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Using mobile technologies to develop new ways of teaching and learning

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CHAPTER 1



Using mobile technologies to develop new ways of teaching and learning

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The pedagogical uses of mobile technologies

The use of mobile devices—such as mobile phones and mp3 players—has grown to such an extent over recent years that they now overtake the proliferation of personal computers in modern professional and social contexts (Attewell, 2005). The ready availability and uptake of these devices has permeated the means of human communication, socializing and entertainment to such an extent that is it rare to find a person in western society who does not own at least one such device. However, it appears that little use has been made of these convenient tools in learning contexts, and that there is little theoretical foundation to the learning environments that do use them. While the so-called 'early adopters' are willing to use new technologies for pedagogical purposes, it is not yet clear that there are sound theoretical reasons for the use of mobile devices in learning.

In this project, we endeavoured to demonstrate that the advances in philosophical and practical developments in education have created justifiable conditions for the pedagogical use of mobile technologies based on authentic learning.

m-Learning in education

In general, mobile learning—or *m-learning*—can be viewed as any form of learning that happens when mediated through a mobile device, and a form of learning that has established the legitimacy of 'nomadic' learners (Alexander, 2004). While it has been described as 'an emergent paradigm in a state of intense development' (O'Malley, Vavoula, Glew, Taylor, Sharples, & Lefrere, 2005) few universities have adopted widespread m-learning technologies, and in those that have, it is not clear that they are being used in pedagogically appropriate ways. Many research studies and projects have examined mobile learning from an identified theoretical perspective (cf. O'Malley, et al., 2005; Naismith, Lonsdale, Vavoula, & Sharples, 2004; BECTA, 2006; Thornton & Houser, 2004; Wood, 2004; Cortez, et al., 2004; Chesterman, nd; Rogers et al. 2002; Proctor & Burton, 2003; Perry, 2003). For example, teachers in higher education in the

Abstract.

The chapters of this e-book comprise the pedagogical and research endeavours of a team of academics in higher education who worked with mobile learning devices over two years on a project entitled New Technologies: New Pedagogies project: Using mobile technologies to develop new ways of teaching and learning. The project endeavoured to take an innovative approach not only in the creation of new, authentic pedagogies for mobile devices but also in the action learning approach adopted for the professional development of participants. The project involved 15 people including teachers, IT and PD personnel. It was a large and ambitious project that resulted not only in a range of innovative pedagogies, but in the creation of more knowledgeable and confident users of mobile technologies among teachers and students.

UK have made use of SMS (short messaging service) as prompts for course requirements, polling classes and pop guizzes with some universities experimenting with phone exams where the user's voice print identifies them as the test taker (NMC and Educause, 2006). There is evidence that some young people resent this 'usurping' of their favoured technologies for such prosaic and teacher-centred activities (Geser, 2004). Kim, Mims, and Holmes (2006) reviewed the way universities use personal digital assistants (PDAs), and found that storage and retrieval of information such as e-books, courseware, and timetables are the general uses. Similarly, digital audio players such as Apple's iPod have primarily been used in higher education to 'deliver' lectures that are recorded and subsequently podcast as RSS feeds to students' computers to be downloaded to iPods (Belanger, 2005). This transmission of information is a common feature of many research findings, where the teacher creates the content and the students receive it (for example, McCombs & Liu, 2006; Pownell, 2006; Scott, Nishimura & Kato, 2006; Miller & Piller, 2005).

A framework for classifying educational uses of mobile technologies provided by Patten, Arnedillo Sanchez and Tangney (2005) suggest that the uses indicated above relate mainly to *administration* functions such as calendaring and timetabling; *reference* functions such as ebooks and dictionaries; and *interactive* functions as in response and feedback activities. They argue that the theoretical underpinnings of these activities appear to be either non-existent or principally behaviourist in nature.

Uses of m-learning in education

Despite the significant potential of mobile technologies to be employed as powerful learning tools in higher education, their current use appears to be predominantly within a didactic, teacher-centred paradigm, rather than a more constructivist environment. It can be argued that the current use of mobile devices in higher education (essentially content delivery) is pedagogically conservative and regressive. Their adoption is following a typical pattern where educators revert to old pedagogies as they come to terms with the capabilities of new technologies, referred to by Mioduser, Nachmias, Oren and Lahav (1999) as 'one step forward for the technology, two steps back for the pedagogy' (p. 758). Adopting more recent theories of learning has the potential to exploit the affordances of the technologies in more valuable ways. Patten, Arnedillo, Sanchez and Tangney (2005) argue that the benefits of mobile learning can be gained, through collaborative, contextual, constructionist and constructivist learning environments. This is supported by Switzer and Csapo's (2005) observation that mobile technologies afford learners opportunities for collaboration in the creation of products and for sharing them among their peers. Authentic learning environments in higher education typically involve these characteristics (Herrington & Herrington, 2006).

This project moved beyond established approaches to create new pedagogies for mobile technologies that promoted their use—not for simple one to one communication or delivery of information—but to focus on their use as cognitive tools in authentic learning environments. While the project itself focussed on only two specialised mobile technologies, the methods developed for the professional development workshops are applicable not only to other new and emerging technologies, but to a range of other contexts requiring a self-reliant, action-learning approach. The action-learning nature of the professional development lends itself to the ready adaptation, implementation and embedding of the approach in a range of different educational contexts.

This chapter presents the aims and scope of the *New Technologies*, *New Pedagogies* project, together with a description of the design and implementation of the professional development and the individual pedagogies developed. Resulting pedagogies and professional development activities are described in the chapters of this e-book.

Although general guidelines on the use of technology have been delineated by MCEETYA (2005), currently no specific and cohesive national policy on the use of mobile technologies in learning exists in Australia. Ideas such as those presented in the chapters of the e-book, will be ideally positioned to inform such policy.

Project aims and scope

The aim of the project was to develop innovative pedagogies using mobile technologies, to enhance teaching and learning in higher education.

The project set out to investigate the educational potential of three hand-held, ubiquitous mobile devices: mobile phones, personal digital assistants (PDAs) and digital audio players (mp3 players, such as iPods). However, in implementation, only two devices were used: smartphones (Palm Treo 680 mobile phones), and digital audio players (Apple iPods). An action-learning framework for professional development was designed and implemented with teachers from the Faculty of Education at the University of Wollongong. Action-learning is defined as an educational process whereby the participants study their own actions and experience in order to improve their performance. This is done in conjunction with others, in small groups called action-learning sets (Revans, 1982). Thus, each teacher explored and invented pedagogies that made appropriate use of a mobile device for a different subject area.

To avoid a technology-driven pedagogy the project investigated ways of designing and implementing teaching in authentic contexts that would enhance student learning with understanding. Specifically the project aimed to complete the following:

- 1. Investigate the potential uses or 'affordances' of two personal mobile devices.
- 2. Engage teachers from a Faculty of Education using an actionlearning professional development framework to explore and invent pedagogies appropriate to the use of a mobile device in completing a complex task within an authentic learning environment.
- 3. Implement the use of mobile technologies and authentic tasks in learning activities over a period of 4-7 weeks in a range of different subject areas.

- 4. Describe, categorise and disseminate resultant pedagogies and professional development activities through a dedicated website and a published handbook.
- 5. Implement the professional development activities for mobile learning across other faculties at the University of Wollongong and disseminate to other universities across Australia and overseas.

Approach and methodology

Theoretical perspectives

The project was guided by two major theoretical frameworks. *Authentic learning* (Herrington & Oliver, 2000; Herrington & Herrington, 2006) provided the basis for the pedagogical activity while *action learning* (Revans, 1982) was adopted as the framework for professional development. Both theories reflect constructivist epistemology emphasising group collaboration in the creation of further knowledge and understandings.

Authentic learning situates students in learning contexts where they encounter activities that involve problems and investigations reflective of those they are likely to face in their real world professional contexts (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991). Herrington and Oliver (2000) have identified nine characteristics of authentic learning:

- *authentic contexts* that reflect the way the knowledge will be used in real-life
- *authentic activities* that are complex, ill-defined problems and investigations
- access to expert performances enabling modelling of processes
- *multiple roles and perspectives* providing alternative solution pathways
- *collaboration* allowing for the social construction of knowledge
- opportunities for reflection involving metacognition
- *opportunities for articulation* to enable tacit knowledge to be made explicit
- *coaching and scaffolding* by the teacher at critical times
- *authentic assessment* that reflect the way knowledge is asses in real life.

These characteristics formed the basis for teachers to plan and design learning environments where mobile technologies could be used in their different subject areas and specialisations. However, individual teachers were free to use alternative theoretical perspectives for the design of the pedagogies if appropriate.

Action learning (Revans, 1982) was adopted as a professional development framework to assist in the design of each teacher's learning environment. The approach typically involves a small group of colleagues solving workplace problems utilising their own processes of sharing, reflection and facilitation (e.g., Zuber-Skerritt,

1993), an approach that contrasts with traditional professional development that relies on the transfer of 'outside' expertise.

Project focus questions

The following questions framed the project enquiry:

- 1. What are the technology affordances of smartphones and iPods for teaching and learning in higher education?
- 2. What are appropriate strategies for the professional development of higher education teachers in the pedagogical use of m-learning devices?
- 3. What pedagogical strategies facilitate the use of m-learning devices in authentic learning environments in higher education?
- 4. What pedagogical principles facilitate the use of m-learning devices in authentic learning environments in higher education?

The project was conducted in four phases over two years, comprising investigation of the devices themselves and their functionality, the design and implementation of action learning professional development sessions for university teachers, the design of 10 pedagogies to be implemented with either the smartphone or the iPod in classes across a range of disciplines in a Faculty of Education, and the evaluation and research of each project together with the creation of design principles applicable to higher education teaching generally.

Project team and communication

The project team comprised four team leaders, and a project manager. A *professional development and IT team* was also created to lead the professional development seminars and support the professional learning of the teachers. This team comprised three advisors with professional development, information and communications technology (ICT) and educational development expertise. Originally 12 teachers or teaching teams committed to the project. With the tobe-expected fluctuations and changes in personnel over semesters (such as changes in teaching loads, promotions, retirements, study leave, etc.), by the end of the project, 10 projects had been implemented.

The leadership team and project manager, together with the professional development and IT experts, met fortnightly in Phases 1 and 2 for planning and monitoring. A reference group, comprising leaders in educational technology throughout the world, was also invited to be available to the project. Communication with the team and project reference group was enhanced with the creation of a bimonthly bulletin. The bulletin kept team members up to date with the project. It was also an important means of maintaining communication with the reference group, other interested parties within the University of Wollongong and informing the members on the progress of the project.

Conceptual summary of project

A conceptual summary of the entire project is provided in Table 1 below. The table columns show the four phases of the project, and deliverables and evaluation processes for each phase are shown in the last two rows. **Table 1:** Summary of projectprocesses and expected outcomes

	m-learning affordances What are the technology affordances of smartphones, and mp3 players in higher education?	m-learning professional development What are appropriate strategies for the PD of higher ed teachers in the pedagogical use of m-learning devices?	m-learning strategies What pedagogical strategies facilitate the use of m-learning devices in authentic learning environments in higher education? Phase 3		m-learning principles What pedagogical principles can guide the use of m-learning devices in authentic learning environments in higher education?
	Phase 1	Phase 2			Phase 4
	Year 1		Year 2		Yr 2 & beyond
	Semester 1 (August – Dec 06)	Semester 2 (Jan – June 07)	Semester 3 (July – Dec 07)	Semester 4 (Jan – June 08)	Sem 3, 4 & beyond (June 08 on)
Smart phones Mp3 (IPods)	 Investigation of technology affordances through research literature, experts, and location of best practice exemplars in HE Preliminary planning of workshops 	 Preparation and planning of workshops Workshops for Faculty teachers on the development of authentic tasks using devices in pedagogically appropriate ways Trialling of pedagogies 	Individual projects in areas such as: Science education Physical education Visual Arts education Maths education Multimedia education Web-based learning Literacy education Reflective practice Adult education		 Final project conference to present findings and discuss model and principles Finalisation of project website Publication of edited book Long-term evaluation
Products from each phase	Phase 1: Catalogue of affordances of m- learning technologies	Phase 2: Workshop resource (processes and procedures for others to implement)	Phase 3: 12 case descriptions and evaluations Website of exemplars and strategy descriptions		Phase 4: Final conference Edited book Project report Final public website
Evaluation (Reeves & Hedberg, 2003)	Review of literature and existing initiatives	Formative evaluation of PD workshops	Formative evaluation of learning environments and project website Effectiveness evaluation of 12 learning environments		Effectiveness evaluation of whole project Peer review of chapters by team & reference group

Project research approach and methodologies

The project used a design-based research approach (e.g., Reeves, 2006; van den Akker, 1999; Reeves, Herrington & Oliver, 2005) (also known as *development research* or *design experiments*) that involved four phases conducted over the life of the project (Figure 1).



The four phases as they were implemented in the project are described in more detail below.

Phase 1: Analysis of problem by researchers and practitioners (Semester 1)

Phase 1 of the project focused on the exploration of the educational 'affordances' (specific enabling features, cf., Norman, 1988) of mobile devices for teaching and learning in higher education. This phase was conducted over the first six months of the project. A comprehensive review of literature was performed and an EndNote library created. Many electronic resources were collected (in Word or pdf format) and embedded into the EndNote library, and this was updated throughout the life of the project, resulting in a valuable and portable resource for use by team members. This literature review also



encompassed primary and secondary capabilities of each device to explore the obvious uses—and the less well-known functions—that could be employed as cognitive tools in educational contexts.

During this phase of the project sets of smartphones and iPods were purchased for use in the professional development workshops and implementations with students in classes. Other necessary peripherals were also purchased such as memory cards, protective cases, microphones, additional headphones and card readers.

All teachers in the project received an iPod and smartphone to allow for familiarisation and exploration prior to the commencement of the implementations with classes. This allowed them to experiment and familiarise themselves with the devices as they reflected on the needs and abilities of their students. With the devices distributed, seminars and brainstorming sessions were also held to create a catalogue of educational affordances to provide a useful reference on the functions of each device prior to the design of learning activities (this was done before the decision to combine the mobile phone and PDA in the one device, so the affordances for three devices are given). These catalogues are available on the project website (for example Figure 2 shows the catalogue for the iPod).

Publications Learning Pedagogies Affordances | Workshops | Project Select from the affordances below: Mobile phone iPod Features of an iPod Voice recorder Read text document Large hard drive capacity Record video View movie 0 Play audio book Podcasts Contacts Calculato Music What can you do with an iPod in higher education? Oreate a playlist of oral histories of people in the community through interviews, for example, with authors or workers in the community Conduct live interviews allowing interaction between a person in the 'real' world and the classroom, for example, with mentor teachers or authors.

This work enabled a starting point for teachers in the project to plan pedagogies for the use of the devices, and to link the affordances of the smartphone and the iPod to their subject objectives and tasks.

At the end of Phase 1, the project structures had been put into place (i.e., project management, team meetings, project website), a literature review had been conducted (EndNote library), presentation resources assembled (master slide set) and the educational affordances of the devices had been investigated and reported.

Figure 2: Web page of iPod features

Phase 2: Development of solutions within a theoretical framework (Semester 2)

In Phase 2 the focus of the project moved to professional development of the teachers who would implement the mobile technologies in their classes. The research question that directed these activities was: What are appropriate strategies for the professional development of higher education teachers in the pedagogical use of m-learning devices? This phase occupied the second semester of the project.

Initial planning of the professional development was undertaken by the PD and IT team in consultation with the project leaders and project manager. The PD used an action-learning approach rather than a fully pre-planned scope and sequence of activities. Action learning is described by Revans (1982) as an inquiry-based approach for professional learning that focuses on the personal concerns or interests of the participants (see also, Hoban, 2004; Hoban & Herrington, 2005).

The PD framework generally took the form of regular action learning meetings where project members, IT and PD personnel worked collaboratively, reflecting and sharing ideas and experiences on a regular basis in order to find new ways to use mobile technologies for teaching (McGill & Beaty, 2001; Zuber-Skerritt, 1993). The focus of the first two workshops was to discuss the theoretical framework within which the project was situated and to investigate the affordances of both devices and their potential when incorporating them into learning and teaching experiences. The third workshop included hands-on activities with the devices and brainstorming in educational contexts, and the fourth workshop focussed on planning and reviewing specific activities to be conducted in the implementations in the various classes in Phase 3 of the project.

The workshops represented a 'group learning process' in which teaching ideas were discussed, and refined through all phases in an ongoing cyclical process. The workshop sessions drew on the expertise of those within the group. Recognition was made through the structure of the workshops of those with a range of areas of expertise (such as pedagogy or technology), where discussion allowed for the development of shared understandings and goals. In this way, the workshop model is one that any university or institution could readily adapt because it uses existing human and other resources to implement a self-sufficient, Faculty- or Department-wide solution to a problem rather than draw on outside experts to advise on 'correct' procedures. Such a process is beneficial beyond the financial saving of using expertise from within; it allows for acknowledgement of the expertise within the group, building stronger ties between members of that community. The teachers retained the mobile devices throughout the professional development workshop sessions, bringing them to each session to develop their skills in using the devices as well as to discuss their potential for teaching.

Each teacher used one or both mobile devices in depth, to explore the full range of affordances, and worked within the workshop environment to plan an authentic learning environment that comprised 4-7 weeks (about a third of a semester). Planning of a complex task, resources, supports, and integrated assessment items were included in

this process (Oliver & Herrington, 2001). Templates and examples were provided to support teachers' planning of activities and pedagogies in the workshops. These came from literature identified through the literature review, tools designed by different experts within the community and those created collaboratively as part of previous professional development workshops.

At all times, teachers were aware of the common goal of identifying innovative uses of the devices as cognitive tools rather than for simple recording of data, one way transmission of information (such as podcasting of lectures), or communication from one site to another. The teachers used the professional development workshops to share their tasks and the underpinning theory with a range of colleagues whilst they planned their procedures for evaluating the learning environment when the activities were implemented in Phase 3.

By the end of Phase 2, the teachers had designed learning environments ready to be implemented, each comprising: an authentic task, a range of resources, appropriate supports and integrated assessment strategies.

Phase 3: Evaluation and testing of solutions in practice (Semesters 3 and 4)

During Phase 3, the learning tasks were implemented and evaluated with students in classes conducted over two semesters. The focus of the project moved to the third research question: What pedagogical strategies facilitate the use of m-learning devices in authentic learning environments in higher education?

The teachers were thoroughly familiar with the devices by the time they were implemented in their classes. One set (25) of each device was used in this phase to ensure specific affordances were available to students as they completed a task. Each device was implemented four times (2 times x 2 semesters with a handover week mid semester), and each implementation tested a different pedagogical strategy with a different teacher and discipline area. Students were issued with an appropriate device on loan to use individually or in groups, as they completed the given or negotiated task. Students used the selected mobile device for a period of 4-7 weeks to engage with the tasks set and submit the assessment task.

Each case was evaluated using an approach or methodology that had been planned in Phase 2 as part of the workshops. The pedagogies that were implemented in Phase 3 are listed below:

Using a games-centred approach to enhance student learning

Teacher: Greg Forrest

Target group: Second and third year Physical Education and Health (PEH) preservice teachers

Task: iPods were used by pre-service physical education and health teachers to enhance their understanding of questioning methods, the development of dialogue and the pedagogical use of Game Centred Approaches in physical education lessons.

Pedagogies with iPods

Taking iPods into the field to create 'teacher wisdom stories'

Teachers: Lisa Kervin and Jessica Mantei

Target group: Fourth year primary pre-service teachers **Task**: Students used iPods to create a collective of wisdom stories from experienced teachers that was made available to their peers as audio files.

Art on the move

Teacher: Ian Brown

Target group: Fourth year primary pre-service teachers Task: Students used a public art gallery as a resource for interactive visual arts learning experiences. The students created presentations on their findings that were presented and submitted on the iPods as podcasts.

Using iPods to capture professional dialogue

Teachers: Jessica Mantei and Lisa Kervin Target group: Fourth year primary pre-service teachers Task: Students used iPods to capture professional dialogue for reflection on emerging professional identity. Emerging understandings and learning were reflected on to explore teacher identity and the development of professional identity through the coming together of theory and practice.

Digital story books

Teachers: Jan Herrington, Ian Olney and Irina Verenikina **Target group:** First year early childhood preservice teachers **Task**: Students in groups created digital story books for young children, using sound and images to author stories with elements that appeal to very young children. Students created their stories using PowerPoint and then published them to iPods as podcasts.

Energy management in environmental education

Teacher: Brian Ferry

Target group: Third year pre-service primary teachers Task: Using the features of mobile phones, students prepared, implemented and evaluated a unit of work that supported the waste, water and energy management programs of classes in five host schools.

Mathematics (or Science) is everywhere

Teacher: Gwyn Brickell

Target group: First year preservice secondary school teachers **Task**: Students worked with a partner to explore the different ways that presentation software can be used in classrooms, and prepare a presentation to share with the class. Using the smartphone, students prepared a presentation for beginning teachers on the theme: mathematics and/or science is everywhere.

Curriculum resources in adult learning

Teacher: Anthony Herrington

Target group: Postgraduate adult education students Task: Using a constructivist perspective, students designed a resource for teachers/trainers that exploits the affordances of mobile technologies.

Pedagogies with smartphones

Teacher professional development and the use of smartphones in the analysis of K-6 numeracy concepts and pedagogies

Teacher: Mohan Chinnappan

Target group: Second year primary pre-service teachers **Task**: Students investigated the use of smartphones to facilitate interactions and reflections about K-6 mathematics concepts and the teaching of these concepts in the classroom.

Slowmation in science education

Teacher: Garry Hoban

Target group: Undergraduate science education students **Task**: Students used the multimedia capabilities of the smartphone to create slowmation videos for primary aged children in order to develop understanding of scientific concepts.

Teaching episodes

Teacher: Anthony Herrington Target group: Postgraduate adult education students Task: Adult educators used smartphones to create a digital story for use as a teaching resource.

Evaluation of individual projects

On implementation, teachers used data collection methods such as focus group interviews, observations, video recordings, individual interviews, journals, weekly logs, reflective essays, student blogs, content analysis of artefacts, and so on, to investigate the nature and effects of the pedagogical strategies they had created. Ethical approval was sought and approved not only for the entire project, but also for each individual project. During these implementations, professional development—both as formal sessions and informal 'just in time' support—continued on a regular as-needed basis. A writing workshop for the team further enriched the teachers' analyses of their cases. At the workshop, the Endnote library was disseminated to the group to support their literature review for reporting on their findings. The teachers also created for each project a description of the pedagogy, to be uploaded to the project website. Figure 3 provides an example of one of the pedagogies on the website.

Figure 3: Example pedagogy on the project website



At the end of this phase, teachers had implemented the learning tasks (with appropriate resources, supports and assessment items), and uploaded descriptions of pedagogies to the project website.

Phase 4: Documentation and reflection to produce design principles (Semesters 3, 4 & beyond)

In Phase 4, the focus of the project moved to the fourth research question: What pedagogical principles facilitate the use of m-learning devices in authentic learning environments in higher education? In terms of chronology, parts of this process were conducted concurrently with Phase 3, especially for those projects that were implemented earlier in the phase, while other parts of necessity moved beyond the project timeframe of two years. While there were few factors that impeded the success of the project, as with all large projects, there were challenges that needed to be resolved to ensure that the project proceeded in a timely and effective manner.

This final phase of a design-based approach was to use the findings of the implementations and evaluations to create design principles that can be used by other practitioners. It is, in this sense, the most important phase in terms of dissemination because it is here that the collective knowledge of the research, the literature, professional development process, design, implementation and evaluation of the cases, the input of the reference group, and all other knowledge is synthesised into theoretically sound and practical guidelines. The final chapter in this book analyses the findings of the individual projects, the professional development and other aspects of the project to create design principles.

Conclusion

When information and communication technologies (ICTs) are used in universities, too often they are used merely as disseminators of knowledge, that is where students learn *from* the technologies rather than *with* them as cognitive tools (Kim & Reeves, 2007; Jonassen & Reeves, 1996). Jonassen and Reeves (1996) described cognitive tools as: 'reflection tools that amplify, extend, and even reorganize human mental powers to help learners construct their own realities and solve challenging tasks' (p. 699). Mobile devices were used in this project, not as low level communication or recording devices, but as cognitive tools.

The remaining chapters of this book explore mobile technologies in a range of different subject areas in teacher education. In each case, a different purpose and outcome is evident, and each demonstrates how mobile technologies can be used in innovative ways beyond the more widely experienced teacher-directed use of technology. The technical and practical problems of using these technologies are described, along with the successful pedagogical approaches and understandings that have emerged from the individual research studies.

University campuses are awash with mobile technologies, but in the main they remain hidden in students' pockets. This project endeavoured to explore the pedagogical uses of these powerful

devices, and the means to bring them legitimately into use in higher education learning.

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References

- Alexander, B. (2004). Going nomadic: Mobile learning in higher education. EDUCAUSE Review, 39(5), 29.
- Attewell, J. (2005). Mobile technologies and learning: A technology update and mlearning project summary. Retrieved November, 2006, from www.LSDA.org.uk
- Becta. (2006). What is mobile learning? Retrieved November, 2006, from http://www.aclearn.net/display.cfm?page=958
- Belanger, Y. (2005, June). Duke University iPod first year experience final evaluation report. Retrieved, April 2 2006 from

http://cit.duke.edu/pdf/ipod_initiative_04_05.pdf

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.

Chesterman, E. (nd). *Pocket education*. Retrieved April 2006, from http:// westmidlands.ideasfactory.com/new media/features/

Geser, H. (2004). *Towards a sociological theory of the mobile phone*. Retrieved March 28, 2004 from University of Zürich, http://socio.ch/mobile/t_geser1.htm#7.2

- Herrington, A., & Herrington, J. (2006). What is an authentic learning environment? In A.J. Herrington, & J. Herrington (Eds.), *Authentic learning environments in higher education* (pp. 1-13). Hershey, PA: ISP.
- Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development*, 48(3), 23-48.
- Hoban, G. F. (2004). Enhancing action learning with student feedback. *Action Learning: Research and Practice*, 1(2), 203-218.
- Hoban, G., & Herrington, A. (2005). Why teachers are reluctant to use new technologies: Supporting teachers' action learning within a web environment. In P. Kommers, & G. Richards (Eds.), *EdMedia 2005* (pp. 2581-2588). Norfolk, VA: AACE.
- Jonassen, D., & Reeves, T.C. (1996). Learning with technology: Using computers as cognitive tools. In D.H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 693-719). New York: Macmillan.
- Kim, S. H., Mims, C., & Holmes, K.P. (2006). An introduction to current trends and benefits of mobile wireless technology use in higher education. AACE Journal, 14(1), 77-100.
- Kim, B., & Reeves, T.C. (2007). Reframing research on learning with technology: In search of the meaning of cognitive tools. *Instructional Science*, 35, 207-256.
- Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge: Cambridge University Press.
- McCombs, S., & Liu, Y. (2006). Turning iPod into an effective portable learning tool. In C. Crawford, D. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price & R. Weber (Eds.), Society for information technology and teacher education international conference (pp. 438-443). Chesapeake, VA.
- MCEETYA (2005). Joint Statement on Education and Training in the Information Economy. Retrieved February, 2008 from:

http://www.mceetya.edu.au/pdf/infoeconomy2005.pdf

- McGill, I., & Beaty, L. (2001). Action learning. London: Kogan Page.
 Miller, M., & Piller, M. (2005). Principal factors of an audio reading delivery mechanism: Evaluating educational use of the iPod. In P. Kommers, & G.
- Richards (Eds.), EdMedia 2005 (pp. 2581-2588). Norfolk, VA: AACE.
- Mioduser, D., Nachmias, R., Oren, A., & Lahav, O. (1999). Web-based learning environments: Current states and emerging trends. In B. Collis & R. Oliver (Eds.), *Ed-Media 1999* (pp. 753-758). Seattle, WA: AACE.
- Naismith, L., Lonsdale, P., Vavoula, G., & Sharples, M. (2004). Literature review in mobile technologies and learning UK: Futurelab.
- New Media Consortium and Educause. (2008). *Horizon Report 2008: Australia-New Zealand*. Austin, TX: NMC.
- Norman, D.A. (1988). The psychology of everyday things. New York: Basic Books.
- Oliver, R., & Herrington, J. (2001). *Teaching and learning online: A beginner's guide* to e-learning and e-teaching in higher education. Perth, WA: CRITC.
- O'Malley, C., Vavoula, G., Glew, J. G., Taylor, J., Sharples, M., & Lefrere, P. (2005). Mobilearn WP 4: Pedagogical methodologies and paradigms. Retrieved 4 July

2006 from www.mobilearn.org/download/results/ public_deliverables/MOBIlearn_D4.4_Final.pdf

Patten, B., Arnedillo Sanchez, I., & Tangney, B. (2005). Designing collaborative, constructionist and contextual applications for handheld devices. *Computers & Education*, 46, 294-308.

Perry, D. (2003). Handheld computers (PDAs) in schools. Coventry, UK: BECTA.

- Pownell, D. (2006). The What, How, and Why of Podcasting in Teacher Education. In C. Crawford, D. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price & R. Weber (Eds.), Society for Information Technology and Teacher Education International Conference (pp. 2378-2379). Chesapeake, VA.
- Proctor, N., & Burton, J. (2003). Tate Modern multimedia tour pilots. In*MLEARN* (pp. 127-130). London: LSDA.
- Reeves, T.C. (2000). Socially responsible educational research. *Educational Technology*, 40(6), 19-28.
- Reeves, T.C., Herrington, J., & Oliver, R. (2005). Design research: A socially responsible approach to instructional technology research in higher education. *Journal of Computing in Higher Education, 16*(2), 97-116.
- Revans, R. W. (1982). *The origins and growth of action learning*. London: Chartwell-Bratt.
- Scott, D., Nishimura, S., & Kato, S. (2006). Using iPods to support content area learning in a Japanese college lecture course. In T. Reeves & S. Yamashita (Eds.), *EdMedia 2006* (pp. 3014-3019). Honolulu, Hawaii, USA: AACE.
- Switzer, S., & Csapo, N. (2005). Survey of student usage of digital technology: Teaching implications. *Issues in Information Systems, VI*(I), 127-133.
- Thornton, P., & Houser, C. (2005). Using mobile phones in English education in Japan. *Journal of Computer Assisted Learning*, 21(3), 217.
- van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, N. Nieveen, R. M. Branch, K. L. Gustafson & T. Plomp (Eds.), *Design methodology and developmental research in education and training* (pp. 1-14). The Netherlands: Kluwer Academic Publishers.
- Wood, W.B. (2004). Clickers: A teaching gimmick that works. *Developmental Cell*, 7, 796-798.
- Zuber-Skerritt, O. (1993). Improving learning and teaching through action learning and action research. *Higher Education and Development*, *12*(1), 45-58.

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