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Distance learning at times and places chosen by the learner:

Adapting resources and learning behaviours for working with mobile digital devices

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List of acronyms

(CoLL)	-	Contextual Life-long Learning – this term suggests that learning is an activity not confined to pre-specified times and places and that traditional education cannot provide people all the knowledge and skills that they need to prosper throughout their life-time.
CQUniversity	-	Central Queensland University
DE	-	Distance Education
eLearning	-	E-learning involves the use of a computer or electronic device (e.g. a mobile phone) in some way to provide training, educational or learning material
ICT	-	Information and Communication Technologies
LMS	-	Learning Management System
mLearning	-	Learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning affordances by mobile technologies
USQ	-	University of Southern Queensland
WHDs	-	Wireless Handheld Devices

Executive Summary

The Distance learning at times and places chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices, was a collaborative project between the University of Southern Queensland (USQ) and CQUniversity, supported by the DEHub and funded by the Australian Government Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) through the DEHub Project. The project's main aim was to investigate the affordances and constraints associated with small mobile wireless handheld devices (WHDs), namely the 4th generation iPod Touch, for enhancing distance and online student learning opportunities. The study addressed the following specific research questions:

1. **How does the introduction of the iPod Touch affect distance learners' interactions with course content?**
2. **How does the introduction of the iPod Touch affect distance learners' patterns of communication with instructors and peers?**
3. **Which capabilities of the mobile devices are valued by distance learners and for what purposes?**
4. **What constraints are evident in the use of the mobile devices to support distance learning?**
5. **What modifications to university study resources are necessary or desirable to optimise their use on the iPod Touch or similar mobile devices?**
6. **What adjustments to course design would enable most effective use of the iPod Touch or similar mobile devices to support learning?**
7. **What costs and associated issues need to be addressed at an institutional level for scalability**

The small-scale study (N=47) used Activity Theory (Engestrom, 1999) to underpin the mixed-method, case study methodology. Student participants were enrolled in nursing and education courses at either USQ or CQUniversity. Two semester-long trials of the iPods were conducted and data were collected using a variety of quantitative and qualitative tools as listed in Table 1. The round 1 trial results form the basis of this report. The activity timeline for the project is displayed in Table 2. The research has highlighted the following key points in relation to the seven research questions:

Outcome 1 - How does the introduction of iPod Touch affect distance learners' interaction with course content?

The project has identified a wide range of difficulties in access to course material via iPod Touch devices that affect distance learners' interaction with course content.

Students reported the main affordances to be anytime, anywhere access to content related to the mobility of the device, immediacy and convenience. However, course material needs to be (re)formatted in a manner that makes it easily accessible from mobile devices. Without due attention, and institutional support to achieve this, students reported difficulties in viewing resources and accessing material through the online course management system (Moodle).

Outcome 2 - How does the introduction of iPod Touch affect distance learners' patterns of communication with instructors and peers?

The project identified connectivity problems in the use of iPod Touch devices that can affect distance learners' patterns of communication with instructors and peers.

Where online access was available, students were able to use the devices for email and skype communication with lecturers. However, communication tools such as Moodle, Wimba and Blackboard Collaborate have not been modified adequately for mobile access. The use of a primarily asynchronous device with intermittent online access to support distance education course communications was problematic in many instances. The project highlighted that the introduction of a communication device to support specific course communication outcomes needs to be well planned into course designs and effectively facilitated with internet access.

Outcome 3 - Which capabilities of the mobile devices are valued by distance learners and for what purposes?

The project identified, through pre and post trial surveys, a range of reasons why mobile devices were either valued or not valued by distance learners, and for what purposes mobile devices were used.

Students reported access, mobility, immediacy, engagement and convenience as key themes in relation to the affordances of the devices. These are represented in Figure 4. However, the study also highlights a need for institutions to make students aware of the value that mobile devices can make to their studies and to ensure that planning is undertaken systemically to integrate the WHDs into course design. Course materials and existing systems need to facilitate online access by mobile devices.

Outcome 4 - What constraints are evident in the use of mobile devices to support distance learning?

The project identified a range of constraints evident in the use of mobile devices to support distance learning.

From a student perspective, the screen size was the main limiting feature of the iPod Touch. Students are increasingly familiar with larger format tablets (i.e. iPad) and further trials could consider comparing a wider range of devices and formats. Likewise, Internet connectivity was seen as a limiting factor.

In general, the most significant constraint on students was that the devices were not an essential tool to support their learning in the courses involved in the trial. Students considered the device to be an 'aside' or an 'optional extra'. This is likely to have impacted negatively on the research results. The study has been effective in identifying a range of constraints and has progressed some solutions to overcoming these constraints.

Outcome 5 - What modifications to university study resources are necessary or desirable to optimise their use on the iPod Touch or similar mobile devices?

The project identified a range of modifications to university study resources necessary to optimise their use on the iPod Touch or similar mobile devices.

Chief among these is the need for formal workflow processes, quality assurance, and institutional support to prepare course material for use on mobile devices. The study has identified that this process is a substantial and important undertaking for institutions to take to make distance education more effective on mobile devices.

Outcome 6 - What adjustments to course design would enable most effective use of the iPod Touch or similar devices to support learning?

The project identified that adjustments to course design would enable more effective use of the iPod Touch or similar devices to support learning. A structured process is recommended, that doesn't necessarily rely on individual academics with limited understanding of the requirements for effective delivery on mobile devices to prepare course materials. The study has identified course design workflow and quality assurance as key factors in preparing distance education courses to effectively use mobile devices.

Outcome 7 - What costs and associated issues need to be addressed at an institutional level for scalability?

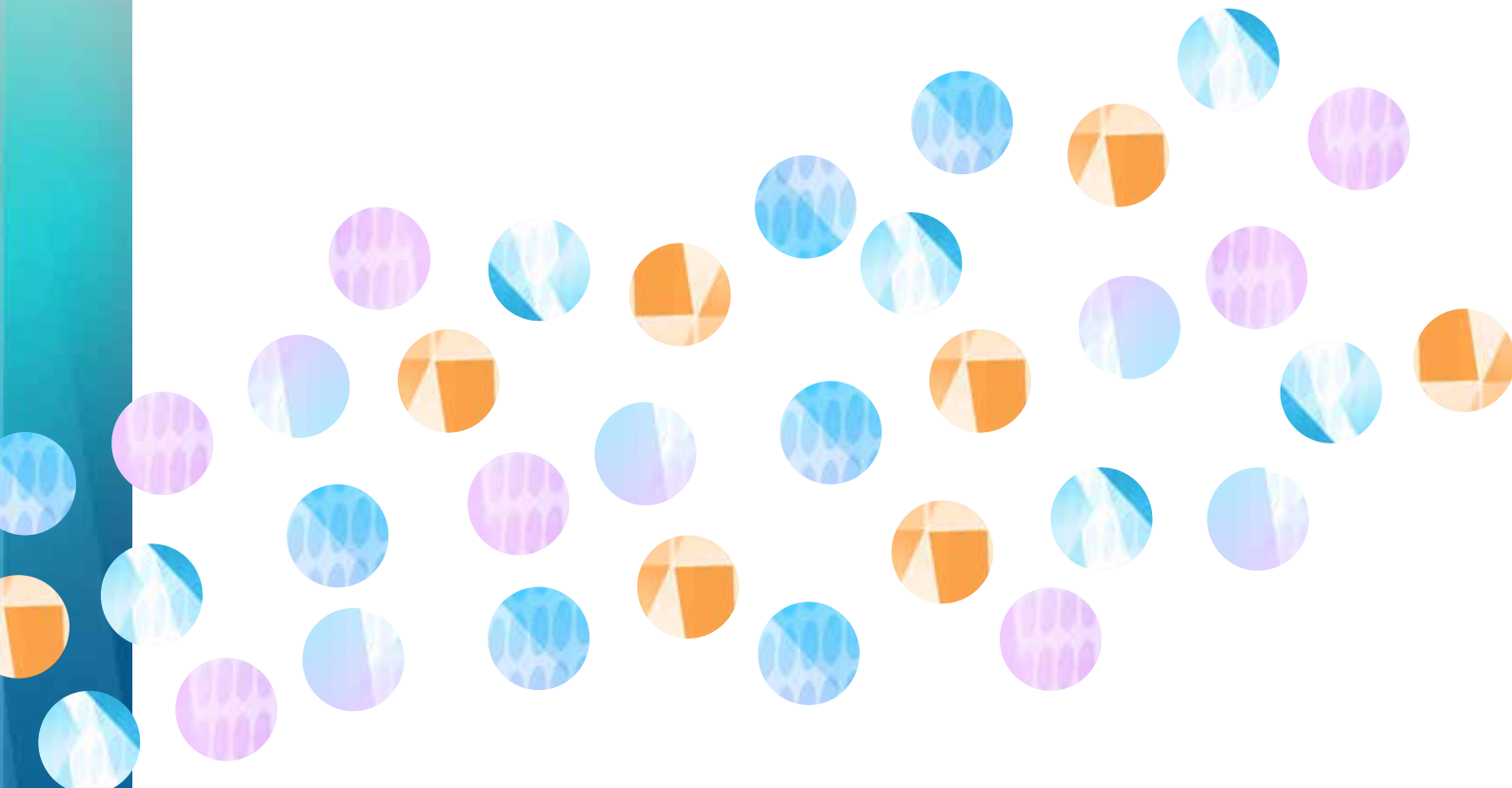
The project identified several costs and associated issues needing to be addressed at an institutional level for scalability.

Issues identified in this project which need to be addressed include:

- **Course development,**
- **Technical support,**
- **Integration with existing systems (LMS, Lecture Capture, Online Communication Tools), academic training, and**
- **Student communication on the effective use of the devices.**

These are important issues that need to be addressed at an institutional level. Simply providing students and academics with the provision of mobile devices is not sufficient to ensure success, and this project has highlighted that these issues need to be addressed, as the impact can result in negative effects on student use of the devices for learning.

Scalability issues also need further development as the project only looked at four courses with small cohorts that were manageable within project funding and staff time commitments. Wider implementation might identify further issues relating to complexity associated with scalability which were not identified by the more focused scope of this study.



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Chapter 1 Background and Context

Introduction

Fulltime study through attendance at classes on campus is no longer the preferred mode for many university students. Busy lifestyles with family and work commitments are among the major reasons students are increasingly opting to study all or part of their degree by distance or online mode. The flexibility of those options is limited by the use of bulky printed materials or media that must be displayed on computers.

Norris and Soloway (2011) suggested that we live in an age of mobilism and that by 2015 every school child in the USA will use a personal mobile computing device. Widespread adoption of such devices would overcome many of the barriers to the flexibility that seems to be increasingly preferred by Australian university students. Although digital devices that meet the expectations of Norris and Soloway for mobility, that is being small enough to be 'always' carried by the user, have up till now been targeted at business and entertainment applications, recent devices are sufficiently powerful general purpose computers to be capable of running applications for education.

Smartphones are particularly significant mobile devices because of the convergence of telephone, Internet-connected computer, camera (still and video), audio recorder and player, and ebook reader. Smartphones are rapidly penetrating the Australian population. Of the 89% of Australian adults owning a mobile phone in April 2011, 37% had a smartphone and the number of users going online with their mobile phone increased by 63% from June 2010 to June 2011 (ACMA, 2011). Smartphones, and similar mobile devices, offer learners more options for 'anywhere, anytime' learning than are available with larger portable devices such as laptop computers. Such devices can store learning materials for access or, depending on network connections, support remote interaction with content and other class members. As more current and potential students have access to such devices and a desire for more flexible learning, it is important that universities investigate the potential of such devices to support learning, as well as the changes that may be necessary to facilitate such use.

Undergraduate students in Australian universities include a variable proportion of mature-age students many of whom are seeking career change opportunities. Of undergraduate students enrolled in Australian universities during 2009, 24% were aged 25 or older and 15% were older than 30 years (DEEWR, 2010). The proportion varies across universities and disciplines, with a survey of final year teacher education students reporting 45% aged 25 or older and 10% aged 40 or older (DEST, 2006). Many of these students will have commitments to family and employment that affect their availability to engage with conventional classes.

One study reported that, in 2006, the typical Australian university student was undertaking substantial paid employment during the semester (James, Bexley, Devlin, & Marginson, 2007). As many as 70% of full-time undergraduates were working almost 15 hours per week on average, with 15% working more than 20 hours per week, and almost 5% working full-time. It is not surprising that many students seek flexible options to meet individual needs for balancing study, family and work commitments.

National data for Australia indicate that, during the decade from 2001 to 2010, the proportion of undergraduates studying part-time has declined from 27% to 21% (DEEWR, 2011). Over the same period the proportion of undergraduates studying in internal mode has remained steady at 83% to 84% while external enrolments have decreased from 13% to 8% and multi-modal enrolments (defined as study units taken partially internally and partially externally) have risen from 4% to 8%. For the university represented in this study, from 2006 to 2010 undergraduate enrolment density (ratio of enrolments to load) decreased slightly from 1.99 to 1.86 indicating a slight increase in the proportion of full-time students. Over the same period internal and external enrolments reduced from 15% and 75% to 13% and 74% respectively while multi-modal enrolments rose from 10% to 13%. The number of web-based subjects offered rose from 119 to 198 and web-based student enrolments rose from 2676 to 12485, an increase of more than 400% (USQ, 2012). These discernible trends are supported by the observation that in 2012 up to 70% of Bachelor of Education students are studying at least some of their subjects online. Moreover even students studying on campus are very likely to access some of their study materials and activities from online sources. The evidence suggests that flexibility of study is likely to be increasingly important to students and that mobility will be part of the solution. Hence, it is important to understand both the potential and the implications of adopting and adapting mobile technologies for learning.

mLearning

Technologies have always mediated the student experience in education. In distance education, they have included paper transmitted via post, email and online interaction with instructors and peers (Taylor, Dawson, & Fraser, 1995). The adoption of mobile digital technologies has given rise to the term, “mLearning”, which has been variously described in the literature. One source defines mLearning as “any service or facility that supplies a learner with general electronic information and educational content that aids in acquisition of knowledge regardless of location and time” (Jueming Chen, 2005, p. 1), which is sufficiently general to encompass a variety of technologies and pedagogies and preferable to more restrictive definitions. Further, Cheung and Hew (2009) referred to “mobile handheld devices as any small machines that can be carried easily in one’s palm and provide computing, as well as information storage and retrieval capabilities.” Wireless Handheld Devices (WHDs) represent a subset of such devices with affordances that render them highly appropriate as learning tools in distance education (Soloway, Norris, Blumenfeld, & Fishman, 2001). Figure 1 represents the relationship between WHDs and related devices. This representation is further explained in Chapter 2.

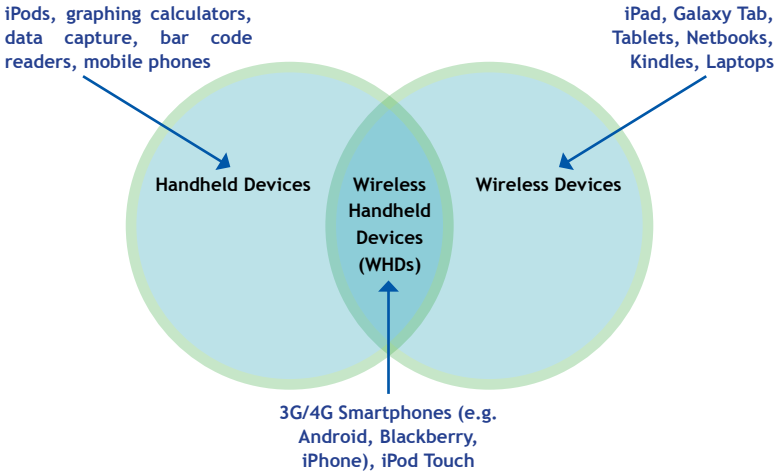

***Figure 1**: Categorisation of computing devices as wireless, handheld or wireless handheld devices (WHD)*

WHDs exhibit properties, including portability, potential for social interactivity, context sensitivity, connectivity, personal ownership and ease of use, that facilitate collaborative mobile learning (Naismith, Lonsdale, Vavoula, & Sharples, 2004). They are a comparatively inexpensive means for students to access multimedia content and communicate, but are subject to constraints imposed by physical, logical and socio-cultural factors (Song, 2011). Physical constraints include screen size, slow processors, difficulty with text input and limited functionality. Logical constraints include availability and price of appropriate programs, difficulties in ending programs, and system instability. Socio-cultural factors include user expectations and preferences. The affordances of WHDs make them potentially useful for learning, but determining their suitability requires understanding of the pedagogy appropriate to such devices.

Because this study investigates students engaging with courses "from a distance", that is, not attending on campus, it is useful to review the praxis between distance education and mobile technologies. mLearning was initially understood as a subset of distance education, which occurred at any place and time, whereas conventional education occurred at a set place and time (Keegan, 2005). The flexibility of distance education was curtailed by online learning because students were required to access information from a computer (Dye, Fagerberg & Rekkedall, 2005). Mobile devices restore flexibility to the distance learner.

Distance Education has been conceptually refined to encompass Contextual Life-long Learning (CoLL), which holds that learning is not confined to specified times and places and that traditional education cannot provide all the knowledge and skills people need to prosper throughout life (Sharples, 2000). Technologies to support CoLL need to be portable, individual, unobtrusive, available anywhere, adaptable to context of learning, relevant to the learner's evolving skills and knowledge, persistent, useful and easy-to-use (Jueming Chen, 2005). WHDs, as described above, meet these requirements.

As technologies change, so does pedagogy. Recent thinking recognises that the process has not been one of new generations replacing what has gone before, but one in which layers have been added for a more complete experience, embracing elements of behaviourism, constructivism, and connectivism (Anderson & Dron, 2011). Recent expansion of online learning raises questions about the nature and role of interaction in distance education. Moore (1993) suggested that 'distance' in distance education is about psychological rather than geographical distance. In an earlier paper, he clarified understanding of interaction in learning as being of the learner with content, instructor and other learners (Moore, 1989). WHDs have potential to make all three forms of interaction more conveniently available at diverse times and places, thereby enhancing learning by reducing transactional distance. However, for this to be achieved, it is important to understand how the introduction of WHDs affects the interactions of university learners and teachers.

Context

This project trialled the 4th generation iPod Touch, equivalent to a smartphone other than for connection to the telephone network, with 80 students in education and nursing courses at USQ and CQUniversity in two different semesters, to evaluate the potential of WHDs to enhance student learning by increasing time on task for learning at times and locations more convenient for the learner. While the project was device specific the findings should be applicable to other mobile device platforms (e.g. iOS, Android, Symbian, RIM and Windows Mobile) that offer similar functionality.

The research investigated the use of the iPod Touch in three main areas of student use for learning:

1. accessing pre-loaded or downloadable course materials and resources including text, images, audio and video,
2. engaging in learning activities through peer to peer and teacher interactions, and
3. making personal records of learning and/or for sharing media in interactions to enhance learning.

These three areas of focus were measured and monitored using a variety of mixed-methods data collection techniques. Key deliverables of the project are:

1. Research reports and publications addressing the utility of the iPod Touch device, student engagement, use and time, engagement with peers and teachers and identification of other barriers and opportunities to enhance student learning;
2. Recommendations for USQ and CQUniversity for scalability or otherwise of mobile devices to enhance the curriculum; and
3. Publishable case studies of the learning experience of students.

Aim and Research Questions

The major aim of the project was to investigate the affordances and constraints associated with the 4th generation iPod Touch, a WHD, for enhancing distance and online student learning opportunities. The study addressed the following specific research questions:

1. How does the introduction of the iPod Touch affect distance learners' interactions with course content?
2. How does the introduction of the iPod Touch affect distance learners' patterns of communication with instructors and peers?
3. Which capabilities of the mobile devices are valued by distance learners and for what purposes?
4. What constraints are evident in the use of the mobile devices to support distance learning?
5. What modifications to university study resources are necessary or desirable to optimise their use on the iPod Touch or similar mobile devices?
6. What adjustments to course design would enable most effective use of the iPod Touch or similar mobile devices to support learning?
7. What costs and associated issues need to be addressed at an institutional level for scalability

Disclaimer

At the time of publication of this report, the project was still ongoing. The commencement of the research was delayed until 9 September, 2011 by internal university legal requirements and processes beyond the control of the research team. Hence, the first round of data collection with the first cohort of students was undertaken between December 2011 and February 2012. The second round of data collection with the second student cohort occurred between February 2012 and June 2012. Data from the first round were analysed and these analyses form the basis of the results reported in this report, as well as the three publications that have arisen from the project to date (Appendices 9, 10, 11). It is anticipated that the round 2 data and the combined data sets will be analysed and reported in subsequent conference and journal publications later in 2012 and 2013.

Chapter 2 Literature Review

Introduction

The major aim of the *Distance learning at times and places chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices* project was to investigate student learning associated with the use of an iPod Touch in distance education courses for Bachelor of Nursing and Bachelor of Education/Learning Management students. Although our focus was student use of iPod Touches, this review examines the research literature pertaining to wireless handheld devices (WHDs) more generally, which include Personal Digital Assistants (PDAs), Smartphones (iPhone, Blackberry, Nokia) and mp3 players (iPods and iPod Touch), but exclude larger devices such as Tablets, iPads, Netbooks or Laptops (Dieterle & Dede, 2006). A search of educational journals and educational databases identified limited scholarly research available on the educational uses of iPod Touches or iPhones; however, a significant amount of research concerning the educational uses of PDAs is available, albeit largely conducted in K-12 settings. The extant research focuses on the potential of WHDs to i) encourage mLearning; ii) enhance student-student communication and collaboration; iii) foster the reshaping of educational structures; and iv) be appropriate as a 1:1 computing tool.

The categorisation of WHDs according to their use by Chueng & Hew (2009) is a useful organising framework for this discussion. The authors suggest seven major categories which emerge from the literature concerning the use of WHDs in education. The seven categories are:

(a) multimedia access tool,

(b) communication tool,

(c) capture tool,

(d) representational tool,

(e) analytical tool,

(f) assessment tool, and

(g) task managing tool.

The broad applicability of these devices perhaps prompted Fung, Hennessy and O'Shea (1998) to suggest that their use could be a 'paradigm shift' towards portable computing in education, with the devices acting as a catalyst for interactive learning paradigms outside the traditional formal learning settings (Schwabe & Göth, 2005). Cochrane (2005) suggests a "Copernican Revolution in teacher instruction" occurring in learning environments deploying these devices. Selwyn (2003) supports the view of Cochrane and argues that WHDs may revolutionise education in ways not previously experienced with earlier technological innovations because they afford two distinct kinds of participation in the same time and in the same space: the normal social participation in face to face learning contexts and a new informatic participation among students mediated by geographically disparate yet connected devices. The latter informatic participation is

critical to university students studying at a distance. In order to establish a context for this research project, a brief examination of the literature in relation to "millennials" and distance education was conducted. Following the context setting, the review will present a number of definitions for mLearning which demonstrate the conceptual developments in this learning domain over time. Included in this "definition" of mLearning is an examination of the particular affordances of WHDs that make them appropriate to use as a mLearning tool and impact on the interaction between the devices and the learners using the devices. Research findings will then be presented in relation to mLearning initiatives in school and university contexts. Although many of the research findings, based largely on school or school related educational activities e.g. teacher education, relate equally to Education Studies and Nursing contexts, there are substantive and specific findings in relation to Nursing and Nursing Education that will be dealt with separately in this review. The overall review concludes with a discussion on Activity Theory, a socio-cultural theory that is used to conceptualise this research.

Millennials and university students

Students attending universities in the second decade of the 21st century are labelled in the literature in terms which refer to their apparent familiarity with digital technologies. The most common terms describing these students are 'digital natives' (Prensky, 2001), 'net generation' (Tapscott, 1998) and 'millennials' (Pardue and Morgan, 2008). Selwyn (2009) summaries various commentators who have coined other terms for these students including 'born digital', 'homo-zappiens', 'net savvy', and 'new millennium learners'. According to these depictions, 'millennials' (which is the term used henceforth to describe these students) are technologically competent and effortless with mobile phones, PDAs, iPhones, mp3 players and iPods. They are often described as optimistic, assertive, positive, friendly, co-operative team players who gravitate to group activities and who prefer multi-tasking (Pardue and Morgan, 2008).

Despite the broad interest in the notion of millennials, until recently, there has been very little empirical research into their ICT skills and experiences. Various authors, based on published empirical research, are beginning to doubt the rhetoric of a universal "millennial student". Kennedy et al. (2009) suggest that while millennial access to and use of computers and some ICTs may be high, this does not necessarily mean that these students want to use these technologies constantly and in all the contexts of their lives. Selwyn (2009), after conducting a review of recent research into millennials and their ICT use, notes that we should be "wary of claims that a digital generation is overthrowing culture and knowledge as we know it and that its members are engaging in new media in ways radically different from those of older generations" (p. 375). Margaryan, Littlejohn & Vojt (2011) go further and suggest that the generational divide implied in the use of terms such as millennials or digital natives is a myth and that ICT use by students is determined by a range of factors including, but not limited solely to, age. Other authors suggest that the discourse around millennials is driven by political or economic concerns (Jones & Shao, 2011). It appears that a significant cause of the current drive to integrate the Internet into higher education is driven by 'internal political pressure' rather than empirically sound evidence. Bennett, Maton and Kervan (2008) suggest that the discourse that surrounds the millennials debate can be likened to 'an academic form of moral panic'. Blin and Munro (2008) observe an increasing disconnect between the actual use of ICT in higher education and the rhetoric which is sometimes used to describe its use, and Selwyn

(2007, p. 84) describes university technology use as ‘‘sporadic, uneven, and often ‘low level’’. In summary, the global empirical evidence indicates that university students prove to be an eclectic mixture of individuals with various interests, motives, and behaviours, who “never cohere into a single group or generation of students with common characteristics” (Jones & Shao, 2011, p. 12) and that it is imprudent to rely on the rhetoric surrounding the millennials as a rationale for the use of new and emerging technologies in higher education (Kennedy, et al., 2009).

While mindful that the technological and informational needs of young people have changed this century, it appears clear that educational institutions need to avoid the rhetoric of the millennial debate and, instead, focus on an enhanced understanding of the realities of technology use in contemporary society (Selwyn, 2009). This is also true in relation to the student use of WHDs, where there is a danger in assuming universal student competency with such devices. A study by Cochrane (2008) determined that whilst ownership and internet access were virtually ubiquitous, the experience of using the devices as a Web 2.0, user-generated tool was low (20%). Cibulka and Crane (2011) reported that over 40% of nursing students in their study required substantial technical support in the use of a WHD. Likewise, Olney, Herrington and Verenikina (2008) reported a level of research naivety on their behalf after discovering in their study of mp3 player usage by university students that “many students had either not used the digital devices, or they required assistance with other aspects such as the use of the microphone, or file transfer between the computer and the device” (p. 698).

These latter comments indicate the importance in our research of ensuring that appropriate levels of technical support are offered to the students prior to and during the periods of iPod Touch use. Our research context is different from many of the contexts researched previously in that there is no face to face contact with the students. All students using the devices study at a distance and, thus, it is important to briefly note some specific implications of this mode of study, particularly in relation to use of WHDs.

mLearning can be understood as a subset of distance education. The educational domain can be divided into two halves known as conventional education (set place; set time) and distance education (any place; any time). Most of the goals that today characterise just-in-time learning, or life-long learning, were anticipated by distance learning (Keegan, 2005). Distance education, to some extent, took a step backwards when it converted from paper-based to online learning, where students largely were required to study at a place (and at a time) where a computer with access to the Internet was available. Dye, Fagerberg and Rekkedall (2005) argue that the use of mobile technologies increases the flexibility of distance education and returns the any place; any time option to the distance learner. The concept of Distance Education has been further refined to encompass the concept of Contextual Life-long Learning (CoLL), which postulates that learning is an activity not confined to pre-specified times and places and that traditional education cannot provide people all the knowledge and skills that they need to prosper throughout their life-time (Sharples, 2000). The general requirements for technologies to support contextual life-long learning require them to be highly portable, individual, unobtrusive, available anywhere, adaptable to the context of learning, relevant to the learner’s evolving skills and knowledge, persistent, useful and easy-to-use (Jueming Chen, 2005). WHDs appear to meet the requirements of (CoLL) as they can provide a “pervasive conversational learning space” (Sharples, 2003) by facilitating almost instantaneous information access “anytime, anywhere” (Trinder, Magill & Roy, 2005).

Technologies of various kinds have always mediated the student experience of distance education. These technologies include printed materials posted to and from students all the way through to email and online interaction with lecturers, tutors and fellow students (Taylor, Dawson & Fraser, 1995). Just as the technologies used in distance education have changed, so have the pedagogies used in this domain. Recent thinking has emphasised either the importance of students making links with content and with each other (Anderson & Dron, 2011), which builds on the concept of connectivism (Siemens, 2004) or a social constructivist approach (Vygotsky, 1978) where students co-create knowledge via the mediation of course materials, the tutor and each other (Blin & Munro, 2008). The recent expansion of online learning prompts the question as to whether interaction in distance education is equivalent to interaction in face-to-face learning contexts. Rather than physical distance being the determining factor in the level of interaction between lecturer and learner, Moore (1993) suggests that Transactional Distance, the psychological and communication gap between any learner and teacher, is the critical factor in determining levels of interaction. Moore (1989) identified three forms of interaction; that is, learner with content, learner with instructor and learner with other learners. Increased knowledge of any effects of WHDs on Transactional Distance was a research outcome of this project. The use of iPod Touches in distance education is relatively new, but builds on existing contributions about the positive outcomes associated with mobile technologies (Koole, McQuilkin & Ally, 2010; Park, 2011). Regardless of technological or pedagogical approach, a key challenge for distance education is to ensure the provision of appropriate learning experiences that make the most of available materials, technologies and pedagogies.

WHD – Affordances and Limitations

WHDs are a specific subset of computing devices with particular affordances which render them, according to Soloway, Norris, Blumenfeld and Fishman (2001), a potential quantum leap in computational availability and highly appropriate as learning tools in distance education. In this review, we adapt the definition of 'mobile handheld devices' by Cheung and Hew (2009) and suggest that WHDs are small machines that can be carried easily in one's palm and provide computing, as well as information storage and retrieval capabilities. The particular affordances of mobile devices can change how students perceive the worth and limitations of the technology (Swenson, Young, McGrail, Rozema & Whitin, 2006). The interaction between humans and tools is a central aspect of Activity Theory (Vygotsky, 1978; Wertsch, 1981), the theoretical framework underpinning our research, which claims that all human action is mediated by tools including technologies and artefacts, such as WHDs; semiotic systems, such as language including diagrams; social interactions, such as those between student and class or student and class teacher; and institutional structures, such as ICT usage policies (Wishart, McFarlane, & Ramsden, 2005).

Figure 2 represents our categorisation of the broad range of computing devices available for student use.

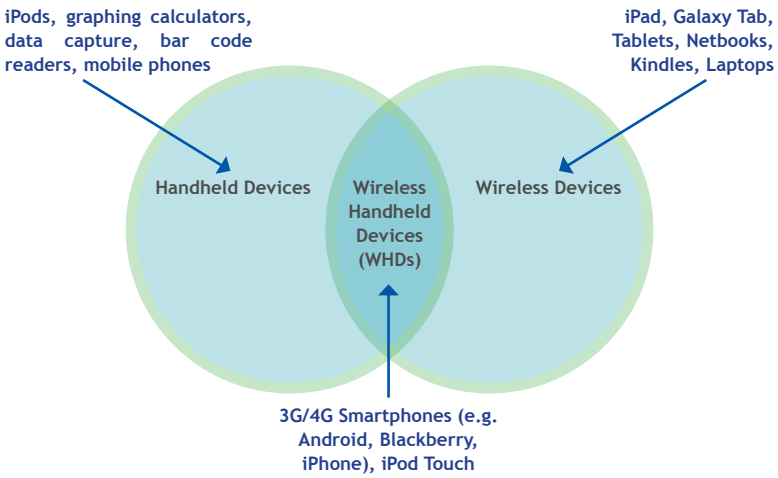

***Figure 2**: Categorisation of computing devices as wireless, handheld or wireless handheld devices (WHD) (adapted from Seppala & Alamaki, 2003; Cheung & Hew, 2009)*

Various authors (Abernathy, 2001; Naismith, Lonsdale, Vavoula, & Sharples, 2002; Roschelle, 2003) identify a range of properties of WHDs that produce unique educational affordances facilitating collaborative mLearning environments. These properties include portability / mobility, social interactivity, context sensitivity, connectivity, individuality / sense of ownership and ease-of-use. The suggestion is that WHDs are an inexpensive way to engage students in developing technology skills and in bridging the digital divide (Johnson, 2005). There are, however, a number of constraints in the use of WHD that can be summarised using themes suggested by Song (2011); namely, physical constraints, logical constraints and cultural / social factors. Physical constraints include screen size, slow processing speeds, difficulty with inputting text and limited functionality (see also Serif & Ghinea, 2005). Logical constraints include difficulties in ending programs, availability and price of appropriate programs (especially medical programs) and system instability (see also Oliver & Barrett, 2004; Koeniger-Donohue, 2008). Cultural and social factors include lecturer / student expectations of the devices and user preferences in relation to phone / SMS / email device use. Particular to nursing contexts are also the issues of sensitivity to personal data and protocols about disinfection control of the devices (see Phillippi and Wyatt, 2011).

On balance, the technical and social affordances of WHDs seem to indicate their appropriateness as a computing device in educational contexts. More important is their potential suitability as an educational device to support student learning, particularly for our context as university lecturers and tutors. Determining their suitability requires an understanding of the underpinning pedagogy regarding the use of such devices. This pedagogy is generally referred to in the literature as mLearning.

mLearning

mLearning has been variously described in the literature. Jueming Chen (2005) suggests that mLearning is "any service or facility that supplies a learner with general electronic information and educational content that aids in acquisition of knowledge regardless of location and time" (p. 1). Vavoula and Sharples (as cited in Jueming Chen, 2005) indicated three ways in which learning can be considered mobile - "learning is mobile in terms of space; it is mobile in different areas of life; and it is mobile with respect to time" (p. 1). Scanlon, Jones and Waycott (2005) suggest that mLearning can be defined as "any educational provision where the sole or dominant technologies are handheld or palmtop devices" (p. 2). Abernathy (2001) defines mLearning as

> *the intersection of mobile computing and e-learning that includes anytime, anywhere resources; strong search capabilities; rich interaction; powerful support for effective learning; and performance based assessment* (p. 1).

The thrust of these definitions is toward the affordances of the devices that enable mLearning; for example, the mobility of the devices, the access to information from various locations etc. More recent definitions of mLearning suggest that the focus needs to shift from the nature of the device, or even the nature of the learner, to a focus on changing contexts for learning and maintaining continuity of learning across these contexts. In this conceptualisation, meaningful learning is fostered when the interactions with technology are learner initiated (Song, 2011) and determined by the context in which the learning takes place. Sharples (cited in Cochrane, 2008) suggested that mLearning is best defined by reference to its contextual and informal learning characteristics." The processes of coming to know through conversations across multiple contexts amongst people and personal interactive technologies" (p. 177). This notion aligns with the socio-cultural perspective of our research project, which recognises that WHDs are powerful learning tools, but only in the sense that they mediate the experience of the learner across a wide range of collaborative learning environments. In summary, definitions of mLearning initially focussed on the technology, then on the enhanced mobility of the user utilising the technology, and finally arrived at an understanding that learning now occurs, mediated by the device, as the learner changes contexts.

Research on WHDs in educational contexts

The majority of research conducted in relation to WHDs has been completed in K-12 settings. This body of research has documented changes in pedagogy with teaching styles being more student-centred (Norris & Soloway, 2004); project-oriented (Norris & Soloway, 2004; Swan et al., 2007) and more inquiry-based (Norris & Soloway, 2004). As is the case with research into laptop use, research into use of WHDs indicates that teachers are becoming more constructivist and flexible in the organisation of classroom activities (Swan et al., 2005). In terms of specific effects on students, research has documented improved motivation (Swan et al., 2005; Vahey & Crawford, 2002) and engagement (Russell, Bebell, and Higgins, 2004; Swan et al., 2005). Students using WHDs are also more independent in their learning (Swan et al., 2007) and work more collaboratively with other students and with their teachers (Fung, et al, 1998; Sharples, 2000; Vahey & Crawford, 2002; Grimes & Warschauer, 2008). However, it remains unclear

whether the findings applicable to school-aged students, the context in which much of the previous research was conducted, transfer to university contexts. It may be the case that university students who engage extensively with mobile technology to enhance their learning outcomes are independent learners who would learn equally as well without WHDs.

As there has been limited research thus far into university use of WHDs, and barely any in relation to their use in distance education (Waycott, 2002 being an exception) or into the use of mp3 players such as iPods (Olney, Herrington & Verenikina, 2008), it is difficult to fully gauge their usefulness in supporting student learning in university contexts. In addition, much of the available research reports on trials at universities in the United States, such as Duke, Berkeley, Stanford, Carnegie, North Carolina (Kim, Mims & Holmes, 2006), where their use seemed primarily to be a marketing strategy to attract future students. As noted in the previous section, and common to K-12 research on WHDs, the most interest and activity in terms of the use of WHDs in universities to date has been on practical and administrative functions (Bird & Stubbs, 2008) rather than pedagogical purposes (Herrington, Mantei, Herrington, Olney & Ferry, 2008).

Findings from peer-reviewed literature concerning WHDs in university settings mirror many of the findings from K-12 usage in relation to the affordances and limitations of the WHDs. These include anytime, anywhere access, less wiring, simplicity of use, installation flexibility, reduced cost, scalability and improvement of communication (Kim, Mims & Holmes, 2006). In two studies which involved custom designed software for WHD use by university students; Bull, Cui, Robig and Sharples, (2005) and Corlett, Sharples, Bull and Chan (2005) noted that that the students appreciated the ability to be able to use the devices for interstitial learning – i.e. learning that occurs in the short time periods between other activities. Students reported that they could use the devices whilst using public transport or during breaks between lecturers or waiting for friends (Bull, et al., 2005). The students also reported positively on the ability to use a range of organisational tools on the devices for communication, time-management and access to content (Corlett, et al., 2005). The communicative affordances of WHDs were also identified in a study of student teachers and their supervisors by Seppälä and Alamäki (2003). In this study, students were provided a Smartphone and were able to communicate with each other and their lecturers, via SMS, during their professional practicum experience. In addition to communication, these students also used the devices as a data collection device for their digital ePortfolio. Cheung and Hew (2009) report on a number of university projects where the devices are used as a student response system tool. In these projects student input is aggregated and displayed during lectures and tutorials to guide the direction of student learning (Jackson, Ganger, Bridge & Ginsburg, 2005).

In a broad study of eight diverse graduate courses Dieterle and Dede (2006) and Dieterle, Dede and Schrier (2007) found that WHDs were used as communication tools (email, instant messaging, video conferencing), data collection tools (science probes), personal information management (PIM) tools (calendar, tasks, memos, contacts etc) (see also Wishart, McFarlane & Ramsden, 2005) and information management tools (databases, wikis, encyclopaedias and online textbooks) (see also Franklin, Sexton, Lu & Ma, 2007). The only study found in a database search on WHD use in distance education contexts was by Waycott (2002) who investigated the

usefulness of PDAs in accessing course materials in an Open University Information Technology course. This study found that the main benefit of the devices was their portability and the opportunity for 'anytime, anywhere' access to the materials

Particular to our context is a study using an earlier version of the iPod Touch by (Richardson, Dellaportas, Perera & Richardson, 2010) involving Accounting students at an Australian university. The findings reflect those of other studies using a range of WHDs in that the mobility of the devices allowed students to use them for study at times and locations, such as travelling on public transport, where they might not otherwise have studied. Disadvantages related to the difficulty in reading text on a small screen and the ability to move to particular parts of a recorded lecture with precision.

Almost universal to each of these studies were common constraints of the WHDs and again these mirror the K-12 research findings. The most common limitations of the devices were usability of the hardware, limited memory and battery life (Corlett, et al., 2005); lack of available software (Wishart, et al., 2005) and of particular concern to Waycott (2002) due to the heavy reliance on access to course materials, were the issues of screen size, poor screen quality and lack of contextual clues such as page numbers and paragraphing on the devices. At a broader conceptual level, beyond the affordances of the devices themselves, were concerns regarding the mismatch between the technology itself and university organisations in terms of lecturer skills, IT support, ethical usage agreements and Quality Assurance (Bird & Stubbs, 2008). A final concern was the lack of student investment in the projects in terms of ownership of the devices. Corlett, et al. (2005) noted that in many of the projects cited, and in their own study, the devices were to be returned at the end of the trial (be that one term, one semester, or one year). As a consequence, students were unlikely to invest heavily in learning how to use the devices or in personalising and extending their use more widely across their studies.

By way of summary, it is suggested, based on the extant literature, that the use of mobile computing devices, owing largely to their size and portability, can increase both collaborative and independent learning, as well as enabling a "transition from the occasional, supplemental use associated with computer labs, to frequent and integral use of portable computational technology" (Roschelle, 2003, p. 260). Their usage places appropriate computing power and versatility into the hands of students. When this is coupled with access to wireless networks, opportunities for collaboration and communication are expanded (Grimes & Warschauer, 2008). We have also proposed a definition of mLearning which is based less on the mobility of the devices and more on the contexts in which the devices are used to support student learning. The focus of the review thus far has dealt with the use of WHDs in school learning contexts and what might be termed university Educational Studies courses. This section of the review focuses on the use of WHDs in Nursing and Nursing Education. Whilst much of what has been claimed previously applies equally well to both Educational Studies and Nursing Education courses, there are specific considerations in relation to Nursing Education which need to be explicated.

Nursing and Nursing Education

In terms of Nursing Education, our research investigates a range of contexts in which nursing students may use the devices throughout their nursing program – be that in their coursework, in communicating with their peers, or in clinical placement. Our emphasis on the use of WHDs throughout the entire course is in contrast to the emphasis of the limited research into the use of WHDs in nursing education which relates to their use in clinical settings. The review of current research involving WHDs in nursing education was initially guided by four themes identified by Jeffrey and Bourgeois (2011) namely, medication administration, self-efficacy, professional nursing judgment and clinical reasoning. Further interrogation of the literature resulted in the following themes being identified for further discussion – access to information enabling greater accuracy and efficiency, point of care use of WHDs, student self-efficacy, and clinical decision making. Prior to examining these themes it is useful to provide a contextual background to the use of WHDs in a range of medical environments.

The case for WHDs in medical contexts

The use of WHDs (initially PDAs and more recently Smartphones) in medical contexts is prominent. Studies conducted early this century report that clinicians rapidly adopted PDAs into their daily practice. In one study, more than half of all doctors younger than 35 years in developed countries used a PDA in 2003 and this percentage rises to 40-50% of all US physicians using a PDA (Baumgart, 2005). More recent research confirms this trend of the rapid uptake of mobile technology with two-thirds of American physicians using smartphones as of late 2009 with the percentage expected to rise to 81% in 2012 (Sarasohn-Kahn, 2012). Kho, Henderson, Dressler, and Kripalani, (2006) report that 60% to 70% of medical students and residents use PDAs for educational purposes or patient care. The creation of applications related to health and health care is also moving quickly with nearly 6,000 health care apps available from the Apple App Store (Sarasohn-Kahn, 2012).

Ducut and Fontelo (2008) suggest that in the last decade, handheld computers or PDAs have become standard equipment for medical students and clinicians to cope with an increasingly complex and expanding information base. Jackson, Ganger, Bridge and Ginsburg (2005) note that physicians and hospital administrators find the devices to be invaluable tools for generating patient databases, prescription writing, and information retrieval. Koeniger-Donohue (2008) recognised the importance of Nursing educators addressing the issue of WHDs to respond to the growing demand for usage of handheld technology by nursing students and nurses as the adoption of handheld devices for clinical practice by nurses has lagged behind that of physicians by approximately two years.

The extensive use of mobile technologies, and indeed computer technologies in general, has prompted a number of regulatory bodies to call for improvements in the quality of nursing education. The need for such improvement in the technological skills in graduates is prominent in announcements from key nursing organisations. The American Association of Colleges of Nursing, the National League for Nursing, and the Institute of Medicine all advocate the incorporation of technology in nursing education (George, Davidson, Serapiglia, Barla & Thotakura, 2010). They suggest a reform of nursing education to prepare students who are capable of practising

in health care environments which require increasingly sophisticated use of technology and recommend that core competencies for nurse practitioners include the incorporation of current technology into practice, thus necessitating mastery of mobile technologies (Cibulka and Crane-Wider, 2011).

The necessity for nursing students to develop clinical reasoning skills mediated by digital technologies is also reflected in the literature. The 21st century organisation and delivery of health care has changed significantly due to an aging population contributing to a more complex illness presentation and also the changing role of patients from a traditional passive relationship with healthcare professionals to that of an informed consumer (Jeffrey and Bourgeois, 2011). In addition to the rapidly changing population, nursing knowledge gained throughout an undergraduate program, due to the rapid turnover in health care information and technology, may well be outdated within five years of graduation. Nursing educators must therefore keep pace with advances in technology and also adopt effective strategies to enhance the learning experience of the students (Ducut & Fontelo, 2008) to ensure, where possible, that students graduate with the technological proficiency to operate effectively in increasingly technological rich medical environments (Jackson, et al., 2005). The emphasis therefore shifts from just equipping nursing students with foundational nursing knowledge and clinical skills, to also equipping them with the skills required to foster self learning. WHDs may have a place in such a schema by extending learning beyond the confines of a classroom (Jeffrey & Bourgeois, 2011). Wu and Lai (2009) suggest that these advanced technologies must be integrated into the nursing curricula to foster students' proficiency in adapting to varied and expanding complex information systems.

If changes to curricula and nursing education practices are to improve the technological ability of students, then such improvements need to be based on empirical research into student use of technology; however, research into the use of WHDs is limited in clinical education. What research has been conducted has dealt with PDA use. A study published in 2009 found that 70% of medical students used PDAs or PDA-like devices while learning. The use of PDAs has been associated with high levels of student satisfaction (Phillippi & Wyatt, 2011) and student feedback suggests that PDAs are useful in clinical settings with more than 79% of the students using their PDAs at least weekly, and 50% using them daily (George, et al., 2010).

Although the PDA research indicates that students are almost uniformly positive in regard to their use, there is little to no research on how to implement, support, and sustain the use of WHDs more broadly across a total nursing education program (Koeniger-Donohue, 2008). A systematic literature review by Jeffrey and Bourgeois (2011) highlights the paucity of literature currently available and suggests the subsequent need for primary quantitative studies examining the effect of WHDs in developing undergraduate nursing students' clinical reasoning skills. For example, Cibulka and Crane-Wider (2011) report that the provision of informatics content, resources, and skill-building experiences throughout the nursing programs were insufficient to prepare nurses to practise proficiently in a progressively technical and digital health care milieu (p. 115). This research project goes someway in redressing the lack of robust studies in relation to the use of WHDs throughout a nursing program.

It was noted earlier that an analysis of the literature resulted in the following themes being identified for further discussion – access to information / point of care / accuracy and efficiency, student self-efficacy, and clinical decision making. Research findings will now be synthesised according to these themes.

Access to information promoting accuracy and efficiency

Medicine, and the way that it is taught, has undergone major changes in the past few years (Ducut & Fontelo, 2008) and a major component of this change is the need to access and process increasingly complex and vast amounts of data (Johansson, Petersson, & Nilsson, 2011). Health practitioners are expected to be able to demonstrate high-level information literacy skills including "accessing, evaluating, analysing, and synthesising immense quantities of medical information" (Ducut & Fontelo, 2008, p. 1). WHDs may provide the means for nursing students to extend their capacity to deal with substantial amounts of information and to base their decisions on up to date information (Murphy, 2005). The popularity of WHDs for the medical community lies in the ability of medical practitioners, researchers, and students to transport multiple textbooks, manuals, dosage calculators, and other reference texts literally in the palms of their hands (Carney, Koufogiannakis, & Ryan, 2004). As indicated earlier, there are over 6 000 health applications available for iPhones / iPods (Sarasohn-Kahn, 2012) with more than 600 applications specifically designed for medical professionals (Phillippi & Wyatt, 2011). Given this vast availability of computing resources, nursing students can retrieve information quickly in relation to drug formularies, laboratory, and diagnostic manuals as well as textbook or journal information and reference library material (George, et al., 2010). A subsequent effect of access to medical information is that such access will prepare the students for their future work context. Giving students accurate sites for reference will help prepare them for future practice and encourage self-directed learning (Phillippi & Wyatt, 2011) with the potential that use of such devices will become a core component of their future routine care planning for patients (Berglund, Nilsson, Revay, Petersson & Nilsson, 2007).

A direct outcome of the access to up to date information provided by WHDs is an improvement in the accuracy and efficiency of nurses and nursing students in clinical settings. (George, et al., 2010) suggest that WHDs can result in error reduction, increased valuing of accurate and current information, and enhanced efficiency. In a study of undergraduate nursing students by Jeffrey and Bourgeois (2011), t-test analysis of data revealed that undergraduate nursing students using WHDs (n=37) performed better in medication accuracy with a resulting mean score of 4.1 by comparison to students using textbooks and calculator resources (n= 50) who scored a mean of 3.5 ($p = 0.037$). It is therefore suggested that students using WHDs "may be more accurate in calculating medication dosages in the medical-surgical clinical environment… and more time efficient in the simulated experience of administering medications than students using textbooks and calculator resources" (Jeffrey & Bourgeois, 2011, p. 47).

WHDs at the Point of Care

A reported positive outcome of WHD use is that they provide excellent access to information at any time and place and that they function as a support tool for when students immediately needed access to information, from verified approved sources (Johansson, et al., 2011). Cibulka and Crane-Wider (2011) reported that 86% of the Nursing Practitioner students in their study used WHDs to retrieve data, and 82% used their device to interpret data. Furthermore, 91% used their device to guide prescribing medications, 50% used it to research diagnoses, and 32% used it to interpret laboratory or diagnostic tests. Of particular importance is that 78% of the students indicated that they used their WHDs on most clinical days to enhance the quality of their practice at the point of care juncture with patients.

The importance of WHDs for nursing students at the point of care is reflected in a number of studies. Ducut and Fontelo (2008) suggest that student nurses and residents use WHDs as portable sources of information at the point-of-care to improve patient management and augment learning; Wu and Lai (2009) note the use of WHDs not only saved students' time, but also that students spent more time with patients because it was not necessary to leave the patient's room to look up information as the portability of the devices facilitated information retrieval at the point of patient care (Dee, Teolis, & Todd, 2005; Koeniger-Donohue, 2008). McLeod and Mays (2008) suggest that the ubiquitous wireless connectivity of WHDs, which enables access online databases of clinical logs, health records, evidence-based guidelines, and peer-reviewed journals, can be leveraged by nursing students to support real-time, evidenced based practice at the point of care.

Clinical decision making and student self-efficacy

The availability of ready access to current information at the point of care suggests that the use of WHDs may assist students with clinical decision making (Wu and Lai, 2009). Jeffrey and Bourgeois (2011) suggest that putting WHDs in the hands of students can "help demonstrate the importance of mobile resources in enhancing clinical decision making" (p. 49). Johansson et al. (2011) report that WHDs supported student clinical learning and decision-making. Lai and Wu (2009) recommend WHDs as an effective learning resource for students as they facilitate the application of evidence-based knowledge to clinical practice. Importantly, for students studying nursing in a distance education context, where geographic distance can pose further challenges for faculty and students in relation to timely responses to student clinical needs, WHDs may provide a mechanism whereby students and lecturers can communicate over distance in real-time (Wu & Lai, 2009). In addition to functioning as an educational tool used to access information, WHDs can serve as psychological support for students whilst in clinical environments (Jeffrey & Bourgeois, 2011). Studies among nursing students showed an increased self-efficacy after using a WHD in clinical placements (Johansson, et al., 2011) as well as increased confidence in medical-surgical environments by students using WHDs rather than textbooks or paper-based resources in the exercise of professional nursing judgement (Jeffrey & Bourgeois, 2011).

The studies cited in this review of literature on WHDs in nursing contexts suggest that they are an important tool in nursing environments undergoing rapid technological change. Preferred treatments, drug dosages, postsurgical care, and preventive healthcare regimens continually change and WHDs allow students to rapidly confirm information which fosters active learning and safe behaviours (Phillippi & Wyatt, 2011). In conclusion, nursing students are positive about the use of WHDs in clinical contexts and their use appears both technologically appropriate and pedagogically sound (Wu & Lai, 2009). What still remains to be determined is the usefulness of WHDs to support student learning across a whole semester of study as opposed to just their use in clinical placement or practical experience contexts and this research provides further empirical evidence to address this research question.

Activity Theory: A Brief Synopsis

Activity Theory is the conceptual and methodological framework underpinning this research. Activity Theory is a body of theorising and research initiated in the 1920s and 1930s by Lev Vygotsky and Alexie Leont'ev, the founders of the cultural-historical school of Russian psychology (Engeström, Miettinen & Punamaki, 1999). This synthesis of the Activity Theory literature builds on the doctoral work of one of the researchers. Activity Theory is an approach that aims to understand individual human beings in their natural, daily circumstances and understanding is developed through an analysis of the genesis, structure, and processes of their activities. Human activity is always oriented to the achievement of goals and motives (Nardi, 1996) and in this sense activity implies an action done in order to transform some object (Engeström, 1999). Activity is understood as a purposeful interaction of the subject with the world, a process in which mutual transformations between the poles of 'subject–object', via the use of tools, are accomplished (Kaptelinin & Nardi, 2006; Martek, 2008).

Activity as Mediated by Tool / Artefact Use

As a meta-theory, Activity Theory presupposes that all activity is mediated and all human experience is shaped by the culturally defined tools and artefacts we use (Nardi, 1996). An activity always contains various artefacts (for example, instruments, signs, procedures, machines, methods, laws, forms of work organisation) through which actions on objects are mediated. These activities are not static or rigid entities but are under continuous change and development. Artefacts themselves are created, manipulated and transformed during the development of the activity and carry the historical residue of their development (Kuutti, 1996). These artefacts reflect the experiences of people who have tried to solve similar problems at an earlier time and reflect similar events. Tools in this respect can be seen as artefacts of design, initially invented, and then modified, re-modified, and potentially replaced, to make an activity more efficient (Meloche, 2006).

Tools (both internal and external), suggest modes of operations; are historically developed; and possess an evolutionary cultural component. In Activity Theory terminology, these instruments of labour (tools or artefacts), are seen to be both an articulated accumulation of social experience and knowledge, and also a cultural source of transmission of this accumulated

knowledge (Meloche, 2006). Tools affect not only our external physical activity, but also our internal mental activity. The crucial nature of tool mediation in Activity Theory is indicated by Wertsch (1981) "It is not that activities could [not] be carried on without them or that they make actions easier, but that they allow and even lead to the creation of types of activities that would not otherwise exist" (p. 26).

All human development is assumed to be enabled and constrained by tools. Their use both mediates and is mediated by our social world and by the cultural history embedded in the tool itself (Wertsch, 1981). Tools import history into person-goal relations, carrying a configuration of resources that both enables a task to proceed, and constrains its possibilities (Roschelle, 1998). The sets of technological tools currently available are ones that have been created for us in response to a previously perceived need or goal (Dourish, 2006). Although all individuals are affected by the historicity inherent in tool use, it is incorrect to assume that this influence is uniform throughout a collection of individuals (such as students completing a university degree).

Human Agency in a Socio-cultural Context

Whilst clearly a socio-cultural framework; the recognition of human agency remains a key component of Activity Theory. Activity Theory has a strong notion of the individual and theorists within this tradition believe that human beings are not merely at the mercy of extant institutional contexts, but rather that humans are endowed with the power to act (agency), which allows for critique and revision of the contexts in which an individual operates (Roth & Lee, 2007). The emphasis on the key role of human agency is a fundamental ontological assumption made when selecting Activity Theory as an appropriate conceptual and methodological framework to understand student use of WHDs. Activity Theory resists the temptation to anthropomorphise artefacts as agents, "People have goals, whereas artefacts merely mediate" (Roschelle, 1998, p. 244). This suggests that it is not sufficient simply to consider a social setting as a social system that is generative of activities, but rather it is necessary to consider how individuals elect to engage with those activities, and for what purposes. In this way, although Activity Theory is premised upon a social / cultural / historical frame the individual is not reduced to society or culture (Larkin, 2010).

Activity Systems

Engeström (1987) reconceptualised the primary Activity Theory heuristic from the initial subject-tools-object triangle (Leont'ev, 1981) into a six element model (Figure 1) which has become an analytical tool used in a wide range of educational research (see Blin & Munro, 2008; Larkin & Finger, 2011; Latheef & Romeo, 2010; Stevenson & McKavanagh, 2004; Sweeney, 2010; Zevenbergen & Lerman 2007).

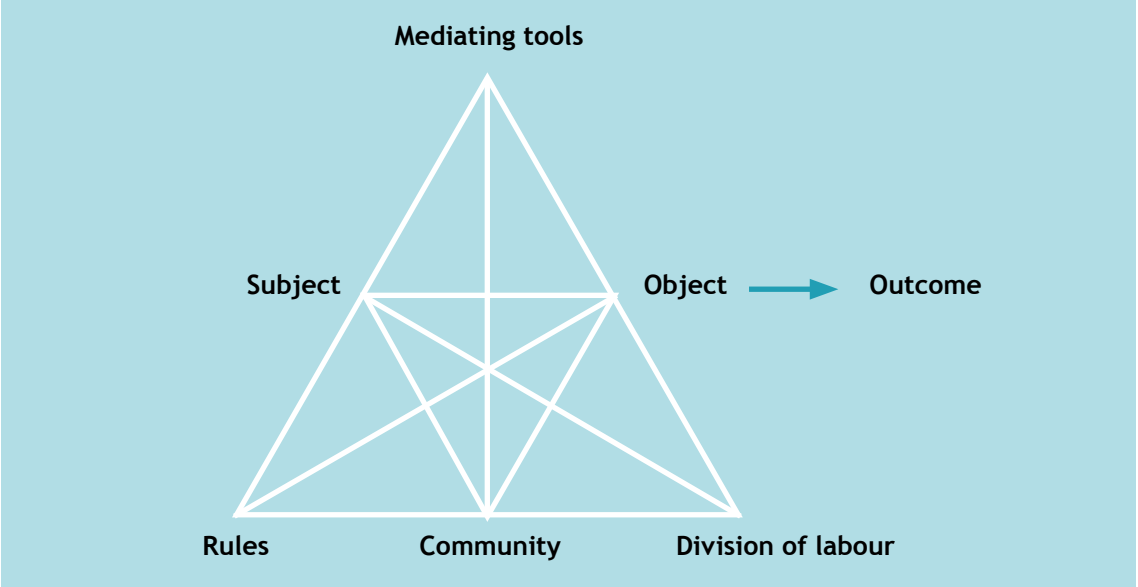

Figure 3: An Activity System (Engeström, 1987, p. 37)

Minimum elements of this system include the Object, Subject, Instruments (or tools – both mental and physical), Rules, Community, and Division of Labour (Sharpe, 2003). Engeström's (1987) framework provides a schematic for the structure of activity which can then be used to examine the various socio-cultural elements which impact upon the relationship between the subject and the community in the attainment of an outcome. The mechanism for growth and development for individuals and the community in an Activity System is the resolution of tensions and contradictions which potentially lead to transformations and expansions within the system (Sweeney, 2010). According to Kuutti (1996), a contradiction is a misfit within elements, between elements, between different activities, or between different developmental phases of a single activity. Contradictions exist when external influences change elements of activities causing imbalances between them. Consequently, Activity Systems are almost always in flux as they work through contradictions which manifest themselves as problems, ruptures, breakdowns, or clashes (Scanlon & Issroff, 2005). Activity Systems can therefore be a powerful tool for identifying tensions; locating them in the system; determining their sources; and generating a basis for expansive transformation.

Appropriateness of Activity Theory to conceptualise use of WHDs

As indicated, Activity Theory and its iteration as Activity Systems, allows the researcher to examine critically the praxis between individual and society, and between object and subject, and seeks to explain cognitive development via psychological processes driven by the individual but mediated by a variety of tools (physical, psychological and historical) in a particular context (Larkin, 2010). In this understanding the activity of individuals becomes central in the cognitive picture – "knowing is not isolated from the world of activity, it is imminent in it and occurs through the various elements of a human activity system" (Stevenson & McKavanagh, 2004, p. 192). It provides a coherent, yet still developing, theoretical framework which provides

a range of practical research tools which can be used to investigate multi-faceted sites. It is an appropriate research methodology for studying complex contexts such as universities. It provides a broad and deep account of the actions of people as an activity unfolds over a period of time. Activity Theory "reaches for a way to incorporate subjective accounts of why people do what they do and how prior knowledge shapes the experience of a given situation" (Nardi, 1996, p. 94).

Three features of Engeström's (1987) Activity Systems render it appropriate to a research context: i) the collective activity system is taken as a unit of analysis, giving context and meaning to seemingly random events; ii) the activity system and its components are understood historically; and iii) inner contradictions of the activity system are analysed as the source of the disruption, innovation, change and development of that system (Young, 2005). Activity Systems are environments which reveal the activity of individuals, and groups of individuals, in a specific setting which often comprises common goals (Yamagata-Lynch, 2003). Although the separate course offerings in this study are unique, our initial research indicates that they share similar educational goals and motives. This research project uses Activity Systems to reveal systemic contradictions and transformations and to reflect upon the impact of WHDs on a range of learning environments.

The following are a selection of indicative studies which utilised Activity Systems as a conceptual and methodological tool in educational and nursing research. Larkin (2011) examined the impact of 1:1 computing in Middle School classrooms; Dale (2003) investigated calculator use in school classrooms; Engeström (1987) explored the inherent contradictions of traditional school-going. Zevenbergen and Lerman (2007), Latheef and Romeo (2010), and Sweeney (2010), investigated the use of Interactive Whiteboards (IWBs) using Activity Systems. Particularly relevant to our context are studies concerning teacher education which used Activity Systems as a conceptual framework. Waycott, Jones and Scanlon (2005) investigated the use of PDAs to support the reading of course materials; both Beauchamp, Jazvac-Martek and McAlpine (2009) and Stevenson and McKavanagh (2004) investigated doctoral education; Cochrane (2008) and Issroff and Scanlon (2002) examined technology use in higher education; and Frederickson, Reed and Clifford (2005) compared Web Based teaching with Lecture Based teaching from an Activity Theory perspective. A database search using "Activity Theory" and "Nursing" retrieved only one article by Nes and Moen (2010) which investigated modes of knowledge in a nursing context. This research will therefore contribute to the development of further theoretical underpinnings in nursing education from a socio-cultural perspective. Publications from this project will propose a way forward for their future use in other university contexts.

Conclusion

It is apparent from the review of the literature that many of the studies concerning the use of WHDs have placed greater emphasis on the affordances of the device, and how to use them, rather than developing a pedagogical approach to their use which might support distance education students. In addition, where research has been conducted, many of the studies used a weak experimental design with minimal reporting of effect sizes, used descriptive research approaches, were conducted over a short period of time and failed to ground the research in a theoretical framework (Chueng & Hew, 2009). Our research, underpinned by Activity Theory, conducted over a period of 12 months, and utilising a variety of data collection and data analysis methodologies, will contribute to the body of knowledge concerning the use of WHDs in distance education contexts.

Chapter 3 Methodology

Introduction

The project was undertaken collaboratively between USQ and CQUniversity. The circumstances of distance learners exist as complex and diverse systems in which the learner has access to a variety of resources and personal support but is also subject to a variety of constraints. It was hypothesised that the introduction of a new device and associated ways of working would be affected by existing elements of the system. Hence research about the benefits of new devices needed to be conducted with sensitivity to the existing system.

Activity Theory was chosen as the basic research paradigm to underpin the study's methodology. Activity Theory as described in Chapter 2 aims to understand human beings in their natural, daily circumstances. Human activity is always oriented to achievement of goals (Nardi, 1996) and in this sense activity implies an action done to transform some object (Engeström, 1999). Activity is understood as a purposeful interaction of the subject with the world via the use of tools (Kaptelinin & Nardi, 2006). Engeström (1987) reconceptualised the Activity Theory heuristic into a six element model (Figure 3) which has become an analytical tool used in a wide range of educational research (e.g. Sweeney, 2010; Zevenbergen & Cronin 2007; Latheef & Romeo, 2010).

Engeström's (1987) model (Figure 3) was used to assist conceptualisation of the investigation in this project by considering how the introduction of a new tool (iPod Touch as a mobile device) affects the actions and interactions of the learner directed toward achievement of the learning outcomes for the specific course. For example, students may use the iPods to study in circumstances where they otherwise might not, to gather data for a digital portfolio demonstrating their learning, or to communicate with instructors or peers from a wider variety of contexts. They might also experience contradictions arising from prior expectations about study at particular times and locations (rules), changes in their interactions with their community (within and beyond the context of the course of study), and other changes in their activity system.

Because Activity Theory, as the conceptual framework, underpinned the research methodology and discussion of the findings, it is appropriate to use mixed methods (Onwuegbuzie, 2002) to facilitate investigation of the beliefs and values of the participants in this study, and how these affect mobile digital device usage. Data were collected by student surveys (pre- and post-iPod use), focus group interviews, student online discussion forums, reflective journals and application logging software. Application-logging software has been seldom used in prior research (Swan, et al., 2005), so a contribution of this project has been the development of software, to monitor the applications installed by each student on their assigned iPod.

To investigate the benefits and constraints of mobile digital devices specifically in DE, students studying in DE or online modes in selected Semester 3, 2011 and Semester 1, 2012 courses at both USQ and CQUniversity were asked to participate. The specific DE/online courses selected were:

USQ Education: EDC3100 ICT and Pedagogy

USQ Nursing: NUR3599 Clinical C – Mental Health Nursing

CQUniversity Education: FAHE11001 Managing E-Learning

CQUniversity Nursing: NURS13119 Professional Nursing Practice; NURS12146 Chronic Disease Management; NURS11151 Beginning Nursing Practice

Forty 4th generation iPod Touch devices were purchased for use by each university (20 each for Education and Nursing students) and 6 for use by project team members (86 iPods in total). It was anticipated that study resources would need to be re-packaged for the iPods to conform to mobile content standards. However, on close examination of the Round 1 S3 courses and in view of the available time, it was determined to trial the existing materials in S3, 2011 and modify them for S1, 2012 should the results from S3 indicate that they were problematic. Trialling the devices at two universities with somewhat different approaches to development and packaging of study resources enhances the robustness of the findings. Limited trials of selected applications and content presentation formats was integrated into the learning experience of students at each university and necessary support materials were distributed to participating students and staff (Appendix 2).

The project involved 2 iterative trials across 2 academic semesters in the courses listed above for which the instructor was a member of the project team. Students in the selected courses were invited to volunteer as participants once ethical approval was obtained (Appendix 3) and against clearly stated criteria (such as naïve users, remote users, and other demographics) some weeks prior to the commencement of each semester. If more students volunteered than could be accommodated with iPods a first come approach was taken against the stated criteria. The selected students were issued with an iPod for use during the semester. Analysis of the quantitative data was undertaken using SPSS19 to determine frequencies and relationships between demographic variables and mean scores on the pre- and post-surveys completed each semester. The qualitative data were analysed using Leximancer to determine themes.

The specific research questions addressed by this project were:

1. **How does the introduction of the iPod Touch affect distance learners' interactions with course content?**
2. **How does the introduction of the iPod Touch affect distance learners' patterns of communication with instructors and peers?**

3. **Which capabilities of the mobile devices are valued by distance learners and for what purposes?**

4. **What constraints are evident in the use of the mobile devices to support distance learning?**

5. **What modifications to university study resources are necessary or desirable to optimise their use on the iPod Touch or similar mobile devices?**

6. **What adjustments to course design would enable most effective use of the iPod Touch or similar mobile devices to support learning?**

7. **What costs and associated issues need to be addressed at an institutional level for scalability**

Reflection Question	Instrument	Reference	Time
1-4	Student Survery - online	Appendix 4	Week 1, Week 15
1-6	Focus Group Interviews	Appendix 5	Week 6, Week 15
All	Student Reflective Journals	Appendix 6	3 per semester - weeks 4, 8, and 15
All	Student Discussion Forum posts		Continuously throughout the semester
7	Application logging		On return of iPod

Table 1: Data collection timetable and instruments used to address each of the research questions each semester

A timeline for the project's activity is displayed in Table 2.

4. Milestone	Completion Date
Tentative Project Approval – pending legal sign off by DEHub	1 May 2011
Team Meeting 1 – USQ FC campus	16 May 2011
Purchase order provided by DEHub for grant	16 June 2011
Ethics Application - USQ	Submitted 21 April Approved 16 June

	[USQ=H11REA081; CQU= H11/05-086]
Development of Research Tools: 1. Quantitative • Survey pre-post 2. Qualitative • Reflections - students & instructors • Focus Group questions • Forums 3. iPod Applications	Finalised 30 June Lime Survey online Online - Survey Monkey Blackboard Collaborate Course websites Software developed/ sourced
Development of Student Use Agreement • Student information & informed consent documents	 Finalised 16 June
Team Meeting 2 - USQ FC campus	1 July 2011
iPods, Telstra MiFis and iTunes cards received from USQ, 43 provided to CQUniversity following acceptance of the USQ Research Agreement by CQUniversity	9 September 2011
Decision to commence data collection in S3 as iPods and other equipment were received too late to start in S2. Round 1 = S3, 2011 and Round 2 = S1, 2012	
Sample Selection: • 20 students/course • Must be distance students as per discussion • Consider demographic variables esp. access to WiFi	 Prior to week 1, each semester
Distribution of iPods & Acceptable Use Agreement	Week 1, each semester
Data Collection timeline: • Surveys - pre - Using online survey tool • Focus group 1 • Focus group 2 • Surveys - post - Using online survey tool • Student reflections - using Survey Monkey • Student discussion forum posts	 Week 2, each semester Mid semester End semester End semester Ongoing throughout semester Ongoing throughout semester
Create & Maintain Data repository	Ongoing
DEHub Interim Report 1	7 October 2011
Team Meeting 3 - via Blackboard Collaborate	21 October 2011

Research Poster Presentation - USQ VC's Community Engaged Research Evening - Appendix 7	11 November 2011
Maintenance of Project Website - USQ	On-going
Maintenance of DEHub Project Wiki	On-going
DEHub Interim Report 2	**31 December 2011**
DEQuarterly article - *Distance learning at times and chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices* - Appendix 8	December 2011 *places*
Literature Review	Completed by 1 January, 2012
Assessment of course online content & modification as required based on Round 1 results	S1, 2012
Data Analysis x 2	End S3, January 2011 and End S1, July 2012
ACEC 2012 conference paper - *Learning at times and paperplaces chosen by the learner: Adapting to study with mobile digital devices* - Appendix 9	Accepted as refereed ACEC12 conference 2012 October 2-5
DEHub Final Report & financial acquittal	**30 June 2012**
Ongoing data analysis and writing	June-December 2012
USQ & CQU Staff Dissemination Workshops	July-August 2012
ascilite 2012 paper - *Going mobile: Each small change requires another* - Appendix 10	Submitted for presentation at ascilite 2012 conference November 25-28

Table 2: Activity timeline

Thus, the project achieved all required contractual milestones as displayed in Table 3. It was hoped to commence the data collection in Semester 2, 2011. However this was not possible due to the lateness of the official approval and receipt of the purchase order for the grant funds from DEHub, as well as the difficulties in getting the necessary equipment ordered and distributed by USQ to CQUniversity. As the equipment was an integral requirement of the project, it was decided by the research team to delay the start of data collection until Semester 3, 2011 and to repeat the cycle in Semester 1, 2012. At the time of writing this report, the second data collection cycle was coming to an end and consequently the analysis of the round 2 data does not form part of this report. That data will be analysed during Semester 2 and the results will be compared and contrasted with those obtained from round 1. Two refereed conference papers (ACEC2012 and ASCILITE 2012) have been written from the round 1 results as well as a research poster for the USQ Vice Chancellor's Community Engaged Research evening and a report for the December DEQuarterly publication. All publications are attached as Appendices to this report.

DEHub Grant Timeline Milestone	Requirement	Due Date
Milestone 1	Project Plan and development of a WikiResearcher page	31 May 2011
Milestone 2	Quarterly report 1 and update to WikiResearcher page	30 Sept 2011
Milestone 3	Mid-way report and update to WikiResearcher page Mid-way Evaluation Financial Acquittal Stage 1 against stated and approved budget items	31 Dec 2011
Milestone 4	Quarterly report 3 and update to WikiResearcher page	31 March 2012
Milestone 5	Final Report and update to WikiResearcher page Final evaluation report Financial Acquittal Stage 2	30 June 2012

Table 3: Required milestones

The next chapter presents the results of the round 1 trial of the iPod Touch.

Chapter 4 Results

This chapter will present the results of the round 1 trial of the iPod Touch Wireless Handheld Device (WHD) with nursing and education students at USQ and CQUniversity. To assist the organisation of the chapter, the quantitative results will be presented, followed by the qualitative results.

Pre- and Post-survey

The pre- and post-survey instruments were administered online using LimeSurvey® (www.limesurvey.org). Data were exported and transferred to SPSS19 for analysis. The survey included several scales, each comprising multiple statements to which participants registered a level of agreement using a 5-point Likert scale from strongly disagree (1) to strongly agree (5) except for the frequency of use scale which used a 6-point scale (1=Not Used; 2=Once/twice a semester; 3=Once/twice a month; 4=Once/twice a week; 5=Once a day; 6=Several times a day). The 5 scales were adapted from the *TPACK Confidence Survey* (TCS) (Albion, Jamieson-Proctor & Finger, 2010) and the *Technology Acceptance Model* (TAM) (Davis, 1985, 1989) in order to measure the participants' level of:

1. **interest in and attitude toward using ICT for learning (13 items),**
2. **expected (actual in the post-test) ease of use of the iPod Touch for learning (6 items),**
3. **expected (actual in the post-test) usefulness of the iPod Touch for learning (6 items),**
4. **frequency of use of ICT (iPod Touch in the post-test) for various study activities (30 items), and**
5. **desirability of a mobile device for study (13 items).**

Scores on the scales were calculated as average ratings and reported as a value between 1 and 5 (1 and 6 for frequency of use) for ease of interpretation.

Key Survey Results from Round 1

All student participants were invited by email (with reminders) to complete both the pre-test and post-test surveys. There were 47 completed responses for the pre-test and 31 for the post-test. Although participants were instructed to enter a reproducible code for anonymous matching of pre-test and post-test responses, only 17 matched data sets were extracted for analysis. Table 4 reports demographic data from these participants. As can been seen in the table, the majority of students in round 1 were female, Australian, secondary qualified and studying education.

	Number	%
Gender:		
Female	12	70.6
Male	5	29.4
Total	17	100
Country of Birth:		
Australia	15	88.2
Other	2	11.8
Total	17	100
Current Highest Level of Qualification:		
Secondary School	12	70.6
TAFE qualification	4	23.5
University qualification	1	5.9
Industry based qualification e.g., hospital certificate	0	0
Total	17	100
University Attended:		
University 1	11	64.7
University 2	6	35.3
Total	17	100
Professional qualification being studied:		
Education	15	88.2
Nursing	2	11.8
Total	17	100

Table 4: Demographic Data Round 1

The pre- and post-test data for these participants were compared using paired samples *t*-tests for each of the five scales described above and these results are presented in Tables 5 and 6. Differences reported in Table 6 have been calculated as pre-post so that positive values represent a decrease in mean rating from pre- to post-test. Participants' attitudes to the use of ICT for learning decreased slightly, but not statistically significantly, during the semester. Scores on all four other scales also decreased, with three of the decreases (iPod usefulness, ICT frequency of use for study, and desirability of mobile device for study) being statistically significant (p =.05).

Scale		Mean	Std Deviation	Std. Error Mean
Attitude to ICT for learning	Pre	4.37	.615	.149
	Post	4.29	.953	.231
iPod Touch ease of use for learning	Pre	3.63	.686	.166
	Post	3.09	.902	.219
iPod touch usefulness for learning	Pre	3.34	.749	.182
	Post	2.45	.996	.242
ICT frequency of use for study	Pre	3.69	.701	.170
	Post	2.09	1.035	.251
Desirability of mobile device for study	Pre	3.82	/593	.144
	Post	2.99	1/168	.283

Table 5: Pre-test and post-test mean ratings on key scales (N = 17)

Paired differences							
				95% confidence interval of the difference			
Scale	Mean	Std. devn	SE mean	Lower	Upper	t (df = 16)	p (2-tailed)
Attitude to ICT for learning	.08	1.09	.27	-.48	.64	.31	.76
iPod Touch ease of use for learning	.54	1.08	.26	-0.1	1.09	2.07	.056
iPod touch usefulness for learning	.89	1.13	.27	.31	1.47	3.27	.01
ICT frequency of use for study	1.6	.88	.21	1.15	2.05	7.50	.00
Desirability of mobile device for study	.833	1.069	.259	.283	1.382	3.212	.01

Table 6: Analysis of changes in ratings on the 5 key scales (N = 17)

Table 7 to Table 11 display the means for the individual items in each sub-scale and only on two items across the 5 scales were the students' opinions more positive at the post-test:

1. **Table 6: I feel confident in my ability to use ICT for study.**
2. **Table 7: Learning to operate the iPod Touch will be (was) easy for me.**

These items are indicated with an *

Please choose from 1-5 to indicate your level of agreement with each statement where 1=Strongly disagree and 5=Strongly agree	Pre-test Mean	Post-test Mean
I am interested in using ICT for personal purposes (e.g., banking, social networking, email etc)	4.71	4.59
I am interested in using ICT for study (e.g., accessing study materials, research, contacting lecturers etc	4.71	4.59
I currently use ICT for personal purposes extensively	4.59	4.53
I currently use ICT for study extensively	4.65	4.59
I believe that ICT can improve my study success	4.59	4.47
* I feel confident in my ability to use ICT for study.	4.41	4.47
I am comfortable using a variety of different types of ICT	4.41	4.41
I learn about new types of ICT easily	4.24	4.06
I keep myself informed about new types of ICT	3.88	3.88
I enjoy playing around with different types of ICT	4.35	4.24
I know enough to solve my own technical problems with ICT	3.65	3.65
I have the technology skills I need to use ICT to achieve personal goals	4.24	4.12
I have the technology skills I need to use ICT in my study	4.35	4.12
Overall	4.37	4.29

***Table 7**: Interest in and attitudes toward using ICT*

Please choose from 1-5 to indicate your level of agreement with each statement where 1=Strongly disagree and 5=Strongly agree	Expected Mean (Pre)	Actual Mean (Post)
* Learning to operate the iPod Touch will be (was) easy for me.	4.06	4.12
I will find (found) it easy to get the iPod Touch to do what I want it to do in my course	3.82	3.47
The iPod Touch will make (made) accessing my course materials easier	3.47	2.82
The iPod Touch will make (made) communicating with my lecturer easier	3.59	2.76
The iPod Touch will make (made) communicating with my peers easier	3.53	2.88
The iPod Touch will make (made) completing my assessment tasks easier	3.29	2.47
Overall	3.63	3.09

Table 8: Expected and actual ease of use of the iPod Touch for learning

NB. The words inside brackets in each item indicate the change made for the post-test survey to indicate actual ease of use of the iPods for learning.

Please choose from 1-5 to indicate your level of agreement with each statement where 1=Strongly disagree and 5=Strongly agree	Expected Mean (Pre)	Actual Mean (Post)
Using the iPod Touch in my course will enable (enabled) me to accomplish tasks more quickly.	3.29	2.41
Using the iPod Touch in my course will enable (enabled) me to accomplish tasks more easily.	3.18	2.47
Using the iPod Touch will make (made) it easier to complete my course successfully.	3.35	2.35
Using the iPod Touch will improve (improved) my course results.	3.06	2.29
Using the iPod Touch in my course will increase (increased) my interaction with the course materials.	3.65	2.53
Using the iPod Touch in my course will increase (increased) my communication with lecturers and peers.	3.53	2.65
Overall	3.34	2.45

Table 9: Expected and actual usefulness of the iPod Touch for learning

NB. The words inside brackets in each item indicate the change made for the post-test survey to indicate actual usefulness of the iPods for learning.

Please choose from 1-6 to indicate your level of agreement with each statement where 1=Not Used; 2=Once/twice a semester; 3=Once/twice a month; 4=Once/twice a week; 5=Once a day; 6=Several times a day	Expected Mean (Pre)	Actual Mean (Post)
I use ICT (used the iPod) to manage my studies by accessing university information such as timetables, enrolment information, pay fees and locate instructor contact details	4.47	2.76
I use ICT (used the iPod) to access course study materials through the university website	5.41	2.88
I use ICT (used the iPod) to create and work on documents (e.g., Word, Excel)	5.47	1.65
I use ICT (used the iPod) to create and present multimedia presentations as part of my course requirements (e.g., PowerPoint)	3.88	1.59
I use ICT (used the iPod) to create and present audio/ video as part of my course requirements (e.g., iMovie, Moviemaker, Splice)	2.71	1.82
I use ICT (used the iPod) to access the web to look up reference information for study purposes (e.g. online dictionaries, MIMS)	5.29	3.29
I use ICT (used the iPod) to download files associated with my course	4.94	2.71
I use ICT (used the iPod) to upload files associated with my course	4.18	2.12
I use ICT (used the iPod) to engage in discussion forums about course content	4.29	2.06
I use ICT (used the iPod) to send/receive email	5.76	2.82
I use ICT (used the iPod) to communicate with my instructor/s	4.35	2.18
I use ICT (used the iPod) to communicate with my peers	5.12	2.76
I use ICT (used the iPod) to ask/answer questions about course content	4.29	2.06
I use ICT (used the iPod) to listen to course podcasts and/ or other course audio files	4.71	2.35
I use ICT (used the iPod) to publish podcasts and/or other audio files for use in my course	2.35	1.59
I use ICT (used the iPod) to watch videos related to my course	3.82	2.35
I use ICT (used the iPod) to create and publish videos for use in my course	1.88	1.59
I use ICT (used the iPod) to upload and share photographs related to my course	2.29	1.82

I use ICT (used the iPod) to access social networking software (e.g., Twitter, Facebook) to connect with others in my course	4.35	3.18
I use ICT (used the iPod) to share digital files related to my course (e.g., photos, audio files, movies, digital documents, websites)	3.82	2.24
I use ICT (used the iPod) to access social bookmarking software (e.g., del.icio.us) to build collaborative pools of study resources	1.71	1.65
I use ICT (used the iPod) to communicate synchronously with my instructor/s (e.g., Skype, FaceTime)	1.88	1.35
I use ICT (used the iPod) to communicate synchronously with my peers (e.g., Skype, FaceTime)	2.12	1.82
I use ICT (used the iPod) to read RSS feeds (e.g., news feeds)	3.35	2.12
I use ICT (used the iPod) to maintain a blog or vlog as part of my course requirements	2.76	1.65
I use ICT (used the iPod) to contribute to another's blog or vlog as a part of my course requirements	2.76	1.47
I use ICT (used the iPod) to contribute to the development of a course wiki	3.29	1.35
I use ICT (used the iPod) to access my grades/marks	3.00	1.94
I use ICT (used the iPod) to receive discussion starters or discussion questions from my instructor/s	3.29	1.65
I use ICT (used the iPod) to receive assessment questions or survey questions from my instructor/s	3.18	1.94
Overall	3.69	2.09

***Table 10**: Frequency of use of ICT (or iPod) for study purposes*

NB. The words inside brackets in each item indicate the change made for the post-test survey to indicate actual frequency of use of the iPods for study purposes.

Please choose from 1-5 to indicate your level of agreement with each statement where 1=Strongly disagree and 5=Strongly agree	Expected Mean (Pre)	Actual Mean (Post)
It will help (helped) me get better results	3.12	2.53
It will help (helped) me to better understand the subject material	4.00	2.53
It will make (made) completing work in my course more convenient	3.88	3.06
It will allow (allowed) me to more easily access the course materials on the web	3.76	3.06
It will allow (allowed) me to more frequently access the materials on the course website	3.82	3.06
It will allow (allowed) me to more easily communicate with my lecturers	3.59	3.00
It will allow (allowed) me to more frequently communicate with my lecturers	3.59	3.06
It will allow (allowed) me to more easily communicate with my peers	3.71	3.18
It will allow (allowed) me to more frequently communicate with my peers	3.76	3.24
It will provide (provided) me with access to a greater range of ICT tools with which to complete set study tasks	4.12	3.00
It will improve (improved) my ICT skills generally	4.29	3.47
It will improve (improved) my career or employment prospects in the long term	3.82	2.82
It will provide (provided) me with essential skills for my future career	4.24	2.88
Overall	3.82	2.99

Table 11: Reasons to use mobile ICT devices (such as an iPod Touch) for study purposes
NB. The words inside brackets in each item indicate the change made for the post-test survey to indicate actual reasons for use of the iPods for study purposes.

Based on the survey results of round 1, after having access to the iPods for a semester, these nursing and education students appeared to be less positive about their potential usefulness for study and did not use them as frequently for study during the semester as they anticipated they would even though they reported that they had little difficulty learning to operate the iPods.

Qualitative data collection Round 1

With respect to the round 1 data it was decided to pilot the method of analysis on the education student data from USQ initially prior to analysing the other cases. The approach used was experimental and it was determined that there was little to be gained, in view of the very tight timelines for reporting, in committing effort to a process that might not yield results. This section will report the results from the qualitative analysis, using the pilot analysis techniques, for the USQ Education students' reflections.

The reflections, online discussion archives and interview data for the USQ Education students in round 1 were amalgamated and analysed using a constant comparison method. The researchers searched for common themes and patterns within the data and inconsistencies were also recorded. As was noted by the course facilitators in the following section, students did not complete the reflections on a regular basis and few students participated in the focus group interviews from each case. It was therefore determined that all qualitative data for each case would be combined and analysed as a single case.

As a first step, the text of student responses was passed through Wordle (www.wordle.net) which produces a visual mapping of words in the data based on frequency of occurrence with the option to remove common words (such as 'a', 'the', 'and', etc.) that do not carry meaning about the data. This process identified frequently occurring words (including 'access', 'lectures', 'information', 'people', and 'remote') that could be used as starting points for thematic analysis. Text was scanned to generate a key phrase list, which was then used to tag responses from individual respondents to each of the questions that had been posed to them. This tagging of participants' responses against the key phrase list was used in Microsoft Excel to produce a frequency table and associated radar chart (Figure 4 below) showing the relative frequencies with which identified themes appeared in responses to three key questions.

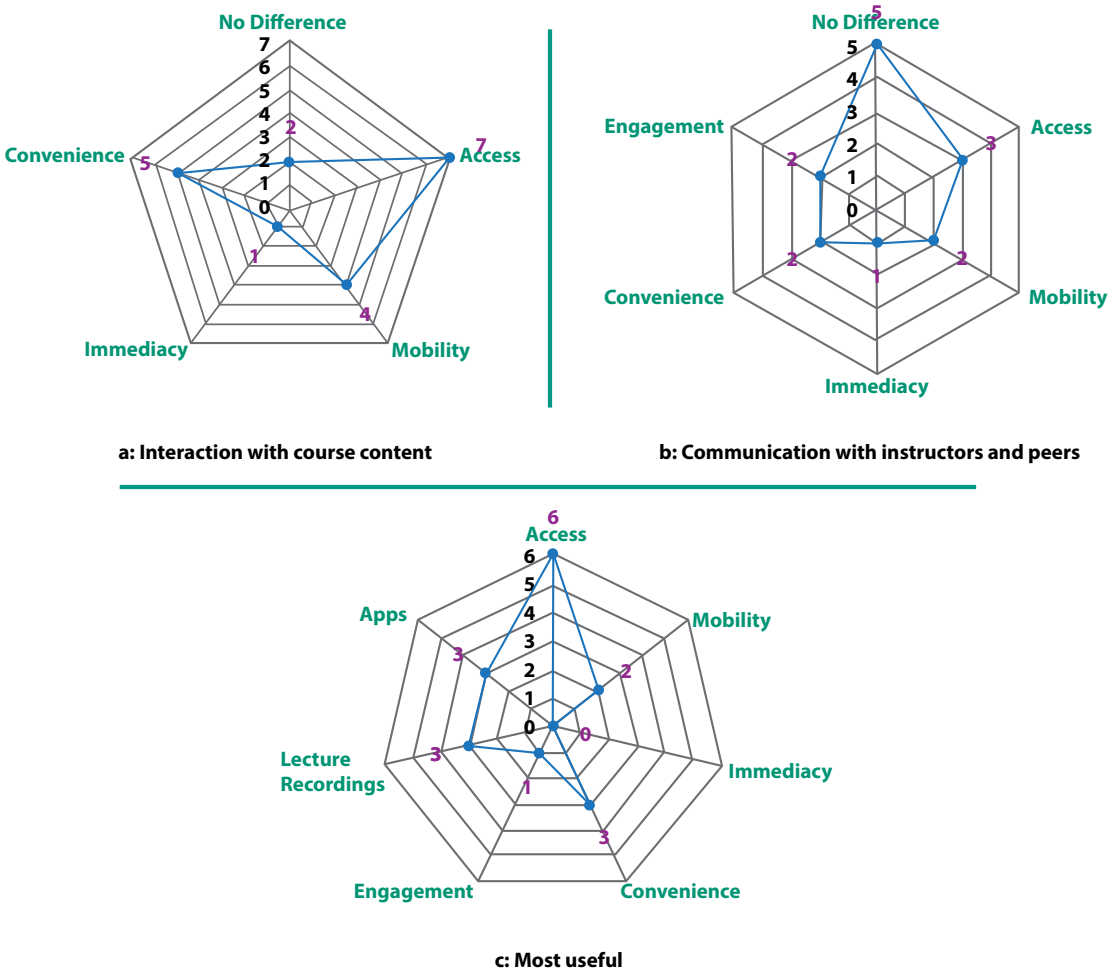

Figure 4: *Radar plots of key themes from student interview data*

The first question asked about differences that the iPod Touch may have made to interaction with course content (Figure 4a). Major themes in the responses were *access*, *convenience* and *mobility* with comments including being "able to listen to lectures while I walked my dogs" and "time management [becoming] less of an issue because I didn't have to rely on my home computer to access…readings and tools." One respondent mentioned *immediacy* of access "at the drop of a hat without having to set up my laptop and wait for it to load."

The second question asked about changes to patterns of communication with instructors and peers (Figure 4b). Most participants reported no difference but where changes occurred they mostly related to access, mobility, convenience, and engagement. Specific comments referred to more convenient access to email "instead of having to turn on my laptop", to access while away from home, and to being "able to record myself in the car and while taking part in normal day to day activities that I could then recall and send to my lecturers and peers."

The third question asked what participants found most useful about the iPod Touch (Figure 4c). The dominant theme was *access*, represented by comments about use away from home, mobility facilitated by the small size, and being able to watch or listen to recorded lectures "while I walked my dogs."

Across the three questions the most common themes were *access* (16 instances), *convenience* (10), and *mobility* (8) but these three and other concepts were often linked in a single statement, for example, the student who reported using the iPod to "listen to lectures while I walked my dogs." Most participants reported no change to communication resulting from the iPod; changes to interaction with course content were more numerous; and the responses for *access* in the question concerning the most useful aspects were predominantly about accessing recorded lectures or other course material.

Facilitators' summaries from round 1

During the first semester of implementation, participants in four cases (courses) were provided with an iPod Touch. The cases are identified according to area of study (Education or Nursing) and the university (1 or 2). Facilitators from the courses recorded their experiences, which are summarised here.

Education course

- University 1

Students (n = 19) participated in an ICT and pedagogy methods course during semester 3, 2011. This is a core course for Bachelor of Education students taken in the third year of a four year program. Two students joined the project using their personal iPhone. During the semester three students withdrew citing workload issues.

The course was offered online, using the LMS (Moodle) to store documents, recorded lectures, tutorial activities, additional readings and online discussions. For this pilot, no materials were modified for specific use on the iPods. Synchronous weekly tutorials in Wimba were offered to the whole class.

A separate LMS area provided information about using the iPods and discussions for both learning and social purposes. Students shared how they used their iPods on their three-week professional experience placement as well as during the Christmas break. They also used a wiki to share tips, ideas and apps related to learning with a mobile device. The iPod research area was available to all course participants but only project participants interacted in that space.

Students appreciated the opportunity to try new ICT tools both for their own learning and also during their professional experience. Many students commented that the limited screen space made the device difficult to use to read documentation and work within the LMS, although they valued the opportunity to communicate anywhere at any time and also felt that the mobility of the device kept them connected (to their peers and also their families).

Education course

- University 2

Participants were enrolled in an e-learning course. They accessed study materials presented as text, images, audio or video through a Moodle site. Course materials for Mobile, formatted for a small screen, were an optional source. Flash resources were either transcribed or converted for the Mobile access version. Tutorials were created, and an online, synchronous session was held to introduce the devices and suggested apps.

The timing of the mail-out of the devices was problematic because students were attempting to settle into an intense set of courses. It was decided to mail out the devices at the end of Week 2. Although participants were advised about the data collection processes, they were not pushed to complete them immediately but were asked to familiarise themselves with the devices. Not all devices were allocated by the end of Week 2 but all were requested by students by Week 4.

Based on preliminary data indicating that the iPod Touch was considered to be an “aside” to the course, its use for learning was treated more explicitly in tutorials, with mobile options offered across all activities. Creating a purpose for the use of the iPod Touch was important, with the discussions about their affordances resulting in the later requests for a device.

Nursing course

- University 1

Students in this course were reluctant to participate and just 9 of the 20 iPods were distributed. One student withdrew from participation prior to the end of the semester citing technical inadequacy as the reason.

Students indicated that the size of the iPod screen limited their ability to access documents. The other often cited difficulty was lack of connectivity to the Internet for access to course materials. A WiFi base station with 3G network access to the Internet was provided to one group of 4 students located at the same clinical site and sharing accommodation but differences in clinical shifts made sharing difficult.

To facilitate the use of the device, the academics regularly communicated with participants through an on-line discussion forum to deliver information about the devices, instructions for use and reminders about data collection. Although the academics raised questions for discussion there were no responses and no queries from the students. However, students occasionally made telephone contact for technical support while they were on clinical placement and away from their home campus.

Nursing course

- University 2

Students were recruited from Health & Behaviour (distance only course) and / or Professional Communication for Nurses (distance course with a one day residential). Recruitment was difficult, with only 13 students agreeing to participant. Two students withdrew prior to completion of the semester, citing workload issues as the reason.

Interaction with the course content, lecturers and fellow students occurred mainly through the LMS (Moodle). Use of the iPods in both courses was optional but the facilitators of both courses used iPods in their delivery (e.g., delivery of content during residential school; interacting with students via Skype).

Despite frequent reminders to complete surveys and reflections and to attend the focus groups, participants did not fully engage in data collection. There was some reluctance to use Blackboard Collaborate to engage in the focus groups. This may have been due to these students having never used Collaborate before. It appears the lack of a defined role for the use of the iPods within the courses and the lack of confidence in the use of Blackboard Collaborate resulted in poor participation levels and the poor response rates to the surveys and focus groups.

Conclusion

This chapter has presented the results of the round 1 trial of the iPod Touch in education and nursing courses at USQ and CQUniversity. The following chapter will discuss these results and provide an overview of the future research directions of the project in 2012 and 2013??.

Chapter 5 Discussion and Conclusion

This chapter will discuss the quantitative and qualitative results from round 1. It will also provide the limitations of the study and future directions in 2012 and 2013?.

Discussion

As noted in the literature review, Activity Theory provides a useful framework for conceptualising the interactions of human beings with the various components of systems with which they interact in order to accomplish desired outcomes. Figure 3 represented the relationships among components in a generalised activity system. Figure 5 presents possible representations of the salient components of the activity systems experienced by students and academics participating in this study in round 1. In each case the generalised labels have been substituted with labels particular to the systems under consideration in this study. The activity systems experienced by students and academics will interact and have common components, some of which are apparent in the labels. Although the real activity systems will be more complex and will vary for individuals the representations include what we believe to be the most significant elements from this study to date. These representations are expected to evolve as the data from round 2 are analysed.

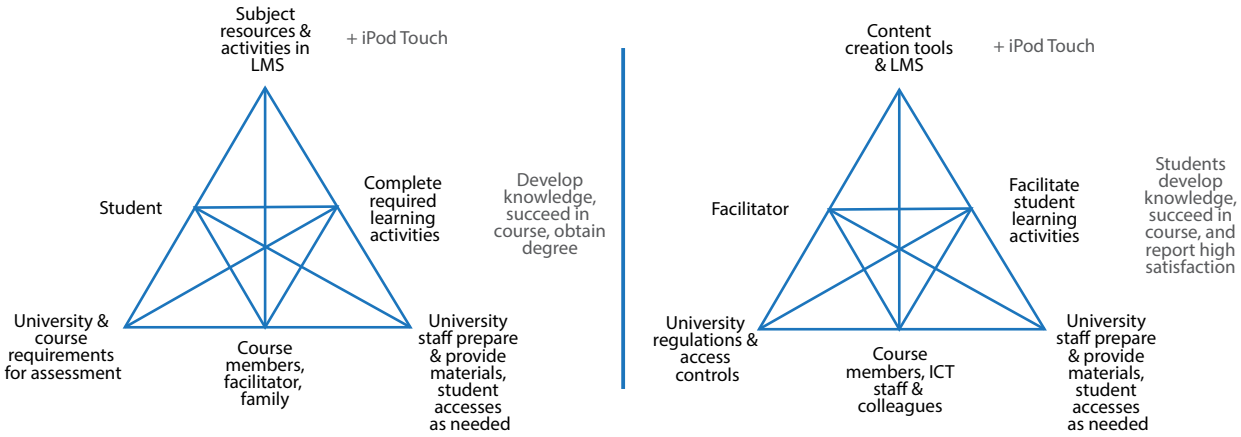

***Figure 5**: Activity systems experienced by students and academic facilitators*

Students are represented as directing their activity toward successful completion of required learning activities as the object in their activity system with their outcome being to pass the subject and ultimately their degree. The object and outcome for the academic facilitators are related to those for the students but with a difference in emphasis on facilitating student completion resulting in passes and satisfaction with the course. Other parts of the systems are similarly parallel with variations in perspective according to the different roles being played in the systems. In each case the addition of the iPod Touch to the available tools represents a potential contradiction to the system that will affect, and be affected by, other elements of the system.

The results presented in the previous chapter offer some insights into how the introduction of an iPod Touch might have affected the activity systems being experienced by these student participants. Students reported positive attitudes toward the use of ICT for learning, together with levels of availability of computers and Internet connectivity that would have enabled them to conveniently access course materials and interactions through the LMS when at home or in similarly equipped locations. Most students reported limited or no access to mobile devices suggesting that access to an iPod Touch would increase the variety of locations in which they might be able to access suitably packaged course content and learning interactions.

These expectations were reflected in their responses to the questionnaire at the beginning of the semester. On the 'ease of use' scale they expected that it would be easy to learn how to use the iPod (mean = 4.06) and to get it to do what they wanted in the course (3.82), which appeared to focus more on communication with staff (3.59) and peers (3.53) rather than on access to materials (3.47) or completion of assessment (3.29). Expectations about 'usefulness' focused on increased interaction with course materials (3.65), increased communication with staff and peers (3.53), easier completion of the course (3.35), accomplishing tasks more quickly (3.29), more easily (3.18) and finally improving their results (3.06). Among these expectations the only two that were realised were the ease of learning to use the iPod, which registered an increase in mean rating from 4.06 (pre) to 4.12 (post) and their confidence in using the iPod for study (pre-test=4.41 to post-test=4.47). Every other item on the scales for 'ease of use' and 'usefulness' recorded a decrease from pre-test to post-test. Items with larger (greater than average) decreases in mean scores from pre-test to post-test included those that focused on interaction with course materials, completing the course successfully, accomplishing tasks quickly, completing assessment tasks and communicating with staff. The latter recorded the largest change of all items from 3.65 (pre) to 2.53 (post) which is somewhat surprising in light of the qualitative data in which accessing course materials, especially recordings, emerged as a major theme. The explanation may lie in the change being in the mode and location of access to materials rather than an increase in *amount* of access. Another explanation may be that the type or format of the materials limited the affordances of mobility because some are less than satisfactory on current WHDs. For example, PDF files may not zoom or, if they do, require inconvenient horizontal scrolling to read.

From the perspective of the activity system, students clearly anticipated the introduction of the iPod Touch as an additional tool to bring changes that would facilitate their achievement of the object and outcome. However, the effects in most areas were less than anticipated. At least part of this may be attributable to the short time over which the project ran. Allowing for time taken to recruit students for the project, distribute the iPods and return them at end of semester, and for the 3 weeks during which students were on professional experience, the participants had approximately 9 to 10 weeks of regular class time during which to experience working with the IPod Touch. Expectations about it being easy to learn to use were fulfilled but students may have needed some time to learn and appreciate its use and may not have discovered all the functionality either inherent in the device and its OS or available through easily sourced and installable apps. Moreover, the short timeframe limited the time available for course leaders to identify, from student feedback, the resources that were problematic and provide alternatives. If course resources are to be device-independent and WHD-friendly, course leaders will need time to experiment with a range of devices to ensure maximum accessibility for students using these devices.

The course materials in round 1 were not modified specifically to support access using the iPod but the file formats provided in the course (.htm, .doc, .ppt, .pdf, .mp4, .mp3) were capable of being accessed using the iPod touch. Some files could be downloaded and stored for later access on the iPod Touch without access to a computer, some could be streamed while connected to the Internet, but some could be downloaded only on a computer and then transferred to the iPod, limiting the potential of the device to be the 'total' access solution. However, access to audio content, supported by the mobile devices would not have been possible otherwise for some students. Although it appears that the total amount of interaction with materials did not increase as a result, students reported greater mobility of use, for example, while mowing or walking the dog. The iPod has therefore had a perceptible effect on the activity system with regard to access to and use of course materials.

Introduction of the iPods brought fewer benefits for communication than students had anticipated. In part, this may have resulted from restricted network connectivity (WiFi only where available) of the iPod compared to a smartphone, but part will have resulted from interaction between the iPod and other tools in the activity system. Synchronous communication in the course used Wimba, which requires Java and as a consequence does not work on the iPod. Asynchronous communication using the discussion forums in the LMS (Moodle) is possible but sometimes awkward because the default configuration of the LMS is not well tuned for use on the smaller screens of mobile devices. Some students mentioned using the iPod successfully for email but other modes of communication characteristic of small mobile devices (SMS, Twitter, Facebook) are not officially supported by the university and may or may not have been in use by members of the course community in the activity system. Thus, the iPod had only a limited effect on communication within the course activity system because of technical limitations in the device and historical factors in the existing tools, rules and community of the activity system.

In seeking to understand the effect of introducing the iPod Touch on the course activity system it is also important to consider the system also from the alternative perspective of the facilitator responsible for the course. As described in the section about participants and setting, although there was a specific section of the LMS space developed to facilitate students participating in the iPod project the first round of iPod Touch use involved no significant modification of course materials to support the new device. The division of labour is a key node in this activity system, with the facilitator providing links and creating the spaces for interaction and students using the links and contributing experiences in the forum. Like the students, the facilitator was constrained by the existing tools in the system that had variable levels of usability with the iPods. Resources on the web were generally accessible from the iPod by following the links provided; discussion forums were workable with effort; Wimba could not be used; and the format, and ease of downloading for offline use, of recorded materials was determined by the standard tools (Camtasia Relay) available as part of the university learning and teaching systems. Rules in the activity system, in the form of university regulations and controls on access to systems, effectively constrained the use of the iPods to substituting for a computer to access existing types of materials and interactions. Provision of materials in different formats; the inclusion of Web-based activities; and assessments that used the capabilities of the iPod to capture, create, and submit student-generated content, were restricted by existing system capabilities or university regulations that would have required more time than was available to negotiate adjustments to the course. These limitations by rules and access to technical

support within the community element of the activity system may have caused contradictions between student and object that resulted in students' expectations for access to material, communications and assessment not being realised.

Limitations of round 1

Round 1 has limitations associated with its small size (47 student participants), restricted context (two Education and two Nursing courses) and very short timeline (a single semester with limited preparation). However, despite those limitations, it has demonstrated the potential for WHDs to disrupt existing activity systems by facilitating access to study materials at a wider variety of times and locations. It has also identified elements of the learning activity system that may need modification in order to facilitate greater use of WHDs and suggests areas in which attention to course design might enable more of the potential of WHDs for learning to be realised.

Although students were able to access most course content using the iPod Touch, there are changes that could usefully be made to improve readability on the small screen and to make it more convenient to download files from the LMS for storage and offline use on the device. These considerations apply to all WHDs even smartphones, which are likely to be more frequently connected to the network than the WiFi-only iPod touch but can still benefit from offline access for savings of time and data costs. Communication within the constraints of existing university systems presented more challenges. The LMS and associated systems need to be reviewed for compatibility with smaller screens and there are likely benefits in considering options for shorter form communications characteristic of mobile users. SMS, Twitter and Facebook exemplify messaging that works well on mobile devices and similar functionality could be incorporated within the LMS or associated systems.

Both students and facilitators require time to become familiar with the core and extended functionality of WHDs before their true potential for learning and teaching can be realised. As the capabilities of such devices evolve it will be important for university regulations and systems, the 'rules' and 'division of labour' of activity systems, to provide for creative exploration of the possibilities for delivery of content to learners, communication within the learning environment, and the collection, possibly for assessment, of content captured or generated by students using WHDs. Existing systems typically have restrictions preventing embedding of learning more integrally in the real world activities of learners and thus limiting their opportunities for authentic learning

Future Directions

At the time of writing this report, round 2 had just concluded. The data had been collected but not collated nor analysed. It is anticipated that the round 2 data will be analysed separately using similar methods to those used for round 1 then both data sets will be amalgamated and analysed, providing a larger and more reliable picture of the impact of the iPod Touch WHDs for learning.

The study has endorsed the Activity Theory approach as a valid research paradigm with which to investigate the research questions posed in this study. The team will continue to use the results from both the quantitative and qualitative data to modify the learning contexts experienced by students and academic facilitators when using WHDs and thus further facilitate student learning in online contexts.

Overall, the results from round 1 indicate that course design, instructor and student knowledge and expectations for mobile devices in teaching and learning and institutional barriers are key factors in preparing distance education courses to effectively use mobile devices. This study has demonstrated that WHDs have the capacity to interrupt the activity flow in the teaching and learning context. However, many barriers need to be overcome to make optimal use of their affordances for teaching and learning none the least of which is integration with the existing systems. Simply providing students and academics with the provision of mobile devices is not sufficient to ensure success.

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Appendix 1: Participant Information and Consent Form

University of Southern Queensland

The University of Southern Queensland & CQUniversity

Participant Information

TO: Participants

TITLE OF PROJECT: Distance learning at times and places chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices

Principal Researcher: A/Prof Romina Jamieson-Proctor

RESEARCH TEAM: A/Prof Peter Albion, Dr Petrea Redmond, A/Prof Trudy Yuginovich, Julie Harris, Dr Andrew Maxwell, Teresa Sander, Wendy Fasso, Dr Rose-Marie Thrupp

Description

The purpose of this project is to evaluate the use of the iPod Touch in three areas of student use for learning: first, accessing pre-loaded or downloadable course materials and resources including text, images, audio and video that have been appropriately packaged for use on the devices, second, engaging in learning activities through peer to peer and lecturer interactions, and third, making personal records of learning and/or for sharing media in interactions to enhance learning. These three areas of focus will be measured and monitored using a variety of data collection techniques including unique data-logging software during the semester.

The research team request your assistance because you are studying one of the courses that this research project has identified and you are engaging in online/distance learning experiences during the semester.

This project is funded by the Distance Education Hub (DEHub) consortium which aims to provide leadership in researching, developing and implementing models for distance education research, teaching, and community engagement across the Australian tertiary sector. Details about DEHub can be found at: http://www.dehub.edu.au/ DEHub will have access to and disperse the results obtained from this study via its website and other publications.

Participation

Your participation in this project is voluntary. You can withdraw from the project at any stage without comment or penalty. Your decision to participate or not, or to withdraw from the project will not affect your current or future ***relationship with*** the University of Southern Queensland.

1. **This project involves an interview, identified survey and focus groups. If you decide to withdraw your data please notify a member of the research team. Any information obtained from you will be destroyed.**

2. **This project also involves the use of data logging software to track your use of the iPod during the semester. This software will only collect information on what programs are used and will not invade your personal communications privacy. The iPods will also be used for interviews and the video/audio from these sessions will be recorded for transcription and analysis. This video/audio will not be made available to anyone outside the immediate research team and will only be used for research purposes.**

It is expected your participation in the data gathering activities (1 & 2 above) will take approximately 3 hours of your time spread across the semester. You will be provided with the iPod for your use throughout the semester however.

Please note: the data obtained from this project may be used at a later time for research purposes only.

Risks

There are no risks beyond day-to-day living associated with your participation in this project.

Confidentiality

Any information obtained in connection with this project and that can identify you will remain confidential. It will only be disclosed with your permission, subject to legal requirements. If you give us your permission by signing the Consent Form, we plan to ***publish*** the results with ***DEHub and in other recognised academic forums e.g., conferences and journals***.

In any publication, information will be provided in such a way that you cannot be identified.

All data received for this project will remain stored for a minimum of 5 years in secure facilities.

Consent to Participate

Please read this information sheet carefully so that you understand what the project involves. If you do not understand any part of the project or require further information please contact the research team members named above.

We would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate

Questions/further information about the project

Please contact the research team members named above if you have any questions or if you require further information about the project.

Concerns/complaints regarding the conduct of the project

If you have any concerns or complaints about the ethical conduct of the project you may contact the USQ Ethics Officer on +61 7 4631 2690 or email ethics@usq.edu.au. The Ethics Officer is not connected with the project and can facilitate a resolution in an impartial manner.

Yours sincerely

A/Prof Romina Jamieson-Proctor (for USQ)
Faculty of Education
Fraser Coast campus
Ph: 07-4194 3153
Email: jamieson@usq.edu.au

Teresa Sander (for CQUniversity)
Faculty of Sciences, Engineering & Health / School of Nursing & Midwifery
Ph: 07-4982 0424
Email: t.sander@cqu.edu.au

The University of Southern Queensland & CQUniversity

Consent Form

By signing below, you are indicating that you:

- have read and understood the participant information document regarding this project
- understand that you are free to withdraw at any time, without comment or penalty
- have had any questions answered to your satisfaction
- understand that if you have any additional questions can contact the research team
- understand that you can contact the USQ Ethics Officer on +61 7 4631 2690 or email ethics@usq.edu.au if you have any concerns about the ethical conduct of the project
- understand the project may involve audiotape / videotape of interviews using the iPods software
- are 18 years of age
- if you are a minor under the age of 18 you have discussed the project with your parent or guardian
- agree to participate in the project

Name .....

Signature .....

Date...../...../.....

Statement of Child Consent (for those students under the age of 18)

Your parent or guardian has given their permission for you to be involved in this research project. This form seeks your parent/guardian's agreement for you to be involved. By signing below, your parent/guardian is indicating that the project has been discussed with him/her and he/she agrees for his/her child (you) to participate in the project

Name.....

Signature.....

Date ...../...../.....

Appendix 2: Introductory Support Materials

DEHub.edu.au
Innovation in Distance Education

Funded by the Australian Government Department of Education, Employment and Workplace Relations

USQ and CQUniversity DEHub Project iPod Touch

Distance learning at times and places chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices

22 February, 2012

Thank you very much for volunteering to be part of this exciting research project.

Enclosed you will find the following items which you have borrowed for the period of 1 semester.

- **$30 iTunes voucher**
- **iPod Case**
- **iPod Touch**
- **Reply paid envelope and padding to return items at the end of the semester.**

The iPod must be returned at the end of the semester for use with another cohort. Please keep the iPod box, bubble wrap etc. to protect the iPod on its return journey. You will find a specific space on the course StudyDesk which provides information and space for discussion and sharing your ideas for the uses of iPods in learning. Also use the space to talk about the ease of accessing the StudyDesk and associated materials through the iPod.

Please complete the online survey prior to using the iPod touch. It should take 15 – 20 minutes. There is a link from the study desk or it is available at: http://pama.net.au/limesurvey/index.php?sid=76323&lang=en

If you have any questions don't hesitate to contact me. I look forward to coming with you on your journey of learning with an iPod.

Regards

Dr Petrea Redmond
Faculty of Education
University of Southern Queensland
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Room: G416, Toowoomba campus
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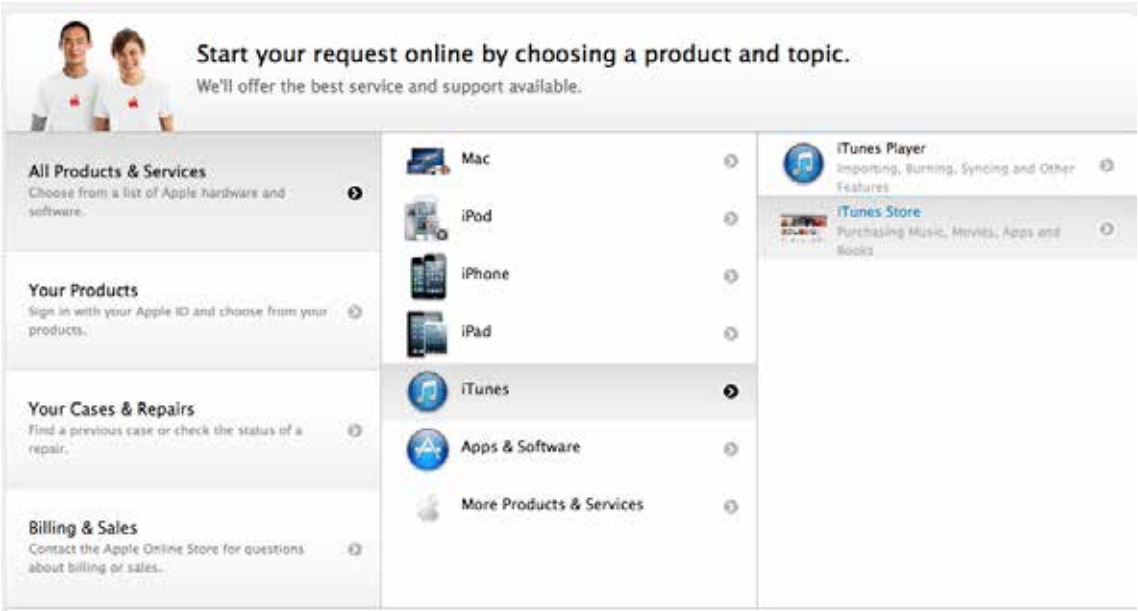
Getting started information

- **Keep the case when unpacking the iPod to assist with transport back at the end of the semester**
- **Use the USB cable to hook up to a computer to charge (or recharge) the iPod (the computer must be on)**
- **Download iTunes (keep the iPod connected to the computer) http://www.apple.com/itunes/download/**
- **Do not register the iPod because someone else will have it next semester Set up your iTunes account for use with your iTunes gift card.**
- **If when you scratch to find the code on your iTunes card the code can't be read go to http://www.apple.com/au/support/itunes/cards-codes/and there are instructions on how to redeem value when the code is illegible/ scratched off. Use the get cards and code support with express lane. You'll get to the following screen, click on the radio buttons and continue.**



- **You may wish to update to the latest iPod software version also (this may take 20 minutes though).**
- **Over the semester select a number of apps to download and use. Use the enclosed iTunes voucher.**
- **As a beginning you might want to download the following**
    - Dropbox (not an app) Free download at http://www.dropbox.com/, use safari
    - iBooks (free)

- Facetime/FaceDial (free)
- Quickoffice ($10 - $15); this enables you to edit word documents etc. that you get from the study desk, webmail, drop box etc.
- Idea Sketch (Free)
- CellSpin ($1.99): mobile blogging; check cheat sheet on study desk
- Speak it: (Free) have the iPod read to you; check cheat sheet on study desk

- **Share on the study desk other apps that you have found might be interesting or have been recommended to you by others.**
- **Please don't delete any apps prior to returning the iPod to USQ.**

Appendix 3: Ethics Approval

University of Southern Queensland

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OFFICE OF RESEARCH AND HIGHER DEGREES
Helen Phillips
Ethics Officer
PHONE (07) 4631 2690 | FAX (07) 4631 1995
EMAIL ethics@usq.edu.au

Thursday, 16 June 2011

Associate Professor Romina Jamieson-Proctor
Faculty of Education
USQ Fraser Coast Campus

Dear Associate Professor Jamieson-Proctor

The USQ Fast Track Human Research Ethics Committee (FTHREC) assessed your application and agreed that your proposal meets the requirements of the *National Statement on Ethical Conduct in Human Research (2007)*. Your project has been endorsed and full ethics approval granted.

Project Title	Distance learning at times and places chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices
Approval no.	H11REA081
Expiry date	30/06/2012
FTHREC Decision	**Approved as submitted**

The standard conditions of this approval are:

(a) conduct the project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments made to the proposal required by the HREC
(b) advise (email: ethics@usq.edu.au) immediately of any complaints or other issues in relation to the project which may warrant review of the ethical approval of the project
(c) make submission for approval of amendments to the approved project before implementing such changes
(d) provide a 'progress report' for every year of approval
(e) provide a 'final report' when the project is complete
(f) advise in writing if the project has been discontinued.

For (c) to (e) proformas are available on the USQ ethics website: http://www.usq.edu.au/research/ethicsbio/human

Please note that failure to comply with the conditions of approval and the *National Statement* may result in withdrawal of approval for the project.

You may now commence your project. I wish you all the best for the conduct of the project.

Helen Phillips
Ethics Officer
Office of Research and Higher Degrees

Appendix 4: Student Pre- and Post-Survey

Distance learning at times and places chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices

University of Southern Queensland & CQUniversity

The purpose of this project is to evaluate the potential of mobile devices, in this case the iPod Touch, to enhance student learning by increasing time on task for interactions that promote learning at times and locations more convenient for the learner. The evaluation will enable USQ and CQU to assess the feasibility of the integration of such devices into learning and teaching systems more broadly.

The survey should take approximately 15-20 minutes to complete.

Participants will be asked to complete the survey twice during the semester: Once in week 2 and again in the final week of the semester.

All responses remain confidential. Your participation is voluntary. Completion and the online submission of the survey will be regarded as the provision of consent.

As we plan to survey you twice, we need to be able to match up your responses from these two time-points to see what changes have occurred in your views. Names will NOT be used in the reporting of results. Once the surveys have been matched, all identifying information will be removed. You are under NO OBLIGATION to agree to a follow-up survey if you participate in the initial survey. You can withdraw from further participation in the research at any time, without having to give a reason. If you withdraw from the project the iPod Touch will need to be returned immediately to your university in the condition that it was issued to you.

Ethics approval has been obtained through USQ - (USQ Ref No: H11REA081), and CQUniversity (CQU Ref No: H11/05-086). If you have any concerns about the ethical conduct of the project, contact William Farmer, Ethics and Research Integrity Officer, Office of Research and Higher Degrees, University of Southern Queensland, *Phone:* (07) 4631 2690, *Email:* will.farmer@usq.edu.au. If you have any questions about the DEHub Project and your participation in it, please email the respective DEHub Project Coordinator for your institution: A/Professor Romina Jamieson-Proctor (USQ) or Teresa Sander (CQUniversity).

Section 1 - About You

1. Identification Code and Follow-up Contact Details

a. Identification Code

We plan to conduct a follow-up survey later this semester, and need to be able to match up your responses from this survey. To protect your anonymity, you are asked to provide an identification code.

Write the first 4 letters of your mother's family name, followed by the first 4 digits of your date of birth.

For example, a student whose mother's family name is 'Smith' and who was born on 2 August would have the following identification code: SMIT0208.

Please **use this code on this survey** and on the follow-up survey later in 2011.

Once the surveys have been matched, all identifying information will be removed.

Please provide your 8 character identification code here:

b. Follow-up Contact Details

To ensure that we are able to contact you for the follow-up survey, please provide your email address. Once the follow-up survey has been matched, your email address will be removed.

Email Contact

2 Gender

☐ Female

☐ Male

3 Age

In what year were you born? (e.g. 1989)

Please write your answer here:

4 Country of birth

☐ Australia

☐ Other

5 Are you living in Australia or another country while studying?

Please choose **only one** of the following:

☐ Australia

☐ Other

Only answer the following question if the following condition is met:

Answer was 'Australia' at question '5 [A5]' (Are you living in Australia or another country while studying?)

6 What is the postcode of the area in which you are living while studying? (e.g. 4305)

Please write your answer here:

Only answer the following question if the following condition is met:

Answer was 'Another country' at question '5 [A5]' (Are you living in Australia or another country while studying?)

7 In what country are you living while studying?

Please write your answer here:

8 Do you identify as any of the following?

☐ Aboriginal

☐ Torres Strait Islander

☐ Neither of the above

9 What is the main language spoken at home?

☐ English

☐ Language other than English

10 What is your current highest level of qualification?

☐ Secondary School

☐ TAFE qualification

☐ University qualification

☐ Industry Based qualification e.g. hospital certificate

11 In what year did you complete that qualification?

Year _____

12 Which university do you currently attend?

☐ CQUniversity

☐ University of Southern Queensland

13 What professional qualification are you studying towards?

☐ Bachelor of Education

☐ Bachelor of Learning Management

☐ Bachelor of Nursing

14 When did you commence studying for your current qualification?

Month Year

_____ _____

15 When do you plan to complete your current qualification?

Month Year

_____ _____

16 Please indicate which of the following units/subjects/courses you are studying this semester

	Access exclusively for my own use	Access any time I need it, shared with other people	Limited or inconvenient access	No access	Note Sure
Desktop computer					
Portable computer (e.g., laptop, notebook or netbook)					
MP3 player unable to play video					
MP3 player able to play video					
iPod Touch					
Digital still camera					
Digital video camera					
Mobile phone (other than a smart phone)					
Smart phone (e.g., iPhone, Android, Blackberry)					
Portable data storage (e.g., flash drive, USB stick)					
Cloud data storage (e.g., DropBox, MobileMe)					
Dedicated video game console (e.g., Xbox, Playstation, Wii)					
Web cam					
Printer					
Scanner					
eBook reader (e.g., Kindle, Kobo, iPad)					

[The list will be determined by answer to Q11 and based on the courses included in the project.]

Section 2 - Access and attitudes to ICT

17 Access to Information and Communication Technologies (ICT) hardware and services

For the purpose of this survey, ICT is a broad term that refers to information and communication technologies, including digital and online resources, software applications and tools such as computers, laptops, iPads, software, digital cameras, handheld mobile devices (iPods, mobile phones/smart phones), interactive whiteboards, the Internet, email, and social networking websites.

Please indicate your current level of access to different types of ICT hardware by selecting the most appropriate response for each:

18 Which value is closest to the advertised speed of your broadband Internet access?

Only answer this question if you have dial-up or broadband access at home.

Please choose **only one** of the following:

O 256 kbps

O 512 kbps

O 1500 kbps

O 8000 kbps

O 20,000 kbps

O Don't know but it is too slow

O Don't know but it is fast enough

19 What is the monthly data limit for your Internet access?

Please choose **only one** of the following:

O Less than 500 MB

O 500 MB to < 1 GB

O 1 GB to < 5 GB

O 5 GB to < 10 GB

O 10 GB or more

O Don't know but it's not enough

O Don't know but it is enough

20 Interest in and attitudes towards using (ICT)

	Strongly disagree				Strongly agree
Please choose from 1-5 to indicate your level of agreement with each statement:	**1**	**2**	**3**	**4**	**5**
I am interested in using ICT for personal purposes (e.g., banking, social networking, email etc)					
I am interested in using ICT for study (e.g., accessing study materials, research, contacting lecturers etc)					
I currently use ICT for personal purposes extensively					
I currently use ICT for study extensively					
I believe that ICT can improve my study success					
I feel confident in my ability to use ICT for study					
I am comfortable using a variety of different types of ICT					
I learn about new types of ICT easily					
I keep myself informed about new types of ICT					
I enjoy playing around with different types of ICT					
I know enough to solve my own technical problems with ICT					
I have the technology skills I need to use ICT to achieve personal goals					
I have the technology skills I need to use ICT in my study					

21 Expected ease of use of the iPod Touch for learning

	Strongly disagree				Strongly agree
	1	**2**	**3**	**4**	**5**
Learning to operate the iPod Touch will be easy for me.					
I will find it easy to get the iPod Touch to do what I want it to do in my course					
The iPod Touch will make accessing my course materials easier					
The iPod Touch will make communicating with my lecturer easier					
The iPod Touch will make communicating with my peers easier					
The iPod Touch will make completing my assessment tasks easier					

How confident are you with the ratings you have made in Q21?

Not at all Confident				Very Confident
1	**2**	**3**	**4**	**5**

22 Expected usefulness of the iPod Touch for learning

	Strongly disagree 1	2	3	4	Strongly agree 5
Using the iPod Touch in my course will enable me to accomplish tasks more quickly.					
Using the iPod Touch in my course will enable me to accomplish tasks more easily.					
Using the iPod Touch will make it easier to complete my course successfully.					
Using the iPod Touch will improve my course results.					
Using the iPod Touch in my course will increase my interaction with the course materials.					
Using the iPod Touch in my course will increase my communication with lecturers and peers.					

How confident are you with the ratings you have made in Q22?

Not at all Confident 1	2	3	4	Very Confident 5

Section 3 - ICT and Study

23 Please indicate how frequently you use ICT for study purposes by selecting the most appropriate response for each statement:

Please choose from 1-5 to indicate your level of agreement with each statement:	Not used 1	Once/ twice a semester 2	Once/ twice a month 3	Once/ twice a week 4	Once a day 5	Several times a day 6
I use ICT to manage my studies by accessing university information such as timetables, enrolment information, pay fees and locate instructor contact details						
I use ICT to access course study materials through the university website						
I use ICT to create and work on documents (e.g., Word, Excel)						
I use ICT to create and present multimedia presentations as part of my course requirements (e.g., PowerPoint)						
I use ICT to create and present audio/video as part of my course requirements (e.g., iMovie, Moviemaker, Splice)						

I use ICT to access the web to look up reference information for study purposes (e.g. online dictionaries, MIMS)						
I use ICT to download files associated with my course						
I use ICT to upload files associated with my course						
I use ICT to engage in discussion forums about course content						
I use ICT to send/receive email						
I use ICT to communicate with my instructor/s						
I use ICT to communicate with my peers						
I use ICT to ask/answer questions about course content						
I use ICT to listen to course podcasts and/or other course audio files						
I use ICT to publish podcasts and/or other audio files for use in my course						
I use ICT to watch videos related to my course						
I use ICT to create and publish videos for use in my course						
I use ICT to upload and share photographs related to my course						
I use ICT to access social networking software (e.g., Twitter, Facebook) to connect with others in my course						
I use ICT to share digital files related to my course (e.g., photos, audio files, movies, digital documents, websites)						
I use ICT to access social bookmarking software (e.g., del.icio.us) to build collaborative pools of study resources						
I use ICT to communicate synchronously with my instructor/s (e.g., Skype, FaceTime)						
I use ICT to communicate synchronously with my peers (e.g., Skype, FaceTime)						
I use ICT to read RSS feeds (e.g., news feeds)						
I use ICT to maintain a blog or vlog as part of my course requirements						
I use ICT to contribute to another's blog or vlog as a part of my course requirements						
I use ICT to contribute to the development of a course wiki						
I use ICT to access my grades/marks						

I use ICT to receive discussion starters or discussion questions from my instructor/s						
I use ICT to receive assessment questions or survey questions from my instructor/s						

For the purpose of this survey, **mobile ICT devices** refers to information and communication technologies, including digital and online resources, software applications and tools such as iPods and other handheld mobile devices (iPads, mobile phones/smart phones) that provide access to the Internet, communication, email and other social networking options.

24 I want to use a mobile ICT device (such as an iPod Touch) in my studies because:

	Strongly disagree				Strongly agree
Please choose from 1-5 to indicate your level of agreement with each statement:	**1**	**2**	**3**	**4**	**5**
It will help me get better results					
It will help me to better understand the subject material					
It will make completing work in my course more convenient					
It will allow me to more easily access the course materials on the web					
It will allow me to more frequently access the materials on the course website					
It will allow me to more easily communicate with my lecturers					
It will allow me to more frequently communicate with my lecturers					
It will allow me to more easily communicate with my peers					
It will provide me with access to a greater range of ICT tools with which to complete set study tasks					
It will improve my ICT skills generally					
It will improve my career or employment prospects in the long term					
It will provide me with essential skills for my future career					

And finally…

25 Please list three ways you think small mobile digital devices such as the iPod Touch could be used to help you with your studies.

1. _____

_____

2. _____

_____

3. _____

_____

26 Please add any other feedback about the use of ICT for learning and teaching at your university that you believe will assist the researchers to better understand student access to and use of ICT resources for study purposes.

_____

_____

_____

_____

_____

_____

25 Do you consent to the use of your responses to this survey for the purposes of research analysis and publication?

☐ Yes

☐ No

Appendix 5: Focus Group Interview Questions

6 Core Focus Group Questions:

1. **What differences has the iPod Touch made to the way you interact with course content compared to previous/other courses?**
2. **What differences has the iPod Touch made to your patterns of communication with instructors and peers compared to previous/other courses?**
3. **What did you find most useful about the iPod Touch?**
4. **What did you find least useful about the iPod Touch?**
5. **Are there changes that need to be made in the course study materials to best utilise the iPod Touch? If so, what?**
2. **What adjustments to course design would enable most effective use of the iPod Touch or similar devices to support learning?**

Additional Prompts:

Research Question	Draft Interview Questions
How does the introduction of the iPod Touch affect distance learners' interaction with course content?	What steps/process did you take with the iPod Touch to access the course content? Did this differ from your steps/ process to access other courses, and if so how? How did you use the iPod to access course content? Was this different to how you access the content without the iPod? Did the iPod improve the way you interact with course content? If yes - how & why? If not, why not?
How does the introduction of the iPod Touch affect distance learners' patterns of communication with instructors and peers?	Did you use the iPod Touch to interact with other students in the course? If so, in what way was this different from your interaction with other students without the iPod? Did you use the iPod Touch to interact with instructors / lecturers in the course? If so, in what way was this different from your usual interaction with instructors / lecturers? Did the iPod improve your ability to interact with your peers and instructors? If so how/why? If not, why not? What is needed to improve the use of the iPods for communication within the course?

What capabilities of the mobile devices are valued by distance learners and for what purposes?	What are the most valuable features/applications of the iPod Touch to assist your learning/understanding of concepts in this course? Why? Would you recommend the course instructor continue to use iPods to facilitate learning in this course?
What constricts are evident in the use of the mobile devices to support distance learning?	Describe any difficulties you encountered with using the iPod Touch in your course. What was the impact of this/these on you/your learning? In the previous question they were asked what was the "most valuable" feature how about what was the least valuable/ worst think about the iPods?
What modifications to university study resources are necessary or desirable to optimise their use on the iPod Touch or similar mobile devices?	What could the university do to optimise your use of the iPod Touch?
What adjustments to course design would enable most effective use of the iPod Touch or similar mobile devices to support learning?	What modifications to course content or resources would you suggest to support your learning experience with the iPods?
What costs and associated issues need to be addressed at an institutional level for scalability?	Did you encounter any costs or issues associated with using the iPod which you feel should be accommodated or addressed by the university?
Concluding questions	Have you any questions you want to ask me about the iPod/ research project or about using the iPod? Was there anything else you wanted to add? Thank you for spending the time talking to me.

Appendix 6: Reflective Journals

Student Reflections:

To be completed weeks 4, 8, 15 of semester online via a survey link to be provided to students

Identification Code

Write the first 4 letters of your mother's family name, followed by the first 4 digits of your date of birth.

For example, a student whose mother's family name is 'Smith' and who was born on 2 August would have the following identification code: SMIT0208. Please **use this code on each reflection**. Once the reflections have been matched, all identifying information will be removed.

Please provide your 8 character identification code here

Q1: How did you use the iPod Touch to interact with course content in the past month?

Q2: How did you use the iPod Touch to communicate with instructors and peers in the past month (frequency, reason, outcomes etc.)?

Q3: What did you find worked really well with the iPod Touch in the past month?

Q4: What were the drawbacks in the use of the iPod Touch in the past month (connecting to course content and communicating with others etc.)?

Academic Reflections:

Your name: _____

1. **What activity occurred in the past month in the DEHub project in your course?**
2. **What worked well?**
3. **What didn't work so well?**
4. **What will you do differently in the future?**

Appendix 7: Independent Evaluation

Report of a formal, independent evaluation of the project

Distance learning at times and places chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices

June 2012

Conducted by

Dr Jason Zagami and Professor Glenn Finger

Griffith University

Project Title: Distance learning at times and places chosen by the learner: Adapting resources and learner behaviours for working with mobile digital devices

Lead Institution: University of Southern Queensland (USQ)

Partner Institution/s: Central Queensland University (CQU)

Project Reference: DeHub Mobile Digital devices

This formal, independent evaluation is conceptualised to provide evaluation insights to inform three purposes:

1. **the degree to which the project achieves stated outcomes;**
2. **the ways in which the project has contributed to the priorities of the DeHub Distance Education research consortium; and,**
3. **the identification of lessons learnt that may assist USQ, CQU and other Higher Education institutions to better achieve their goals in the integration of mobile digital devices to support distance education.**

The project has now reached the conclusion of its planned one year timeline.

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Data Collection

Data collection for this evaluation was conducted by Dr Jason Zagami and Professor Glenn Finger from Griffith University.

Data collection strategies employed included interviews with key stakeholders and participants, report analysis, website and online community analysis. In addition, a range of relevant documents and online resources associated with the project were collected, examined and analysed. A list of these is provided in Attachment 1.

Interviews were conducted with:

- **Associate Professor Romina Jamieson-Proctor**
- **Professor Peter Albion**
- **Associate Professor Trudy Yuginvich**
- **Dr Kevin Larkin**

While the document analysis and online community discussion analysis formed the core of this evaluation, website analysis and interviews of participants highlighted and illuminated important aspects that were not immediately evident in the documented reports.

The data analysis provides important insights into the processes involved in the development of approaches for using mobile digital devices to support distance education.

Project Team

Front Row (left to right): *Dr Andrew Maxwell, A/Professor Trudy Yuginovich, Dr Kevin Larkin*

Back Row (left to right): *Professor Peter Albion, Wendy Fasso, Teresa Sanders, A/Professor Romina Jamieson-Proctor, Dr Rose-Marie Thrupp, Julie Harris*

Project Leader

A/Professor Romina Jamieson-Proctor (USQ) Education

Project Team Members

A/Professor Trudy Yuginovich (USQ) Science

Dr Andrew Maxwell (USQ) Sciences

Professor Peter Albion (USQ) Education

Teresa Sanders (CQU) Sciences

Dr Kevin Larkin (USQ) Education

Dr Rose-Marie Thrupp (CQU) Education

Julie Harris (USQ) Sciences

Wendy Fasso (CQU) Education

Achievement of Stated Outcomes

The project aimed to investigate the use of mobile digital devices to support distance education and this was to be achieved through seven outcomes expressed as seven guiding questions:

1. **How does the introduction of iPod Touch affect distance learners' interaction with course content?**
2. **How does the introduction of iPod Touch affect distance learners' patterns of communication with instructors and peers?**
3. **Which capabilities of the mobile devices are valued by distance learners and for what purposes?**
4. **What constraints are evident in the use of mobile devices to support distance learning?**
5. **What modifications to university study resources are necessary or desirable to optimise their use on the iPod Touch or similar mobile devices?**
6. **What adjustments to course design would enable most effective use of the iPod Touch or similar devices to support learning?**
7. **What costs and associated issues need to be addressed at an institutional level for scalability?**

The evaluation has determined that these outcomes have been achieved with varying levels of success. These are discussed in sequence. A key message from the project evaluation is that important lessons have been learnt in relation to each outcome. These reveal that the provision of the mobile devices does not, by itself, guarantee successful use by either those using them for teaching, or by those using them for learning purposes. In particular, the effective use of mobile digital devices requires early planning, commitment, and in depth engagement by teaching staff in relation to how these will be integral to course design and implementation early by those teaching using the devices. The lessons learnt from this project can inform future implementation of mobile devices into distance learning.

Outcome 1 - How does the introduction of iPod Touch affect distance learners' interaction with course content?

The project has identified a wide range of difficulties in access to course material via iPod Touch devices that affect distance learners' interaction with course content.

Course material needs to be (re)formatted in a manner that makes it easily accessible from mobile devices. While this was identified as a key aspect of the initial project proposal, subject to initial planning discussions, and a significant allocated budget item, it was not sufficiently realised with sufficient resources and processes put in place to effectively support project courses in the repurposing of course material in a timeframe involved. Academic understanding of the importance of formatting for mobile access did not align well with student expectations

and training of academics in what was possible and necessary for mobile delivery of course material and course communication. Due to insufficient attention at this early stage, this was not well developed in many instances. Subsequently, this had flow-on effects to other outcomes such as:

- **Difficulties in viewing resources,**
- **Accessing material through the online course management system (Moodle),**
- **Use of wifi 3G access hubs, and**
- **Lecture capture systems relying on streaming technologies and not asynchronous podcasts.**

Collectively, these were reported to have limited the ability of students to make full use of the iPod Touch devices for enabling effective interaction with course content.

Outcome 2 - How does the introduction of iPod Touch affect distance learners' patterns of communication with instructors and peers?

The project identified connectivity problems in the use of iPod Touch devices that can affect distance learners' patterns of communication with instructors and peers.

Where online access was available, students were able to use the devices for email and skype communication with lecturers. In most cases, minimal use was made of course discussion forums and limited planning in course design for the use of such forums during practicum and clinical placements. Along with the use of forums (Moodle, Wimba and Blackboard Collaborate) that have not been modified adequately for mobile access, limited opportunities for the iPod Touch devices to modify student communication patterns occurred.

The use of a primarily asynchronous device with intermittent online access to support distance education course communications was problematic in many instances. The project highlighted that the introduction of a communication device to support specific course communication outcomes, such as work placement communication, needs to be well planned into course designs and effectively facilitated with internet access.

Where Internet access was provided by wireless 3G hubs, unanticipated limitations and lack of training in the use of such access points in the field did not overcome this inherent limitation of the device for internet based communication for many students.

Outcome 3 - Which capabilities of the mobile devices are valued by distance learners and for what purposes?

The project identified, through pre and post trial surveys, a range of reasons why mobile devices were either valued or not valued by distance learners, and for what purposes mobile devices were used.

The 76% pre- and 50% post- response rates to surveys was somewhat low for a project where participants were provided equipment and may lack some significant disengagement and

negative response data. This highlights the difficulty in generating enthusiasm for innovation when this is seen as outside of students' familiar learning processes, and this is made more difficult where enthusiasm and engagement was not able to be enabled through face-to-face approaches.

Interestingly, the project reported that only 77.5% of the available pool of devices were used by students, and within some nursing courses, less than 50% of students indicated a desire to have access to the device. With most education students in the study participating in a specific course in educational technology where there might be a higher level of promotion and interest, consequently, it seems that the general acceptance level amongst education students might possibly be lower or similar to the nursing findings. These low levels of use identify a significant implementation hurdle for the use of iPod Touch and similar devices, that is, gaining sufficient engagement with student cohorts to make courses adapted to their use viable.

While the delayed access in this study to the devices and uncertainty of their value to the study of project courses will have influenced the valuing of the devices, normally a novelty effect in having access to the mobile devices and instructor enthusiasm might have been expected to impact more positively on students valuing the opportunity provided.

Overall, the study highlights a need for institutions to make students aware of the value that mobile devices can make to their particular studies. While student value of mobile devices for the courses in this study decreased significantly over time, implications can be identified for future use of mobile devices. The contributing factors which this study has identified as needing to be addressed are:

- **The late introduction of the mobile devices in this project,**
- **Low level of integration into course design,**
- **Poor formatting of material for online access by mobile devices, and**
- **Communication difficulties.**

Those who did not take up the option to use the device might have anticipated such problems, or have concerns about their own use of such technologies. However, to ascertain this would require further exploration beyond this project.

Outcome 4 - What constraints are evident in the use of mobile devices to support distance learning?

The project identified a range of constraints evident in the use of mobile devices to support distance learning.

From a student perspective, the screen size was the main limiting feature of the iPod Touch. Students are increasingly familiar with larger format tablets (i.e. iPad) and further trials could consider comparing a wider range of devices and formats.

Likewise, Internet connectivity was seen as a limiting factor. With most of the project expectations for the device being related to accessing online content or participating in online

synchronous communications, the choice of a wifi device being used on practicum and clinical placements imposed additional obstacles to student use of the devices. Cost and project complexity compared to 3G iPhone options might have been worthwhile obstacles to overcome, both for applicability to the research questions and for effective project implementation, as the work around solutions of wifi/3G access points proved too complex in practice for some students.

In general, the most significant constraint on students was that the devices were not an essential or well integrated tool to support their learning in the courses involved in the trial. Students considered the device to be an 'aside' or an 'optional extra', and this was compounded by their limited or lack of availability after courses had commenced. This is likely to have impacted negatively on the research results measuring the effectiveness of the iPod Touch to support student distance learning.

The study has been effective in identifying a range of constraints and has progressed some solutions to overcoming these constraints.

Outcome 5 - What modifications to university study resources are necessary or desirable to optimise their use on the iPod Touch or similar mobile devices?

The project identified a range of modifications to university study resources necessary to optimise their use on the iPod Touch or similar mobile devices.

Unfortunately, this was done through a process of student feedback on lack of access to existing online materials rather than through an identification and repurposing process of course material prior to courses being run. While this process was left to individual academics to manage, it is clear from student experience data that this was not well achieved and more formal workflow process, quality assurance, and institutional support is necessary to prepare course material for use on mobile devices. Some modification of material, particularly lecture capture formats for download and use on the iPod Touch devices was conducted during the second round of the project in response to student access concerns in round one, and some formatting of flash based material was conducted to make this suitable for use with the iPod Touch.

The study has identified that this process is a substantial and important undertaking for institutions to take to make distance education more effective on mobile devices.

Outcome 6 - What adjustments to course design would enable most effective use of the iPod Touch or similar devices to support learning?

The project identified that adjustments to course design would enable more effective use of the iPod Touch or similar devices to support learning.

There was a general lack of course design to make use of the iPod Touch in content delivery or course communication, primarily as a consequence of project implementation delays and an unstructured process relying upon individual academics to prepare course material. These can be identified as key factors inhibiting more successful student experiences with the iPod Touch in this project.

The study has identified course design workflow and quality assurance as key factors in preparing distance education courses to effectively use mobile devices. There was authentic implementation of the project in the project courses and the associated outcomes have drawn upon these implementations.

Outcome 7 - What costs and associated issues need to be addressed at an institutional level for scalability?

The project identified several costs and associated issues needing to be addressed at an institutional level for scalability.

Institutional project management processes had a significant impact on the project. The difficulties associated with purchasing, managing and conceptualising the use of iPod Touch and similar devices at an institution presented the project with many unexpected challenges that needed to be overcome. Many of these need to be addressed by any institution seeking to use iPod Touch or similar mobile devices. Issues identified in this project which need to be addressed include:

- **Course development,**
- **Technical support,**
- **Integration with existing systems (LMS, Lecture Capture, Online Communication Tools), academic training, and**
- **Student communication on the effective use of the devices.**

These are important issues that need to be addressed at an institutional level. Simply providing students and academics with the provision of mobile devices is not sufficient to ensure success, and this project has highlighted that these issues need to be addressed, as the impact can result in negative effects on student use of the devices for learning.

Scalability issues also need further development as the project only looked at four courses with small cohorts that were manageable within project funding and staff time commitments. Wider implementation might identify further issues relating to complexity associated with scalability which were not identified by the more focused scope of this study.

Achievement of Stated Deliverables

The evaluation has determined that deliverables have been achieved, with the exceptions indicated and delayed primarily due to project commencement delays. In such cases, these have been identified and processes have been put in place and are being actioned to achieve these outstanding deliverables in the near future.

Three reports

- **Dehub Grant interim report (6 October 2011)**
- **Dehub Grant interim report (5 November 2011), one month since previous interim report**
- **Dehub Grant final report (June 2012)**

Three conference papers

The evaluators have identified that:

- **Two conference papers are in process for 2012 – one for ACCE, and one for ASCILITE conferences, and**
- **A third paper is planned for SITE in 2013.**

Two journal articles

Publication plans have been made for the preparation of these, though these have not yet been completed as the authors are awaiting data from the second cohort of students.

Workshop at USQ

This workshop was conducted as planned.

Workshop at CQU

This workshop was not conducted separately at CQU, but was conducted in conjunction with the workshop at USQ Fraser Coast.

Literature Review

The Literature Review was completed in April 2012.

Presentation of results at USQ

This presentation has not yet conducted, but is planned to be conducted in July-August 2012.

Presentation of results at CQU

This presentation has not yet conducted but is planned to be conducted in July-August 2012.

Online wiki

This was populated with initial project data and will include final results and reports as published. Development is ongoing.

Achievement of Planned Budgets

Midway financial acquittal (1 December 2011)

It was noted that minimal expenditure had been made at this date on personnel at 3% of budgeted. Direct costs (including equipment) at 35% of budgeted, and Travel costs at 27% of budgeted. Final budget data is unavailable at the time of this evaluation report.

Repurposing of content

Of significant note, as at 1 Dec 2011, no expenditure had been made on the repurposing of content for courses in the project. While this was made available to individual academics to repurpose course material, a more structured process of academic training and quality control, leading to a systematic modification of course material to suit mobile devices, may have improved project outcomes.

Achievement of Planned Schedules

The project was to be conducted in three stages and these were adhered to, though with significant changes to the planned dates for stages and substages. Adjustments were made to accommodate a six month delay in project start date, while remaining within the fixed end date.

The evaluation team considers that Progress Reports [6 October 2011], Progress Report [5 November 2011], and Final Report [June 2012], submitted to the DeHub research consortium are generally accurate and reflective of the progress of the project at those times.

Achievement of Sustainable Outcomes

Given the scope and scale of this trial, the lessons learnt are applicable for further small scale trials and implementation with a small number of courses and students. While this can inform large scale implementations, further trials are recommended at larger scales in terms of number of courses and cohort sizes in order to better understand how the impediments and constraints identified in this study might be amplified in larger undertakings.

Likewise, the sustainability of the implementation conducted in this study, need to enact processes which address the issues identified in this project, particularly with respect to: institutional changes to Learning Management Systems,

- **Lecture Capture processes,**
- **Identifying course communication tools suited for mobile devices,**
- **Systematic reformatting of course content for mobile access,**
- **Establishing workflows and quality control processes for the training of academics, and**
- **Modification of course designs to take advantage of mobile technologies.**

Contribution to the Priorities of the DeHub

Distance education is increasingly making use of information and communication technologies, and mobile devices are a rapidly maturing aspect of everyday life. Mobile devices provide potential to enhance learning and teaching. Student access to mobile devices, and their experiences and expectations to use mobile devices to access information, communicate, and use software (apps) will increase. Undoubtedly, as learners develop identities as mobile learners, this provides opportunities for distance education, which needs to develop informed responses to these trends. This project has taken another step towards this goal and, while it identified that merely providing access does not ensure success, it has also highlighted that higher education lags industry best practice, and the ubiquitous use being experienced more widely beyond higher education.

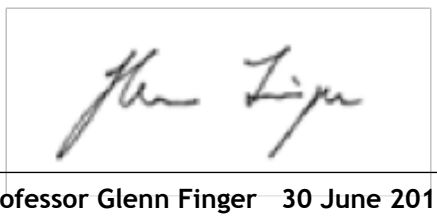
In summary, the evaluation has found that this project has identified issues and implications needing to be addressed for effectively planning for and using iPod Touch and similar devices. These provide insights for priorities needed for both introducing and sustaining similar projects involving the use of mobile devices.

Conclusion

The aim of the study was to learn from the trial of iPod Touch devices in distance education courses. The lessons learnt have been detailed throughout this evaluation, and key findings have been identified and summarised, namely,

- **Greater focus needs to be placed on the preparation stage, before the devices are made available,**
- **Lecturers should be prepared in sufficient detail to take advantage of the opportunities available with the devices,**
- **Quality control processes should be undertaken to ensure that course designs are modified to take advantage of the devices for communication (e.g. email, social media, skype, Wimba and Blackboard Collaborate) and access to resources,**
- **Course material should be modified and with communication tools, systematically tested well before courses commence,**
- **Students should be informed prior to course commencement how the devices can be used to assist their learning and will be used in the course, and**
- **Where necessary, training should be provided in the effective use of the devices.**

While delays in project commencement resulted in difficult and firm decisions needing to be taken on what aspects of the project should receive focus, prioritising attention on the conduct of two trials within the time frame, and eventually, this became just one, resulted in significantly less time in planning and conceptualisation. Delays in the literature review, lack of Research Assistant involvement, content repurposing, and lecturer planning support are understandable, but these resulted in critical preparatory aspects not being completed. This resulted in participants having access to the mobile devices, but without any clearly identified, essential purpose or supporting, well planned integration into course processes for enhancing student learning through the integral use of the mobile devices. The project has usefully highlighted a wide range of potential problems that institutions must address in the implementation of mobile devices into courses. The project has provided a useful platform for the conduct of more extensive trials, and has identified a wide range of issues to be considered to inform subsequent studies.



Dr Jason Zagami 30 June 2012 **Professor Glenn Finger 30 June 2012**