

MOBILE LEARNING SYSTEMS FOR DIGITAL NATIVES

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ABSTRACT

In late 2005 and early 2006 the authors carried out a survey of Information Technology professors in eight universities in Australia, New Zealand, the USA and Europe to explore their ways of coping with large group teaching. The aim was to investigate the effectiveness of various teaching methodologies in similar Faculties teaching IT around the world. Interviewees were selected through web-based research to identify the most comparable teaching departments from various universities locally, nationally and internationally. In telephone interviews many of the respondents reported on their use of the Internet for teaching and managing large groups but none mentioned the use of mobile learning as a strategy. In this paper we argue that mobile devices such as the video iPod, 3G phones and PDAs have the potential to revolutionize the learning experiences of the 21st century students.

KEY WORDS

Mobile learning, case studies

1. Introduction

The world is on the verge of computerizing every aspect of life, in other words - ubiquitous computing [1]. This is being propelled by the development of mobile devices that are used by a majority of people around the globe. Weiser [2] states that the most profound technologies are those that disappear. They weave themselves into the fabric of everyday life till finally they become indistinguishable from it. This description may be applied to mobile devices. Mobile phones initially emerged on the market as large, cumbersome devices with limited uses such as making phone calls and sending text messages. In a few short years since the first mobile phone entered the market, we are now witnessing a huge revolution in the mobile phone industry. Now mobile phones have inbuilt cameras, business software, audio and video capabilities and a host of other applications. In fact mobile devices are, as Weiser said, 'weaving themselves into the fabric of everyday life' [2], which is a main reason for incorporating many services into these small devices.

Small, multipurpose Personal Digital Assistants (PDAs) are allowing people to make phone calls, send text messages, send emails, browse the Web and complete word processing, spreadsheet and other applications all on one device. Young people are adopting iPods which not only allow users to download and play music on these devices but also view video clips as these miniature devices (10.41 x 6.09 x 1.39 cm with a 6.35 cm colour display) now allow for the storage up to 80 gigabytes of information [3]. These devices have so captured the attention of the young that it is appropriate to investigate how they are being and will be used in university settings to enhance learning opportunities for the 21st century student. Students form an important sector of any society in any country, and universities are struggling to provide learning opportunities for these 'digital natives' who are so familiar with mobile devices. The term 'Digital Natives' was coined by Prensky [4] for young people who became acquainted with digital technology from birth and for whom computers, mobile phones, I-pods and video technology are a normal part of life.

At the same time, universities are struggling to cope with large classes which often seem alienating to this young, multitasking generation. As well, large classes limit the interaction among the students and lecturers. Lecturers are not able to engage with all the students and cannot afford to answer all their questions because of limited lecture time and the amount of information that must be delivered. Could the use of mobile devices such as mobile phones, iPods, PDAs and other small wireless devices provide a way to assist? Topic [5], for example, indicates that learners want to receive multimedia streaming on their mobile devices and argues streaming lectures by experts will prove a very helpful resource.

The next section outlines the methodology of the study followed by a section on the background and definitions. Several case studies are presented in Section 4. The conclusion and suggestions for future research are found in Section 5.

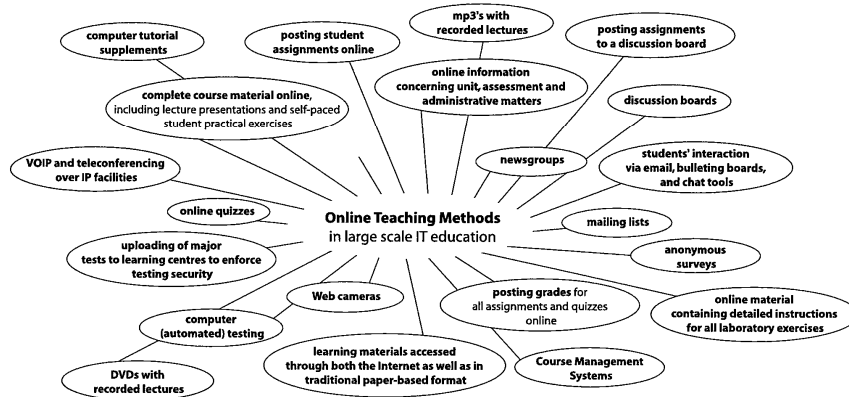


Figure 1: Identified Methods of Interacting with Large Groups of IT Students from Initial Interviews

2. Methodology

The Large Subject Teaching Committee of the Faculty of Information Technology (IT) at the University of Technology, Sydney, was successful in obtaining a grant to conduct a qualitative study in 2005 investigating the effectiveness of various teaching methodologies in similar Faculties teaching IT around the world. Interviewees were selected through web-based research to identify the most comparable teaching departments from various universities locally, nationally and internationally. This is a continuing study and so far representatives from 8 different universities have been interviewed by telephone. Questions were asked about their departmental profile, teaching load, issues, tools and strategies for large group IT teaching and also their evaluation of tested solutions. Many of the respondents discussed their use of the Internet for teaching and managing large groups. Figure 1 outlines the multiplicity of online teaching techniques that have been identified in our research. As can be seen from this diagram, the methods can go from minimal online interaction such as posting grades on the web to full scale web and video presentation of material, lectures, discussion and chat rooms and class management. It appears that Universities have embraced e-learning with enthusiasm.

No university however mentioned using mobile devices. This was a surprising finding, as never in the history of the use of technology in education has there been a technology that was as available to citizens as mobile telephony [6]. There are over two billion people in the world using mobile phones [7].

Mobile phones may be especially important for students. The twenty-first century student is part of the 'e-generation whose best friend is a mobile phone' [8]. Studies from Flinders University in South Australia and Queensland's University of Technology confirm the importance of mobile phones to young people. 'Young people consider a mobile phone the most important item of all – it is more important than access to the Internet or even television' [8]. In developing countries such as China and India mobiles are considered symbols of upward mobility and Professor Katz, director of the Centre for Mobile Communication Studies at Rutgers University found that children in lower socio-economic groups in the US are more likely to have a mobile phone than their richer peers [8].

The effectiveness of online teaching methods reported by respondents in our study on one hand, and the ubiquity of mobile devices on the other hand, reveal a potential of combining online teaching methods with the mobile devices use. The fact that our interviewees have not had experience with such cases yet reveals that despite its potential, mobile teaching has not been widely adopted to date, and its use and possible benefits may not be fully understood yet. We aim to add to this understanding by analyzing what can be learned from existing m-teaching implementations around the world reported in literature.

Research carried out by the authors of this paper led to the development of the research question;

Given the fact that Universities are trying to cope with large numbers of students in classes, how can they build on the success of online teaching

E-learning outcome	Institution	E-learning platform	Experience	Student Perspective
<ul style="list-style-type: none"> • Cost saving • Reduced instructional delivery costs • Incremental revenue from off campus learning 	University of Adelaide	Blackboard	1. Support resources consolidation resulted in saving one million AUD 2. Application Service Provider (ASP) to institutions in Asia and Australia generated a million AUD in revenue	Students demanded more initiatives
	University of North Texas	WebCT	WebCT resulted in more students going for fully on-line courses and less classroom requirements	Students preferred the more personable and collaborative on-line experience
	University of Central Florida (UCF)	e-learning initiatives	Full on-line degree course	Improved student learning Improved flexibility of access

Table 1: Examples of Universities Implementing E-learning [14]

methods and utilize mobile devices as learning tools to increase effectiveness of their teaching, as it appears that mobile devices (especially phones) are the device of choice for young people or Digital Natives?

In this paper, the applied research strategy is multiple case studies of mobile devices used in educational contexts as the unit of analysis [9], [10]. This preliminary study is characterized as an interpretive, exploratory study to identify issues that influence the adoption of the technology and the challenges that face new adopters. Future research will involve building theory from field work that examines professional practice in the educational arena, and specifically in Australia [11].

3. Background and Definitions

The authors examined the roots of Mobile Learning by first investigating the spread of online teaching within the university context as it is apparent from Figure 1 that the universities have enthusiastically embraced e-learning. E-learning is defined as a new pedagogy style through using Information and Communication Technology (ICT) in delivering learning content to learners through technologies such as the Internet, interactive TV, or satellite broadcast. **M-learning or Mobile Learning** is a development from e-learning which, for its part, originates from d-learning (distance education) [12]. Today's students' knowledge of mobile devices makes the entrance of mobile learning (m-learning) possible [13].

3.1 From E-learning to M-learning

Most of the universities around the globe have implemented some kind of e-learning method(s) to enhance the learning process [14]. A survey conducted by

Sloan Consortium found that 97.6% of American public institutions offer some kind of e-learning. Sun Microsystems researched seventeen e-learning initiatives in education throughout Europe, Asia, Australia, and North America and conducted interviews with project leaders and experts in the field (see Table 1 for examples). The qualitative findings from the research were justified by quantitative findings from representative results [14]. Sun focused on e-learning successes in four major areas;

- return on Investment (ROI);
- student satisfaction and achievement;
- scalability;
- collaboration.

The research found that universities which implement e-learning method(s) are gaining many benefits starting from cost savings to improving students' satisfaction and ensuring better performance. Cost savings have been realized at these universities as there:

- is less need for facilities such as classrooms and computers;
- are fewer staff required for large class support,
- is increased revenue due to an increasing numbers of on-line enrolments.

The University of North Texas (UNT), for example, showed significant evidence of the positive impact of e-learning with 1800 out of the 4000 students in year 2003 taking on-line classes even though they were living on campus. They preferred the on-line program compared to the large classroom learning. UNT realized the benefits of e-learning, thus it arranged to reach students in areas of Texas State by offering web classes for certain programs [14]. Sun Microsystems believes that e-learning has a

considerable and continuous positive impact in education and according to the survey results 'all institutions reported that students were satisfied by their initial e-learning experience in education' [14].

3.2 The Large Teaching Group Findings

In our interviews, only one Sydney university academic reported to us that his university is 'not online in a big way'; this participant stated that he prefers face-to-face communication with students and has not implemented any online tools or strategies to assist large subject teaching. That contradicts the other participants' accounts, such as the University of Adelaide's experience which implemented MyUni e-learning to facilitate learning (but not to replace face-to-face communication). This resulted in a big student demand to include more on-line components for more courses. The Royal Melbourne Institute of Technology (RMIT) academics are strong supporters of online technology. They communicate with students through emails to assist with assignments or tasks. Furthermore they have a website with all course material, lecture notes and workshop content in an online format. Some lecturers also record lectures in an mp3 format. They have tried incorporating webcams, without success. Curtin University of Technology in Western Australia has encouraged their lecturers to use webcams. 'One or two have started using this method' but our respondent cautioned that this method of teaching is 'so fresh' that the university could not comment on its success or otherwise as yet.

4. M-learning as a Solution

Mobile learning is the delivery of education material to students via wireless medium to mobile devices mainly Personal Digital Assistants (PDAs), mobile phones, and laptops in order to facilitate anytime, anywhere learning [15]. Globally there are two billion people using mobile phones [7]. According to [16], 'm-Education takes learning using wireless and mobile technologies one step further.'

4.1 Mobile Communication Case Studies

This section outlines the use of instant mobile communication in an m-learning environment. According to Roschelle et al. [17], a survey found that 99% of higher education Japanese students are using e-mail on their mobile devices, which resulted in the school sending multimedia messages (video, audio, text) to its students informing them of future English lessons. This survey also found that students who received mobile e-mail learned more [17].

Another mobile technology used in teaching is the Short Message Service (SMS). Famborough College use the SMS tool to communicate with students and parents about day to day college information such as timetable details,

assignment due dates, parents' evenings and college events. At the University of South Africa, SMS was used to inform students on the due dates of their examination results or closing dates for semester registration, for example [18]. The authors of these studies report on students' approval of communication between themselves and their institution through SMSs. Students were pleased, and/or pleasantly surprised to receive such messages, and such contact from the university was seen as reassuring and motivating [18].

4.2 Ubiquitous Learning Case studies

This section concentrates on the use of mobile devices as ubiquitous access objects that enable the mobile learner to access previously downloaded material anywhere, anytime, while at the same time often providing increased interactivity of the experience. Personal Digital Assistants (PDAs) were used in the project of London Metropolitan University to teach Java programming [19]. A prototype of a learning object on Java programming for the PDA was developed by adapting an existing object designed to help first-year students to learn programming online. These online objects are authored in Macromedia Flash, and are short, self-contained resources that focus on one small learning objective or topic. Java programming code is broken down into step-by-step sequences that are visually highlighted, and explained using simple text descriptions. Visualisation of abstract concepts is supported by the use of everyday familiar examples, animated where possible. Interactive models that illustrate Java code examples enable the students to change variables and see what happens. Scaffolding is used to provide learners with transitional support in learning a task, for example through interactive quizzes that allow programs to be constructed from fragments of code [19].

In the discussed study [19], while adapting the objects to PDA, the researchers replaced most of the explanatory text with audio commentaries, alleviating potential problems of screen overcrowding, text legibility and readability. In developing the audio for the PDA, careful scripting and tone of voice for the commentaries were crucial to ensure it was effective for students. Buttons for the audio explanations replaced the text on each screen. Animations were reduced in scale, and details were simplified to retain clarity. Some of the interactive elements had to be changed, to suit the 'point and click' method of user control on the PDA, for example in the self-test quiz, but the fundamental goals of the task were not changed. The underlying pedagogy was not compromised in the PDA version [19].

In the evaluation by students, it was revealed that they were excited about the opportunities afforded by the mobility and portability of the PDA, in being able to learn anywhere and everywhere, at their own convenience [19]. The only disadvantages mentioned for using it as a learning tool were cost, security and limited storage

space. The users felt that the PDA applications enhanced their experience over alternative learning methods. The use of audio in the applications was highly rated by the majority of users. The PDA version of the object was seen to be much more effective and interactive because of this. The students felt that the PDA version of the learning object was more interactive, saying that interactivity not only engages them more in the learning process, but it also helps them to learn more effectively. The PDA applications were seen as enjoyable and stimulating, and many positive comments were made about them being memorable, innovative, interesting and attractive. Such comments suggest that the PDA may encourage user engagement and make learning applications more interesting and fun to use [19].

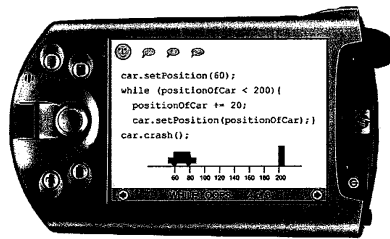


Figure 2: The PDA Version of the Java Teaching Tool [19]

A number of initiatives reported in the literature involved the use of iPods. Georgia College and State University, for example, has used iPods as education and research tools [20]. Table 2 outlines other Universities that have utilized iPods for mobile learning.

University Name	Mobile Learning Activity
Georgia College and State University	Students download films to their video iPods so that they do not have to watch the movies in class; Lectures, language study programs, indigenous music and thumbnail art sketches made available for students of study abroad programs; Freshman survival guide available on iPods.
Duke University North Carolina	Gives free iPods to foreign language students to help them immerse themselves in coursework.
Drexel University Philadelphia	Professors upload study material to a server from which students download it to their iPods.
Mansfield University Pennsylvania	Used PodCasts to make announcements to students.

Table 2: Examples of Innovative Uses of iPods ([20], [21])

As iPods come in audio only and video versions, there have been a number of positive uses reported in both cases. As for the audio version, at the Drexel University School of Education some of the material that professors are able to provide for students to download on their iPods include class assignments, readings, or audio files. The students then can access the material wherever they wish, including the classroom, the library, or even the gym [21]. At the Duke University, some of the most popular student uses included recording lectures and taking oral notes. According to the Duke lecturers [21], students seemed more engaged in classes where they could use the iPods. They also reported strong student use of the iPod audio capabilities in their presentations, and more accuracy in quoting from interviews they recorded on their iPods.

A video screen adds even more possibilities to the iPod use in education. The Duke students would often use the devices to create electronic flash cards [21]. At the Georgia College and State University, a history professor provides 39 films to the students' video-capable iPods so she does not have to spend class time screening the movies. Another professor provides a regular podcast of the week's most asked questions [22]. Positive results from the US universities' experiments with iPods are also summarized in the following statement from President of Georgia College and State University: 'The more you free up your classroom for discussion, the more efficient you are.' [20]. This statement back up research from our literature findings such as: 'The traditional class rooms or lecture halls as physical places are losing their importance for imparting knowledge' [23].

5. Conclusion

The authors set out to examine that *Given the fact that Universities are trying to cope with large numbers of students in classes, how can they build on the success of online teaching methods and utilize mobile devices as learning tools to increase effectiveness of their teaching, as it appears that mobile devices (especially phones) are the device of choice for Digital Natives?*

Evidence from around the world would suggest that universities should investigate adding mobile learning to its blended model of learning to expand student access methods to learning material and extend the opportunities offered by e-learning model. As reported in Section 4, mobile devices may a) improve institution-to-student communication, using SMS or mobile email to provide instant, updated information, b) they may allow students to access audio or video learning material anytime, anywhere, at their own convenience, such as by using PDAs and iPods, and c) additionally, such mobile devices may provide more interactive and engaging experiences, leading to more effective learning, as evidenced in the examples reported in this paper. The fact that digital natives feel so attached to their mobile devices is another

reason for further exploring this option. The convergence of mobile devices to act as both instant communication devices as well as ubiquitous access devices, combined with their interactive possibilities, is an area for future research for mobile learning and teaching. Searching for specific ideas of mobile devices' uses and applications in education to best utilize their potentials and to improve the experience of learning is another possible research direction. The authors are now examining the success factors and impediments to mobile learning and will carry out an extensive global survey of mobile learning experts and digital natives in the first part of 2007.

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