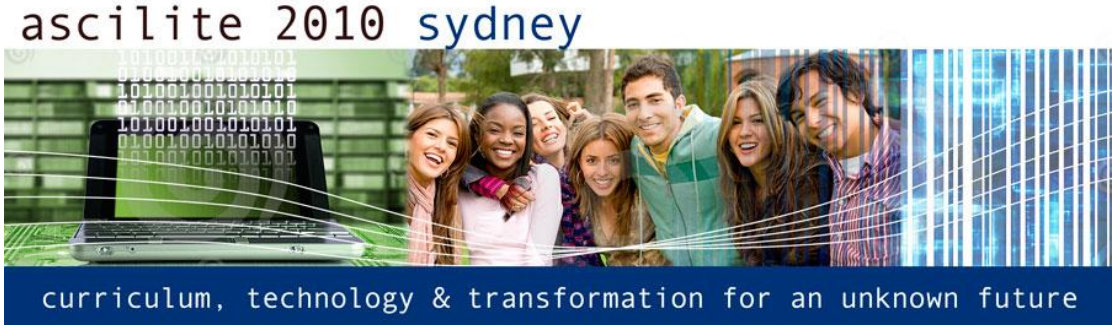

Pad-agogy: A quasi-experimental and ethnographic pilot test of the iPad in a blended mobile learning environment

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Does student use of mobile technologies make a difference to their learning? Many educators make this claim. This research will test and report the learning outcomes, technology orientations, attitudes, times on task and exposure frequencies with iPad tablet computers and make comparisons of these groups using other mobile devices and groups not using mobile devices. Methods include a quasi-experiment and design-based research (DBR) and ethnography. Participants will be 150 students over 2 semesters randomly assigned to rotating a comparison group using a traditional bound textbook and regular access to a Blackboard subject site, another comparison group using their existing mobile devices and an experimental group using iPads to access equivalent content through enhanced Blackboard content and an enriched e-text prepared for this research by Oxford University Press. Surveys, observations, discussions and curricular assessment are conducted weekly as part of the class. Quantitative analysis will be through SPSS and qualitative through NVIVO. The distinctive contribution of this research is the addition of empirical data to this research domain. Early results will be presented at the conference.

Keywords: mobile learning, higher education, enriched e-text, learning moderation system.

Introduction and context

Mobile Learning (mLearning) can be defined conceptually as "learner and device mobility and flexibility, usually involving a mobile device and flexible user access to content and communication" (Brand et al., 2010). The operational definition is the pedagogical use of mobile computing devices such as netbooks, mobile phones, tablet computers, handheld computers and mp3 players. Beetham and Sharpe (2007) categorised mobile learning as: 1. Technology driven; 2. Miniature and portable, and; 3. Connected classroom learning. Motiwalla's (2007) framework communicates how mLearning is distinctive from previous approaches to teaching and learning. Motiwalla explained that other technologically enhanced approaches are limited in that students need to be located where they can access a personal computer or laptop and Internet connectivity. Mobile devices, however, liberate the learner to realise enactment of anywhere, anytime. It is clear from these definitions that mLearning has the potential for delivering new approaches to teaching and learning.

Audience research by international polling firms demonstrated substantial increases in mobile devices attracting *The Economist* to publish two recent surveys of business, economic, social and demographic trends in global mobile phone diffusion (Standage, 2009; Kluth, 2008). These publications reported

that the diffusion of mobile phones has reached 4 billion units covering two-thirds of the world population. By these figures, mobile phones are the single most widely diffused communications technology after the radio. Of these 4 billion units, 1 billion are in developed economies and 3 billion are in developing economies. Moreover, mobile phone use outstrips internet use around the world by a ratio of 3 to1. Internet-enabled mobile phones account for 25% of all mobile phones in use around the world and their uptake now accounts for almost all new mobile phone activations in developed economies. Economists predict that by 2020, Internet-enabled mobile phones will reach complete global penetration.

Literature review

Extant research on mLearning has focused on the use of mobile phones (Johnson, Levine, Smith & Stone, 2010) and handheld computers such as the Palm devices (Finn & Vandenham, 2004). The seminal work by Kukulska-Hulme and Traxler (2005), for example, focused primarily on Windows Mobile devices and the use of e-texts in Open University contexts. However, the introduction of mainstream tablet computers in 2010 provides new opportunities for research on emergent mLearning technology and pedagogy beyond distance education and small-screen mobile devices. Indeed, the concurrent introduction of new tablet computers with the research described in this paper offers the promise of primacy in publishing results related to these devices, teaching and learning in tertiary institutions. The popularity of the Apple mobile computing "ecology" (the iPod, iPhone and iPad) suggests that these tablets, and tablet computers in general, will diffuse quickly and widely. Popular press hyperbole has referred to 2010 as the "year of the tablet" and most have privileged the Apple iPad as the flag-bearer (Talevski, 2010). How they are used in higher education needs to be documented with empirical research that tests educational efficacy, not only interface acceptance or popularity.

Initial models and frameworks of mLearning have been followed in empirical research. The majority of this research addresses perceptions and acceptance of mLearning, however, and understanding of the efficacy of mLearning for student acquisition of knowledge and skills is lacking. For example, Liaw, Hatala and Huang (2010) researched attitudes toward mobile learning with 152 surveys of university students. The researchers reported that positive perceptions toward mobile learning increase when the systems are designed for autonomy and are highly interactive. Cavus and Uzunboylu (2009) studied 41 undergraduate computer education students in North Cyprus who answered attitude and critical thinking measures following use of mLearning devices. The researchers questioned whether use of mobile devices promoted critical thinking and whether they had a measurable impact on student creativity in higher education. The researchers found that student perceptions of mobile learning systems significantly increased over time and they found increased levels of critical thinking. They also interpreted survey results as evidence of significant improvement to student creativity despite not measuring this directly. Chao and Chen's (2009) study was more robust. They designed an experiment to determine whether there were significant differences when students used paper-based versus mobile learning approaches to reading and note-taking. The researchers then elaborated the data through an intensive case study. In their first study, 40 undergraduate students were randomly assigned to two groups of 20 each. The experimental group used mobile devices while the control group did not. Next, the researchers conducted a case study of six participants, all of whom used mobile devices for learning tasks. The researchers collected data through system logs, use diaries and interviews. Their research revealed that students used a blend of paper-based texts, personal computers and mobile devices for learning tasks. There was no significant difference in knowledge retention between the experimental and control groups. The limitation of these studies is that the conclusions, such as that *m-learning can facilitate and assist users' knowledge management* exceed the capacity of surveys to demonstrate; they lacked adequate control groups for comparison and avoided or inadequately measured learning.

Research questions and scope

This brief review of the literature on mobile learning in higher education reveals four apparent gaps:

1. There is a scarcity of research that measures whether use of mobile devices for higher education task has an impact on learning;
2. Research does not detail the learning functions for which mobile devices are being used;
3. The literature does not document the blend between face-to-face teaching and mobile learning; and

4. Because the iPad has just been released to the market, there is no published research which addresses its use for learning.

The pilot research described in this paper attempts to address these four gaps to observe metacognitive, cognitive, affective and behavioural dimensions of mainstream tablet computer use in a blended learning classroom environment. In particular, it adopts the definition of mobile learning that, while focusing on the mobile technology and a blended classroom learning environment, explores a constructivist and learner centred view by tasking learners with building their own knowledge of subject material through individual and group processes and thereby addresses the four gaps.

First, learning outcomes are to be measured at regular intervals and comparisons will be made between traditional classroom and blended mLearning classroom contexts. Second, learning tasks are specified as information and communication through mobile access to the Learning Management System and by accessing the e-textbook. Third, the research explicitly situates the research in a blended learning context, observing and identifying the learning tasks for which the educator and students use face-to-face pedagogies and those for which they activate mobile learning. Fourth, the mobile device under consideration is newly released and can be compared with small-form devices such as iPods, PDAs, phones and netbook computers.

The following research questions will guide this research:
RQ1: What are the observed learning outcomes from mLearning in a blended tablet computer environment compared with traditional classroom instruction?
RQ2: Among students who use tablets for mLearning, what learning habits and expectations develop?
RQ3: Does electronic mobile content attract greater use of a learning management system?
RQ4: Do students who use tablets for learning report higher levels of satisfaction with their subject and university?
RQ5: How do students' computer self-efficacy, attitudes to technology, and technology related anxiety change over time with use of mLearning?

Methods

The research design will apply a multi-method approach that includes a quasi-experimental design with comparison (traditional classroom) and experimental (mobile learning blended classroom) groups to test learning combined with an ethnographic design to observe environmental and social factors surrounding the quasi-experimental setting and gain appreciation of contextual confounds inherent in technology-focussed experimental research in education. In particular, the most efficacious uses of the iPad for learning will be explored by allowing students to evolve uses and express thoughts and feelings with respect to this technology for mobile learning. For this part of the study, a design-based research approach (Wang and Hannafin, 2005) will be applied to allow the researchers.

The project is running over two semesters. The subject, *Digital Media and Society*, is serving as the host for the research and enrolment in the subject is 75 students in the current semester. The same content of the subject is delivered to all students. However, in the first week of the semester, students are readied for use of tablet computers and participation in the study followed by 1-week periods in which some students use iPads (treatment), some use their existing mobile devices, including phones and laptops (comparison), and some use neither (comparison). All students have an opportunity to use the iPads at least three times during the semester. Communication tools such as *Twitter* are also used to give students a live system for posting comments about topics discussed in class. Blackboard Learning Moderation System is used heavily with e-text resources, podcasts and vodcasts as well as lecture notes, tutorial agendas and in-class exercises. The treatment condition varies in two respects from the comparison conditions. One, students in the treatment condition are required to use the iPad in lectures and tutorials where they are tasked with simple Internet search and content (typing) production exercises such as note-taking for their group discussions. Two, students in the treatment condition have a copy of the enriched e-textbook version of the print text published by Oxford University Press (OUP). OUP expressed high interest in this project and the OUP Director of Higher Education agreed to provide the e-textbook as part of this study. OUP created the e-book from scratch and enriched it with dynamic content. In all other respects the groups are identical and have access to the same content. Some comparison group students access Blackboard from their laptops or PCs and some use print-only materials and the print version of the text. At the end of every week, a summative quiz administered to

treatment and comparison groups is used to determine knowledge acquisition. Skills questions assess practical skills such as posting to social networks, blogging, writing and organizing. Measures of Blackboard use (based on logons and page access) are taken and attitude questions assess satisfaction. The key validated scale used in this study is the Computer Technology Use Scale (CTUS) which assesses three domains including 1) computer self-efficacy, 2) attitudes to technology, and 3) technology related anxiety (Conrad & Munro, 2008). Specific 'design' exercises and questions are used each week to provide students with input into the progression of the research and enact a design-based research approach.

Under the NHMRC requirements for ethics including self-determination, students are not coerced to participate in any way. The Chief Investigators (CIs) do not mark assessment items; instead, a tutor marks the minor assessment included in the dependent variable metric for the study. Students are required to sign consent to participate in the research and are told that the purpose of the research is to assess their use and attitudes toward the technology. They are not informed that their results will be compared with comparison group results and will therefore be blind to the learning research question.

At the time of this writing, the project has just begun. Upon completion, data will be analysed using mixed methods (Somekh & Lewin, 2005). Quantitative data will be analysed using SPSS (the first CI has 20 years experience with the Base package). The research report will present descriptive statistics, correlations, MANOVAs and convergent reliability and validity tests including psychometrically valid reporting (Crocker & Algina, 1986). Open ended items will be thematically analysed using NVIVO (the second CI has 20 years experience with qualitative analytic procedures). Interpretation of the data will be rigorously conducted, reporting credibility, transferability, dependability and confirmability (Marshall & Rossmann, 1989).

Results and discussion

The results and discussion for the first semester of the research (approximately 75 students) will be complete and presented at the conference.

Conclusion

Research into mobile learning is exciting both in its student learning potential and as a newly emerging knowledge domain. Because this nascent field is the focus of an emerging literature, opportunity abounds for research to make a meaningful contribution. The relationship between teachers, learners, curriculum and media technologies is an important theme of inquiry. The teaching/research nexus requires that university academics collect evidence to strive for continual growth and development in teaching, and inform the content and process of our teaching through the research that we conduct. This research is about how university educators can connect with and encourage learners to use multiple means of inquiry and to encourage teachers to use multiple forms of presentation. The authors of this paper are combining their respective expertise in multimedia, games, and use of educational technologies, and in pedagogy and student diversity to discover and disseminate new knowledge in the fields of digital media and higher education teaching and learning.

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