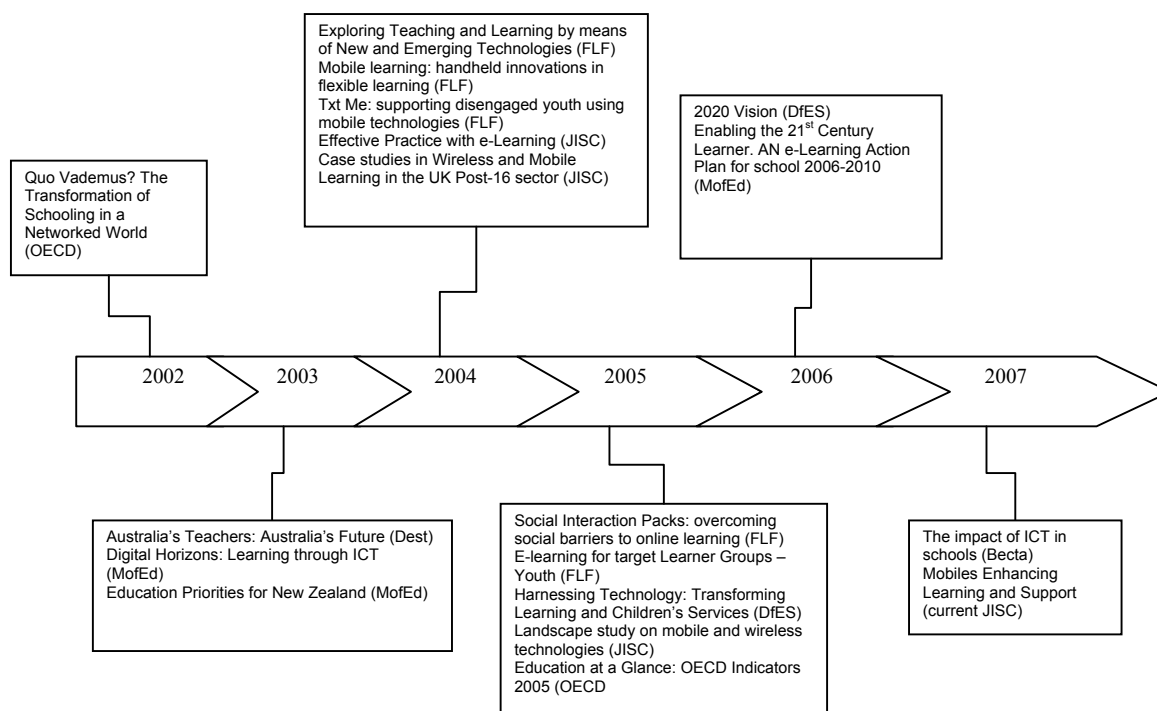
It is clear that M-Learning presents a number of advantages for teaching and learning in tertiary settings. However, formal education policy has been slow to respond to this new technology and it is currently the initiative of individual institutions to translate these WMDs into learning technologies that will be adopted by educational settings. A brief overview of key policy documents from the OECD, the United Kingdom, Australia and New Zealand has been presented graphically as indicators of the current position regarding this technology. Policy documents included in this overview are those that specifically refer to mobile technologies. As can be seen from figure 1, the OECD initially indicated the potential of this technology in 2002, however education policy has been slow to respond. It was not until 2004, that policy documents specifically concerned with mobile technologies began to emerge.

Changes facing educators working in tertiary settings

There are a number of changes facing educators who are incorporating mobile technologies into learning scenarios in tertiary settings. These will be explored below:

Teacher resistance

Teaching is a profession that requires its practitioners to constantly change and adapt. New approaches to learning, new theories, new policies and new technologies are constantly presented to teachers as elements that need to be acquired and incorporated in the classroom. The fast pace of technological change has meant that teachers have been presented with many new developments and tools from this field in a relatively short period of time. Some educators resist such changes, some embrace them enthusiastically. However, as Selwyn (2003) states “it would be unwise for educationalists to dismiss the rise of mobile telephony as a passing ‘fad’ or affectation of youth culture and fashion. Instead, the mobile phone epitomises a significant technological shift as ICTs rapidly converge into highly mobile and individualised artefacts” (p.132). Unlike other educational innovations, this new technology is firmly rooted in the society in which educational institutions are a part of. Ignoring the use or applications of this technology would be ill-advised. It should be remembered, that whilst they are widespread and prevalent, they are not replacements to teacher-led learning. As Roschelle (2003) suggested “most wireless mobile technologies for education in the literature today fall in the tool camp; they do not control learning, nor do students program them” (p.261). Hence, teachers need to view M-Learning as a powerful tool that will compliment their teaching.



FLF *Australian Flexible Learning Framework*
MofED *Ministry of Education (New Zealand)*
Dest *Department of Education, Skills and Training (Australia)*
Becta *British Educational and Communication Technology Agency*
DfES *Department for Education and Skills (UK)*
JISC *Joint Information Systems Committee (UK)*

Figure 1: Overview of policy initiatives

Mobile technologies as a bridging tool

Mobile technologies present as a means of bridging the gap between formal and informal learning. Learning is no longer limited to time spent in formal educational settings but can now be carried across to informal contexts. This would have enormous benefits for adult learners, field work with school-based learners and re-engaging disenfranchised learners. Mobile technologies are forcing us, as educators, to reconceptualise learning contexts. Learning need not be limited to formal prescribed contexts, but can more easily take place in learner-focused contexts. If we consider Generation Y, this is a group of learners who have not been constrained or limited to where and when they communicate or when they access information. This dynamism and fluidity is expected by today's learners to be carried across to education. "There is a need to re-conceptualise learning for the mobile age, to recognise the essential role of mobility and communication in the process of learning, and also to indicate the importance of context in establishing meaning, and the transformative effect of digital networks in supporting virtual communities that transcend barriers of age and culture" (Sharples, Taylor & Vavoula, 2005, p.1).

Empowering teaching professionals to keep pace with technology reforms

Teaching professionals need to be empowered with skills, time and accessibility to new technologies if they are to keep pace with technology reforms. "As mobile connectedness continues to sweep across the landscape, the value of deploying mobile technologies in the service of learning and teaching seems to be both self-evident and unavoidable" (Wagner, 2005, p.42). As new technologies emerge, teachers should be empowered enough to reach out and use them without hesitation nor fear. How do we empower teachers? Via education, information and access. New technologies will be absorbed and used if the teaching profession is presented with the advantages they present on student learning and this is only possible via education. Teachers need access to more training, more information and more opportunities to see and use new technologies for themselves.

Changes in Teacher Role	
A shift from: Knowledge transmitter, primary source of information, content expert, and source of all answers. Teacher controls and directs all aspects of learning.	A shift to: Learning facilitator, collaborator, coach, mentor, knowledge navigator, and co-learner. Teacher gives students more options and responsibilities for their own learning.
Changes in Student Role	
A shift from: Passive recipient of information. Reproducing knowledge. Learning as a solitary activity.	A shift to: Active participant in the learning process. Producing and sharing knowledge, participating at times as expert. Learning collaboratively with others.

Figure 2: Changes in traditional roles (UNESCO, 2006, p.3)

Changes to traditional teacher and student roles

Traditional teacher and student roles have the potential to change when ICTs are added to the learning equation.

Conclusion

The adoption of M-Learning in tertiary settings would appear to be underway, though it is still in its infancy. The early trials of WMDs in tertiary settings would indicate that the successful adoption of this technology is largely dependent on issues of design and fit. With careful planning, the learning potential of this technology could be harnessed in a meaningful and contributory manner. Unlike other educational contexts, tertiary institutions are well situated for easy uptake of this learning technology. The feasibility of implementation in tertiary settings would appear to be a strength with the prevalence of WiFi hotspots across campuses and the prevalence of WMDs among the student and teaching body. It presents as a learning tool with great applicability and as Cochrane (2005) concluded, the m-learning revolution is underway, and it is time tertiary education harnessed its potential (p.196).

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