

An Exploratory Qualitative Study to determine factors influencing the adoption of mobile learning for tertiary education

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ABSTRACT

The advent of mobile devices has provided a new direction to the current models of e-learning. While current models warrant students to access educational resources using a desktop computer with Internet technology, mobile devices extend the concept to directing educational resources to students' devices and added a new dimension of 'anyhow', realizing mobility. This research looks at the tertiary students view point to understand how mobile technology can be utilized in an effective and efficient manner in order to realize educational strategies. Students' opinions were extracted using a focus group discussion and the preliminary results are reported in this paper.

INTRODUCTION

While many technologies may fall under the banner of "wireless handheld technology" we zoom into "personal digital assistant (PDA)" as the appropriate technology for some solutions leading to mobile learning. Our choice to zoom into PDAs are primarily twofold: (i) the PDA technology has come a long way and it now offers all in one solution including mobile telephone, (ii) being part of mobile technology now it has a tremendous growth potential in the next few years. It is estimated that 83% of the population in Australia (17.2 M) will own a mobile device within the next three years. An Australian consulting firm, IDC predicted mobile services to generate revenue of AU\$8.4 billion in 2003, and grow at an average annual rate of almost 10 percent to reach AU\$12.1 billion in 2007. The Allen Consulting Group has estimated that mobile phone industry added AU\$5 billion to Australia's economy in 2002 (<http://www.itfacts.biz/index.php?id=P290> ; accessed 31 March 2005). It is therefore envisaged that in the next 3/4 years a significant proportion of the mobile technology would be integrated PDAs with mobile telephone facility.

Among the advantages of using PDAs in tertiary setting are (<http://www.medindia.net/pda/index.asp>):

- PDA's are Lightweight, durable, Safe, Low power equipment that do not interfere with medical equipment.
- There is no monthly usage charges.
- Protocols to guide with standard management decisions can be quickly reviewed on the PDA.

This project therefore investigates the "wireless handheld technology" in the form of "PDA" in tertiary setting in Australia. Despite its obvious advantages (as listed above) what are the reasons for the uptake of PDA in tertiary institutions in Australia? What are the behavioral determinants to adopt PDAs by students? What are the roles of education

vendors in the context of PDA usage in Australia? What they must do to customize and/or develop applications for PDAs for students in Australia?

The specific aims of the research are:

1. to investigate the behavioral determinants of PDA adoption by students in Australia.
2. to develop a PDA adoption model based on (i) and the literature and test the validity and reliability of the model by application to the education service providers in Australia.
3. to enhance tertiary industry's (various stakeholders including IT vendors) understanding of students' response to the PDA adoption in education in Australia.

LITERATURE REVIEW

The proliferation of wireless devices has enabled content providers to 'push' content to users. The devices enable users to access content anytime, anyhow and anywhere. Recent implementations of these devices include context-based information push, where users can be recognized based on their profile and their current location, and selective information is provided based on these two criteria.

An example is in the health and sports domains, where snippets of information are provided to users of handheld devices. Such innovative provision of information has enabled the device manufacturers to dictate information push on users. In the past two years this concept has been introduced into the tertiary sector, where mobile devices have been used to study the effectiveness of communication between the content provider and students.

Despite the technological growth in this area, it is still unknown whether such technologies will be adopted by users. The reasons for this skepticism include the hardware limitations placed on the device, the complication encountered by users due to relatively small screen sizes, unreliable wireless coverage and limited memory available for user applications.

To predict the acceptance of technology, there are models available. In Information Systems, the Technology Acceptance Model (TAM) is widely used for prediction. However, TAM has been criticized because of its inability to predict technology acceptance in professional settings such as health. Further, in recent the weaknesses of TAM have been exposed in terms of its testing and suitability. There is also widespread criticism on TAM to the effect that in circumstances such as wireless, TAM may not be able to predict the technology acceptance.

In the tertiary context, prediction of technology also depends upon the content as this is an integral part of the learning environment available to the users. Therefore, any model that predicts the acceptance of technology should also consider how the content is enabled on the devices that use the technology. When it comes to wireless handheld devices, the major question that needs to be answered concerns how the instructional design strategies for handheld devices to address their limitations, the user expectations, and how academics will meet these expectations.

The recent USQ Network Review committee agreed that the university has to develop a position paper on the use of wireless technology at all campuses, with consideration to its

application for learning and teaching. USQ is committed the implementation of wireless technology at Springfield campus, and the Faculty of Business will have a strong presence at Springfield. This research will inform the application of wireless technology for teaching and learning, an need identified in a recent communication (12 April 2005) with John Dunsdon, Associate Director, Network Services, ITS, USQ.

While there is a plethora of literature available for online learning, evaluating learning management systems such as WebCT and the Internet for learning purposes (Zemsky & Massy 2004), the impact of handheld devices on mobile learning is a relatively non researched phenomenon (Bridgland & Blanchard 2005). A European-led research and development project, ‘*MOBIlearn*’ commenced in 2002, to explore context-sensitive approaches to informal, problem-based and workplace learning by using key advances in mobile technologies. USQ is actually listed as a partner in this project, but is no longer active since the departure of the past head of ITS. This research aims to contribute to mobile learning research by studying the factors that determine the uptake of wireless handheld devices for tertiary education purposes.

RESEARCH DESIGN & METHOD

The research design for this study consists of three distinct phases. The first phase is an exploratory study to identify initial themes for a mLearning adoption model. The second phase is a confirmatory study based on stage 1. The third phase is a confirmatory study using the themes derived from phase 2. While the first two phases involve qualitative techniques, the third phase involves a quantitative technique. These three phases are explained below:

Phase 1 - Choice of wireless devices and user expectations (exploratory):

In this phase a pilot focus group session was facilitated with a selected group of students of USQ to understand issues associated with the choice of wireless devices. The principal purpose of this focus group was to unearth themes required for the study as very limited information can be found in the literature on wireless adoption for education purposes. The focus group sessions were conducted to ascertain drivers and impediments of choice of devices and user expectations. The session *generated, discussed, and evaluated* a set of themes as derived from initial literature review in a group environment.

Phase 2 – Choice of content provision (confirmatory):

In this phase another focus group sessions will be conducted similar to that of stage 1. The participants will again be USQ students. The main objective of this stage is to extract various processes involved in meeting user expectations derived from stage 1 and to confirm the themes extracted from the previous stage.

Phase 3 – Choice of content provision (confirmatory):

Once the themes are ascertained from the previous phases, a university wide survey will be conducted to quantify the determinants. A survey instrument will be prepared based on the themes derives from the focus group sessions prior to administering the survey.

DATA COLLECTION – SOME ISSUES

The focus group was facilitated for duration of 2 hours. A special room with audio and video recording facility was booked for this purpose. The data collection involved 5 participants chosen from an 3rd year Information Systems course at USQ. The choice of this course was justified by the fact that (i) the students were aware of the frontier technologies such as wireless technology; (ii) students were conversant with learning management systems (LMS) used by USQ; (iii) students were able to comment on the merits of using a mobile technology for learning purposes and (iv) students were aware of the technology adoption issues.

3 out of the 5 participants were international students. One was from China, one from Thailand and other from Africa. This combination helped the focus group discussion as the university catered to a large population of overseas students using the LMS system provided by the university. However, some participants had difficulty in communicating due to language barrier. This aspect was particularly not beneficial to focus group interaction. Specifically one lady participant could not provide much input into the whole process, (a) due to lack of understanding on the content that was being discussed and (b) due to inability to respond to the questions presented. While the numbers of participants were 5 in total, due to lack of contribution from one member, it can be considered as a focus group with 4 members and thus a mini group. This is an acceptable level for a pilot study.

The issue of homogeneity was addressed by selecting participants who were doing 3rd year of undergraduate study within faculty of business, and studying the same course. This was considered suitable since awareness of subject under discussion (m-learning) and the type of course learning (all enrolled in network management) should have some correlation and provide similar background to understanding of the issues under discussion.

While every effort was taken to identify participants from a 3rd year course, the facilitator had very little knowledge of the students and their prior qualifications. Only after the completion of the focus group, it was learnt that one international student was exposed to USQ only for 2 months, while another was about one semester and another for 4 years. This possibly could have compromised the homogeneity issue. In addition to this, age of the participants could have compromised homogeneity issue. Among the 5 participants, two students can be classified as mature age students (40 -50), others can be grouped under 20-30's age group category. Another factor that became quite obvious after the selection of the participants was the difference between the local students and international students. At the start of the focus group this was not evident; however the local versus, international students did identify issues such as language, age and type of enrolment into the course and their background which may be potential factors in understanding and implementing focus group.

This experience was useful as the purpose of the pilot focus group discussion was to identify such issues. These issues will be addressed in the next set of focus groups that

are planned for August 2005. These issues will be resolved through questionnaire asking questions on participants' background, nationality, and number of years at USQ, age, gender, exposure to handheld devices, use of mobile phones and PDA's and ability to show and relate the nuances of features and thereby comparing the different models and their functionality. This is considered to be important to this study as this research endeavors to understand whether course materials can be supplied through handheld devices. Participant's prior knowledge of devices might be worthwhile in this investigation, as students will have the ability to convey or discuss the types of courses that can use handheld devices, the nature of activities that can be performed using these devices and the identify the advantages and disadvantages of learning that can be done on these devices subject to issues such as bandwidth, model and features.

DATA ANALYSIS

Preliminary analysis of data identified that m-learning was a concept still in infant stages and may not be well received due to lack of available resources. The following reasons appear to influence the adoption of mobile learning in tertiary education:

- A lot of overseas students were poor in English and would like to learn this language through interaction with students and lecturer. Class interaction was considered to be the good place for this sort of interaction. Hence the suitability of mobile learning model is questioned by participants.
- Participants were reluctant to pay hefty tuition fees just to get study materials off the web or through some electronic text books using mobile devices. Obviously they can do the same at their home country. The students didn't like the idea of being provided with a lot of text books and reading materials without interaction with other students and academic staff.
- Participants opined that students pay a lot of money to experience interaction from lecturers. Therefore the concept of m-learning whilst good, would not allow expected levels of real-time interaction.
- Real-time interaction also has some disadvantages. For example, many overseas students work outside the university hours and may be encouraged to be connected to the computing networks after hours. This may influence students to avoid lectures. This is seen as a disadvantage facilitated by the technology.
- In terms of legal issues, participants felt that engaging in study modes facilitated by the technology may adversely impact their visa status as there is a requirement by the Australian Immigration Department for face-to-face attendance.
- One of the rules imposed by the department of education in Australia for overseas students enrolled in full-time mode is a compulsory 80% attendance and anything less would jeopardize their study and thus their stay in Australia. Therefore according to these participants m-learning may not be useful to overseas students unless m-learning is accepted as a proper learning channel. However, these participants felt that m-learning can be complemented with class room education.
- Mature age students felt that m-learning although is beneficial is limited by hardware features such as the size of the gadgets, hard to see display, limited memory and processing capabilities. These were cited as a barrier to the use of technology for m-learning.

- The perception of staff engaging in m-learning was looked upon as a need for training as the participants believed some possible skill imbalances between departments. For example in the use of computer as a tool to convey teaching material, students felt that staff from IS discipline or computer science possess necessary background than other departments such as marketing. They felt that this may adversely influence the production of course materials and compromise the standards dictated by the university. The prices of the mobile devices were considered to be as another limitation to m-learning with many brands offering more features for more money.

When the data were examined using NVivo, a software application for data analysis, the following themes emerged. The analysis was conducted based on the initial themes as portrayed above and the following table represents the ‘nodes’ as extracted by the software application. The initial extraction of free nodes was aggregated using the ‘tree’ option provided by NVivo to arrive at the following table.

Table 1: Preliminary table Drivers and Inhibitors of MLearning in tertiary education

NVivo revision 2.0.163		Licensee: Gururajan
Project: MLearning 2		User: Administrator Date: 30/05/2005 - 2:24:49 PM
NODE LISTING		
Nodes in Set: All Tree Nodes		
Created: 30/05/2005 - 2:23:30 PM		
Modified: 30/05/2005 - 2:23:30 PM		
Number of Nodes: 30		
1	(1)	Drivers
2	(1 1)	/Drivers/easy access
3	(1 2)	/Drivers/interaction
4	(1 3)	/Drivers/improved service
5	(1 4)	/Drivers/broadcast
6	(1 5)	/Drivers/flexibility
7	(1 6)	/Drivers/detect plagiarism
8	(1 7)	/Drivers/security
9	(1 8)	/Drivers/multilingual
10	(1 9)	/Drivers/teamwork
11	(1 10)	/Drivers/convenience
12	(1 11)	/Drivers/connectivity
13	(1 12)	/Drivers/availability
14	(1 13)	/Drivers/improved communication
15	(1 14)	/Drivers/better device features
16	(2)	Inhibitors
17	(2 1)	/Inhibitors/expensive
18	(2 2)	/Inhibitors/training for staff
19	(2 3)	/Inhibitors/depend upon courses
20	(2 4)	/Inhibitors/device limitation
21	(2 5)	/Inhibitors/connectivity
22	(2 6)	/Inhibitors/resource availability

23	(2 7) /Inhibitors/physical interaction
24	(2 8) /Inhibitors/learning styles
25	(2 9) /Inhibitors/age
26	(2 10) /Inhibitors/security
27	(2 11) /Inhibitors/legal implications
28	(2 12) /Inhibitors/health issues
29	(2 13) /Inhibitors/experience
30	(2 14) /Inhibitors/lack of access

The aggregation of the nodes into trees also enabled us to develop a preliminary model of drivers and inhibitors as shown in the figures below:

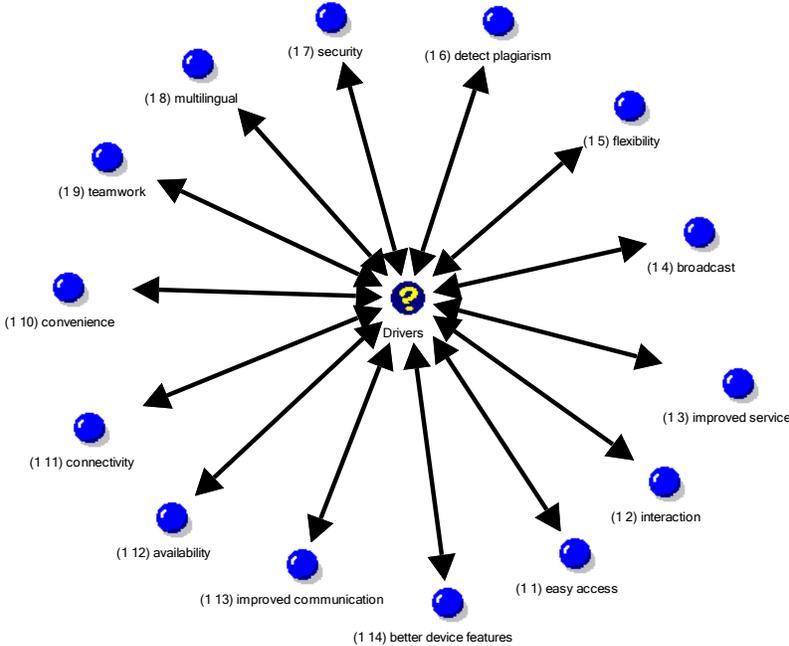


Figure 1: Preliminary model of Drivers

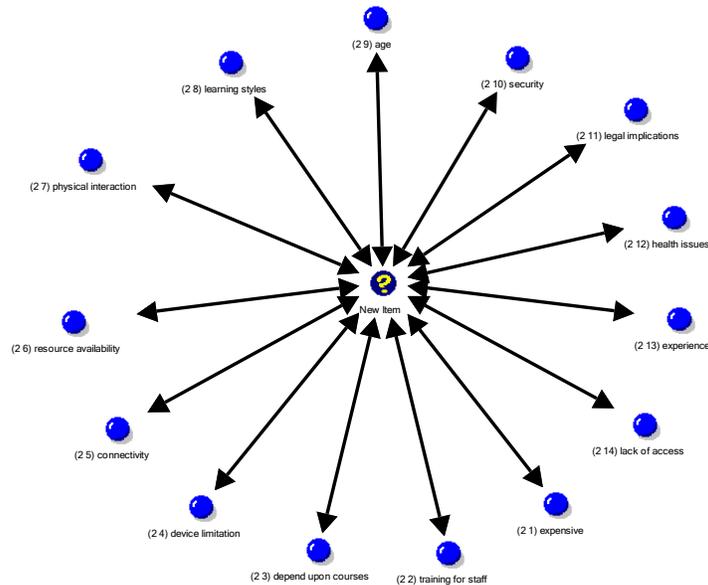


Figure 2: Preliminary model of Inhibitors

DISCUSSION

The preliminary focus group discussion indicates that there are 13 factors each for drivers and inhibitors as provided in table 1. Participants of the focus group have clearly indicated that access and the flexibility provided by the wireless access to be the major driver of mLearning in tertiary setting. They have also highlighted the convergence of technology, where voice, text and graphics can be combined in one device, would provide advantages as there is possibility to establish interaction in a wireless technology domain. A surprising factor that emerged was the use of multilingual dictionaries with the technology that would facilitate better understanding in regard to non-English speaking students. This aspect is worth considering as various translation programs are already available in the market and their integration into mobile devices for mLearning may not be difficult. Similarly, the connectivity schemes offered to the wireless technology is found to be a major driver of the technology for mLearning purposes.

In terms of inhibitors, cost and security issues appear to be significant. Participants expressed that the device cost and cost to access services to be major inhibitors. Despite the fact that hardware charges are rapidly declining and telecommunication access charges are also decreasing, participants found these two aspects to be potential inhibiting factors of mLearning adoption. Participants also recognized existing limitations such as device size, hard to see screen and the memory restrictions to be major inhibitors of mLearning adoption. Three issues raised by participants namely learning styles, legal implications and health issues appear to be surprising as education literature is yet to uncover these inhibiting factors. While legal implications in this context refer to Australian immigration policies, the other two inhibiting factors are applicable to other international setting as well. The inhibiting factors – age and experience – appear to be somewhat surprising because many previous studies have indicated that due to technology

advancement and maturity, users have gained considerable experience with digital devices and hence any training aspects associated with adoption can comfortably be ignored. However, the focus group discussion has clearly identified these two factors as inhibiting factors. Further, training to academic staff in preparing handling these devices is also expressed to be an inhibitor, adding consistency to their opinions.

In essence, the focus group discussion identified 13 factors of drivers and inhibitors each during this preliminary investigation. The model is still in its early stages and we did not establish any relationships between these factors. This is evident from the fact that security appeared in both drivers and inhibitors as participants felt that this factor can fall under both categories.

CONCLUSION

The pilot focus group enabled identification of initial factors in order to construct a second focus group. As indicated, the pilot focus group contained limitations and these need to be addressed in the next focus group. The initial set of drivers and inhibitors provide a basis on which the second focus group can be facilitated to converge upon issues. Once this is accomplished a survey instrument will be prepared to quantify the factors. While the focus group discussion data were analysed using NVivo, the survey data will be analysed using SPSS regression models. This will provide a list of drivers and inhibitors to determine the factors of adoption.

REFERNCES