Learning at times and places chosen by the learner: Adapting to study with mobile digital devices

Romina Jamieson-Proctor  
*University of Southern Queensland, Fraser Coast*

Peter Albion  
*University of Southern Queensland, Toowoomba*

Kevin Larkin  
*Griffith University, Gold Coast*

Petrea Redmond  
*University of Southern Queensland, Toowoomba*

Julie Harris  
*University of Southern Queensland, Fraser Coast*

Wendy Fasso  
*CQUniversity, Bundaberg*

Teresa Sander  
*CQUniversity, Emerald*

Trudy Yuginovich  
*University of Southern Queensland, Fraser Coast*

Andrew Maxwell  
*University of Southern Queensland, Toowoomba*

Abstract

There has been substantial research into the use of Information and Communication Technologies (ICT) in higher education but, as mobile access to the Internet becomes the norm, there is a need to explore how mLearning can offer the flexibility expected by increasing numbers of undergraduate university students. This DEHub funded project, conducted by two Queensland Universities, investigated the potential of mobile devices to enhance student learning by increasing time on task at times and locations more convenient for the learner. This paper describes the conceptual background and approaches and reports some initial findings. The key finding is that the presentation of study materials and learning activities requires adjustment to support effective mobile access.

Special Note: This *Distance Education Hub (DEHub)* project was funded by the Australian Government Department of Education, Employment and Workplace Relations (DEEWR).
Introduction and Background

Increasing numbers of university students are choosing to study all or part of their degree in distance or online mode. Their reasons vary, but often relate to busy lifestyles with family and work commitments. Bulky printed materials and media on computers limit the times and locations at which they can engage with study.

Mobile digital devices, small enough to be ‘always’ carried by the user, have been developed for business and entertainment. Among such devices, smartphones have particular significance because they represent to varying extents the convergence of telephone, Internet-connected computer, still and video camera, library, and music player. In April 2011, 37% of Australian mobile phone users (themselves 89% of adults) owned a smartphone and between June 2010 and June 2011 there had been a 63% increase in the number of users going online via their mobile phone (ACMA, 2011). It is expected that penetration of smartphones among the Australian population will continue to increase rapidly. Compared to larger portable devices, such as laptops, smartphones offer learners new opportunities for learning at more convenient times and locations, by enabling access to learning materials stored on the device or, subject to network connectivity, to remote interaction with content, teachers and peers.

Literature review

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.

As the technologies used in distance education have evolved, so have the pedagogies. Recent thinking has highlighted the progression from behaviourist and cognitivist pedagogies toward constructivism (Siemens, 2004) while recognising that each generation complements, rather than replaces, its predecessors (Anderson & Dron, 2011). Rather than students being solely receivers of transmitted knowledge they become co-creators (Blin & Munro, 2008). Early definitions of mLearning focused on the affordances of enabling technologies but more recent thinking has emphasised maintaining continuity of learning across changing contexts, such that 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. Whether mLearning is viewed from the perspective of changing technologies or pedagogies, a key challenge is to provide appropriate learning experiences that maximise the benefits to be gleaned from the available materials, technologies and pedagogies.

Enabling learning to occur “regardless of location and time” (Jueming Chen, 2005, p. 1) will require the associated technologies to be conveniently carried by learners and to be continuously connected to the Internet. Such devices correspond to what Cheung and Hew (2009) described as “wireless handheld devices” (WHD), that is, small devices that can be carried easily in one’s palm and provide computing, as well as information storage and retrieval capabilities. A smartphone, as described above, is the most capable device that fits this requirement but other less expensive devices, such as certain personal digital assistants (PDA) and the iPod Touch, satisfy most, if not all, of the requirements.

Waycott (2002) found that the main benefit of PDAs used in an Open University IT course was their portability and the opportunity for ‘anytime, anywhere’ access to materials. More broadly, benefits of WHDs in educational settings include anytime, anywhere access; lesser requirements for wiring;
simplicity of use; installation flexibility; reduced cost; scalability; and improvement of communication (Kim, Mims, & Holmes, 2006). Two studies using custom software for WHD use by university students noted that students appreciated using the devices for learning in short time periods between other activities (Bull, Cui, Robig, & Sharples, 2005; Corlett, Sharples, Bull, & Chan, 2005). Students also reported positively about using organisational tools for communication, time-management and access to content (Corlett, et al., 2005). Studies of eight diverse graduate courses found that WHDs were used as tools for communication, data collection, and personal information management (Dieterle & Dede, 2006; Dieterle, Dede, & Schrier, 2007).

Affordances and Limitations of mobile devices for learning

WHDs can be an inexpensive way to engage students in developing technology skills and in bridging the digital divide (Johnson, 2005). Characteristics of WHDs that give rise to educational affordances include portability or mobility, social interactivity, context sensitivity, connectivity, personal ownership, and ease of use. The affordances of particular WHDs can change how students perceive the technology in general (Swenson, Young, McGrail, Rozema, & Whitin, 2006).

However, the use of WHDs may be constrained by physical, logical, and socio-cultural factors (Song, 2011). Physical constraints identified by Song include screen size, slow processing speeds, difficulty with text input, and limited functionality. Additional physical constraints may include usability of the hardware (Waycott, 2002), limited memory and battery (Corlett, et al., 2005), and lack of available software (Wishart, et al., 2005). Logical constraints include difficulties in ending programs, availability and price of appropriate programs (especially medical programs), and system instability (see also Koeniger-Donohue, 2008; Oliver & Barrett, 2004). Socio-cultural factors include instructor and learner expectations of the devices and preferences in relation to phone, SMS, and email use. Social factors may also include lack of student investment in projects if the devices are not their own. Particular to nursing contexts are issues of sensitivity to personal data and protocols around disinfection control of the devices (see also Phillippi & Wyatt, 2011).

The use of mobile computing devices can increase both independent and collaborative learning, as well as enable a “transition from the occasional, supplemental use associated with computer labs, to frequent and integral use of portable computational technology” (Roschelle, 2003, p. 260). We have proposed a definition of mLearning based more on the contexts in which the devices are used for learning than on the mobility of the devices.

This project trialed the iPod Touch, equivalent to a smartphone other than for connection to the telephone network, in education and nursing courses at two universities to evaluate the potential of such devices to enhance student learning by increasing time on task for learning at times and locations more convenient for the learner. The research evaluated the use of the iPod Touch for accessing course materials and resources, engaging in learning activities through peer to peer and teacher interactions, and making personal records of learning and/or for sharing media to enhance learning.

Method

Two Queensland universities conducted this project over two semesters (summer 2011 and semester 1, 2012). Forty iPod Touch devices were purchased for each university: 20 for education and 20 for nursing students. Students studying in selected nursing and education subjects at both universities were recruited each semester by issuing an invitation and accepting on a first-come basis up to the limit of available iPods, which were dispatched to participants by mail together with an iTunes gift card to defray the cost of software purchased for study purposes.

A case study approach was adopted with each participating class comprising a case. Multiple data collection methods were used to enable rich descriptions of each case and to support cross-case comparisons at the conclusion of the project. Data were collected using:

1. A pre/post survey based on previously validated instruments.
2. Fortnightly reflections by students and facilitators logged in an online tool.
3. Focus group interviews conducted with student participants in each of the cases.
4. Online discussion forums in which student participants discussed their use of the iPods, shared resources, and answered questions posed by their course facilitators.
5. Software developed to extract a record of applications installed on the iPods at the time of return following a semester of use.

This paper reports selected survey data from the first semester of implementation together with summaries from the subject facilitators. Subsequent papers will report on the survey data from the second semester of implementation and additional qualitative data from both semesters.

The survey instruments were administered online using LimeSurvey® (www.limesurvey.org). Data were exported and transferred to SPSS 19 for analysis. The questionnaire 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). The scales reported in this paper addressed interest in and attitude toward using ICT for learning (13 items), expected (actual in the post-test) ease of use of the iPod Touch for learning (6 items), expected (actual in the post-test) usefulness of the iPod Touch for learning (6 items), frequency of use of ICT (iPod Touch in the post-test) for various study activities (30 items), and 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.

Results

Key Survey Results from Semester 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 1 reports demographic data from these participants.

Table 1

Demographic Data Semester

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
<td>70.6</td>
</tr>
<tr>
<td>Male</td>
<td>5</td>
<td>29.4</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td><strong>Country of Birth:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>15</td>
<td>88.2</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>11.8</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td><strong>Current Highest Level of Qualification:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary School</td>
<td>12</td>
<td>70.6</td>
</tr>
<tr>
<td>TAFE qualification</td>
<td>4</td>
<td>23.5</td>
</tr>
<tr>
<td>University qualification</td>
<td>1</td>
<td>5.9</td>
</tr>
<tr>
<td>Industry based qualification e.g., hospital certificate</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td><strong>University Attended:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University 1</td>
<td>11</td>
<td>64.7</td>
</tr>
<tr>
<td>University 2</td>
<td>6</td>
<td>35.3</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td><strong>Professional qualification being studied:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>15</td>
<td>88.2</td>
</tr>
<tr>
<td>Nursing</td>
<td>2</td>
<td>11.8</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>
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 2 and 3. Differences in Table 3 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 at the 1% level.

Table 2
Pre-test and post-test mean ratings on key scales (N = 17)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Std Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude to ICT for learning</td>
<td>Pre</td>
<td>4.37</td>
<td>.615</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>4.29</td>
<td>.953</td>
</tr>
<tr>
<td>iPod Touch ease of use for learning</td>
<td>Pre</td>
<td>3.63</td>
<td>.686</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>3.09</td>
<td>.902</td>
</tr>
<tr>
<td>iPod touch usefulness for learning</td>
<td>Pre</td>
<td>3.34</td>
<td>.749</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>2.45</td>
<td>.996</td>
</tr>
<tr>
<td>ICT frequency of use for study</td>
<td>Pre</td>
<td>3.69</td>
<td>.701</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>2.09</td>
<td>1.035</td>
</tr>
<tr>
<td>Desirability of mobile device for study</td>
<td>Pre</td>
<td>3.82</td>
<td>.594</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>2.99</td>
<td>1.168</td>
</tr>
</tbody>
</table>

Table 3
Analysis of changes in ratings on the 5 key scales (N = 17)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. devn.</th>
<th>SE</th>
<th>95% confidence interval of the difference</th>
<th>t (df = 16)</th>
<th>p (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude to ICT for learning</td>
<td>.081</td>
<td>1.094</td>
<td>.265</td>
<td>-481 to 644</td>
<td>.307</td>
<td>.763</td>
</tr>
<tr>
<td>iPod Touch ease of use for learning</td>
<td>.539</td>
<td>1.075</td>
<td>.261</td>
<td>-13 to 2069</td>
<td>2.069</td>
<td>.055</td>
</tr>
<tr>
<td>iPod touch usefulness for learning</td>
<td>.892</td>
<td>1.126</td>
<td>.273</td>
<td>-313 to 1471</td>
<td>3.268</td>
<td>.005</td>
</tr>
<tr>
<td>ICT frequency of use for study</td>
<td>1.600</td>
<td>.880</td>
<td>.213</td>
<td>1148 to 2052</td>
<td>7.496</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Desirability of mobile device for study</td>
<td>.833</td>
<td>1.069</td>
<td>.259</td>
<td>283 to 1382</td>
<td>3.212</td>
<td>.005</td>
</tr>
</tbody>
</table>

Facilitators’ summaries from Semester 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 & Behavior (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.

**Discussion and Conclusion**

Despite the potential to engage up to 80 students with an iPod Touch in the first semester of the project, the actual distribution involved 62 students, of whom 47 responded to the pre-test and 31 to the post-test questionnaires. Both universities distributed all available iPods for Education students but encountered reluctance from Nursing students. The reasons are uncertain but it would be reasonable to expect greater interest in ‘innovative’ approaches among Education students, especially since at both universities the participants were recruited from subjects that focused on enhancing learning with ICT. Motivation associated with the relevance of the project for the education students may have overcome concerns about workload or other inhibiting factors.

Participants reported strong ratings agreeing with a set of statements about interest in and attitude toward ICT for learning. Most (88%) were studying Education courses with a focus on ICT and that may explain the strong responses to this scale.

Initial responses about desirability of a mobile device for study, and expectations about ease of use of the iPod Touch and its usefulness for learning were also positive, though not as strongly as the response to ICT in learning. Mean responses for all three scales were lower on the post-test, with means for usefulness and desirability of mobile devices below the midpoint and significantly lower than at pre-test. Although the mean for ease of use reduced, the change was not significant. One interpretation is that the lower scores reflect disappointment with the experience of using the iPod Touch but that the participants perceived the issues as being related to the possibilities for use within the subjects they were studying than to the capabilities of the device. This interpretation would be consistent with the comments from facilitators about problems students experienced in using the iPod with the LMS and course documents and the comment about the need to create a purpose for its use in the study context. Although the project plan provided for conversion of study material to be compatible with the iPod Touch, little such conversion was undertaken and neither were learning activities adjusted for the iPod Touch.

The scale probing frequency of use of ICT (iPod Touch in the post-test) recorded the largest decrease, with the implication that the iPod Touch did not support the range of activities for which participants expected to use ICT. The 30 items in that scale covered a variety of possible activities, some unsuited to the iPod Touch. More detailed analysis at the item level may reveal meaningful patterns when the data for both semesters are available. Considering the comments from facilitators, it seems likely that some of the issues lie with the LMS (Moodle) being poorly configured for mobile access and some materials, such as PDF files, being inappropriate for the small screen because text does not reflow and requires scrolling when magnified to a readable size. Alternative formats, such as HTML and ePub, may not suffer from that problem.

Data collection is continuing in the first half of 2012 with some adjustments based on what was learned from the first semester. Based on the data presented above, the key lesson appears to be that the presentation of study materials and learning activities will require significant modifications to enhance
the student experience with mobile devices. Given the rapid uptake of smartphones by the Australian population, universities should be undertaking those adjustments with some urgency to ensure that learners are able to use their devices for study at times and places of their choosing.

References


Learning at times and places chosen by the learner: Adapting to study with mobile digital devices

4th World conference on mLearning Conference theme: Mobile technology: The future of learning in your hands, Capetown, South Africa.