

Interactive Mobile Learning: Using PDAs for Higher Education in Human-Computer Interaction Study

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Abstract: Wireless technology impacts human living, not only in the business environment, but also in the education environment. Mobile devices such as PDAs and mobile phones, can be used to increase students' motivation in learning, without the limitation of time and place. Mobile learning is the next generation of learning that uses mobile devices in education to enhance active learning. We propose an interactive mobile learning system for human-computer interaction (HCI) study in a faculty of Information technology. The system consists of three main features, including multilingual computer assisted instruction (CAI), an interactive Web board, and a class alert system to support mobile learners using PDAs.

Introduction

Mobile learning, sometimes called m-learning, is an evolution of education technology from e-learning, an evolution from desktop computers to pocket computers (handheld devices). Many handheld or mobile devices, such as mobile phones and Personal Digital Assistants (PDAs), are popular wireless devices with rapidly increasing numbers of users. An evaluation of the use of PDAs at Undergraduate level in Bristol University in the UK (Ramsden 2003) indicated the successful use PDAs in online learning. PDAs also play important roles in supporting learning for students who need special practicing and are involved in searching large volumes of information, such as medical and law students (Manhattan Research 2002). With the small and lightweight features of pocket computers, PDAs can be used as learning tools to motivate students' learning without limitation of time and place.

According to Goh and Kinshuk (2004), mobile learning is still in the early stage, and more research in this area is required. They also summarised that most of the content in mobile learning comprises only text or still images, and that rich multimedia is required. Mobile learning is a valuable teaching method when using mobile devices, and our research aimed to investigate the potential of mobile learning for postgraduate level students in the authors' faculty. This paper reports an interactive mobile learning system used in an HCI module. We have designed a multilingual CAI tool, an interactive Web board, and a class alert system for PDAs, with the focus on use by MSc students in the faculty of Information Technology.

Mobile Devices

Livingston (2004) defines mobile devices as being "small enough to fit comfortably into a purse or pocket, so you can conveniently keep it with you at all time". Following the above definition, PDAs and mobile phones are considered as potential mobile devices to support mobile learning. The current mobile devices are summarized below.

- **Tablet PCs** can be used to send E-mail, take notes, watch video, etc. They are also useful for converting handwriting to text, helpful for sharing notes for group work. As a tablet PC is a flat PC, it is quite helpful in collaborative learning, since the view of the screen is not obstructed during discussion (Cobcroft et al. 2006).
- **iPods** are not designed for supporting education, their purpose is for playing music (Bugeja 2005). Users can easily transfer music files from computers to iPods.

- **Palmtop Computers** – sometimes called pocket computers or handheld computers – work well with many good software tools, such as dictionaries, spell-checkers, and graphic calculators. These handheld computers have potential in assisting students’ learning (Savill-Smith & Kent 2003).
- **Personal Digital Assistants (PDAs)** are the next generation of palmtop computers. They can connect to the Internet, and users can send e-mail and SMS messages and use PDAs as a tool for hosting discussions. They are accepted as being more convenient in comparison to desktops and laptops (Cochrane 2005).
- **Mobile Phones** have a display area smaller than a PDA’s screen, but the number of mobile ownerships has increased rapidly in recent years, because of low price, compact size, and their utility as a good communication tool.

Mobile Learning

Mobile learning refers to the use of mobile devices in teaching and learning. It is a new learning technique that can be used to encourage active learning. Most current education applications are designed for use on desktop computers or laptops, which assume a fixed location. In order to increase learning flexibility, students should be enabled to learn at times and places of their choosing. In this paper, we focus on the use of PDAs to support interactive mobile learning. Benefits of using a PDA for learning include: being able to use it anywhere and everywhere (e.g. on a bus, on a train, in a car, in a restaurant or on holiday); its compact size makes it easy to hold and use; and its use can relax the user (since they do not need to sit down at a desk) (Bradley et al. 2005). Leung & Chan (2003) proposed that the main mobile learning characteristics are the following:

- they are dynamic with new content,
- they operate in real time,
- they support collaborative work and build learning communities, and
- they provide a choice of individual learning styles.

Many researchers have been investigating ways of employing mobile devices in teaching and learning. Mobile learning research is still at the early stage (Goh & Kinshuk 2004), and we should therefore explore other ways to facilitate the use of mobile devices in the learning process. The following are some mobile learning systems (Table 1) which help with English language learning, mobile history tour, and learning Java programming.

Authors (year)	Mobile devices	Subjects	Strategies
P. Thornton & C. Houser (2004)	Mobile Phones	English lessons	<ul style="list-style-type: none"> - Sent SMS or E-mailed 100 word English vocabulary to the mobile phones of 44 Japanese university students. - Used the multimedia capabilities of 3G mobile phones and PDAs to display short, web-based videos and 3D animations and to give visual explanations of English idioms.
Y. Cui & S. Bull (2005)	Handheld computer	A language learning environment	<ul style="list-style-type: none"> - A mobile intelligent tutoring system for Chinese learners of English provides: <ul style="list-style-type: none"> • “multiple context input: location information and amount of available time; • individual learner models; • adaptive and individualised learning materials; and • appropriate interactions over varying periods of time.”
C. Bradley et al. (2005)	PDAs	Mobile history tour	<ul style="list-style-type: none"> - On the tour, the user learns about the history of the area. Each of eight short walks is highlighted on a map displayed on a PDA, and an audio guide gives instructions on which way to walk and what to look out for, and provides historical information about the area (maps, photographs, illustrations, audio accounts).
C. Bradley et al. (2005)	PDAs	Learning object on Java programming	<ul style="list-style-type: none"> - This system consists of four main features, including <ul style="list-style-type: none"> • “explanations of the common key programming concepts that students find difficult to understand; • Java programming code is broken down into step by step sequences, and explained using simple text descriptions;

Authors (year)	Mobile devices	Subjects	Strategies
			<ul style="list-style-type: none"> • interactive models are provided that illustrate Java code examples, and allow the students to change variables and see what happens; and • interactive quizzes that allow programs to be constructed from fragments of code.”

Table 1: Mobile learning research

Interactive Mobile Learning System

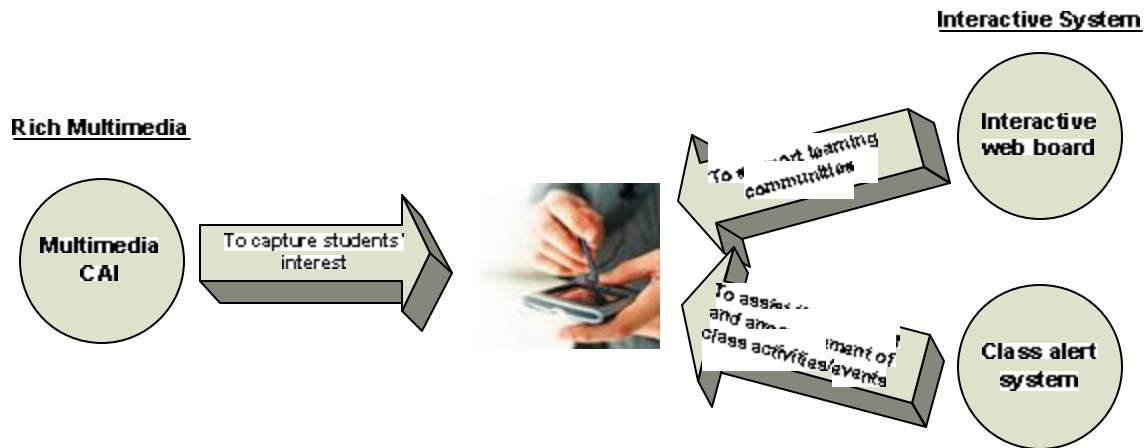


Figure 1: Interactive Mobile Learning System

Our interactive mobile learning system provides a multilingual CAI, supporting learning communities by using an interactive web board, and assisting the planning and announcement of class activities and events by sending SMS or e-mail alerts (Figure 1). PDAs are considered as effective mobile devices that students can have with them all the time in their pockets. An interactive mobile learning system has been developed for using on PDAs that have Windows Mobile 5 operating system. The software used to develop this system can be classified into three groups as following.

- Developing tools: Visual Basic .NET 2005, ActiveSync 4.1 and Window Mobile 5.0 SDK for Pocket PC
- Graphic design applications: Adobe Photoshop CS2, Adobe Image Ready CS2, and Adobe Illustrator CS2
- Audio software: Jet Audio, and MP3 Cutter Junior

Multilingual CAI of Human-Computer Interaction

Using the multimedia CAI on mobile devices can enhance learning by making a lesson more interesting. The Human Computer Interaction (HCI) module in the Faculty of Information Technology at King Mongkut's Institute of Technology North Bangkok in Thailand was chosen for this investigation. The module aims to give students an understanding of the principles and methods for user center design. The first CAI lesson starts with the design principles. In the future we expect to develop more CAI lessons, such as direct manipulation, menu selection, collaboration (synchronous/asynchronous distributed interfaces), Window design, error messages, color guidelines, user manuals and online help.

For the first lesson, different interface design principles are proposed, such as “eight golden rules” by Shneiderman (2005), “design principles” by IBM, and “seven principles” by Norman (1998). Shneiderman's eight golden rules of interface design (Table 2) are succinct summaries applicable in most interactive systems (Dix et al. 2004), and form a good focus for an initial lesson in an HCI module.

1. Strive for consistency	make the elements of your interface consistent
2. Cater to universal usability	let the interface grow with the user
3. Offer informative feedback	let the user know what happened
4. Design dialog to yield closure	let the user know the task is done
5. Prevent errors	design the system to prevent errors
6. Permit easy reversal of actions	let the user undo actions
7. Support internal locus of control	keep the user in control, not computer
8. Reduce short-term memory load	rely on recognition, not memory

Table 2: Eight golden rules of interface design

The multilingual CAI (Figure 2) is designed to support the HCI module for the International Program, which consists of both Thai and overseas students. Three languages are supported – English, Thai, and Indonesian – and both audio commentaries and explanation texts are provided in each language. One of our aims for the multilingual CAI is to offer students a choice of learning in different languages. Therefore students can learn by both listening and reading in their preferred language. The explanation texts also provide a benefit to students who have hearing impairments. Students can select a particular rule number, and play the lesson in a similar fashion to playing a DVD movie, with stop, pause, play, forward, and backward features. They can change the language easily by clicking on the languages tab at the bottom (Figure 2).



Figure 2: Multilingual CAI

Interactive Web Board

The web board is design to support the learning communities, and students can use it to discuss about the HCI module with their classmates and instructor. Students can choose to be alerted to new issues/questions or responses to his/her questions by sending him/her an SMS and/or E-mail. Therefore without logging on to the system, students can receive the messages or the answers that they looking for via SMS or E-mail.

Alert System

The alert system is designed to support instructors and students in planning class activities and announcing information. A simple calendar is used for planning purpose (Figure 3). Instructors and students can select the method of delivery for those messages by sending an SMS and/or E-mail. This alert system can be preset to alert the student about an event a given number of hours or days in advance. Increasing the convenience of instructors' planning, without limiting where or when they perform that activity, is one of our aims. Examples of alerts sent to students include reminders of an assignment deadline, class cancellations, and other class information at any time and place.

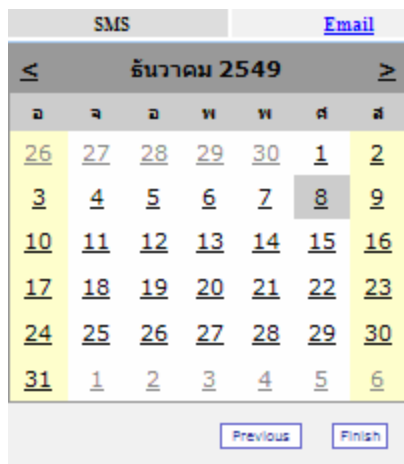


Figure 3: Class Alert System

Conclusions

We have described an interactive mobile learning system, which includes multimedia CAI to capture students' interest, an interactive web board to support learning communities, and a class alert system to support instructors in planning teaching activities and informing students of events and activities. Rich multimedia and interactivity are two of the important features of successful mobile learning system. Although the mobile devices can be used to support teaching and learning, they are not designed for the education purpose (Keough 2005). Wishart et al. reported that many students who have PDAs feel uncomfortable using PDAs in university, because not many students currently use PDAs for that purpose, and students also are nervous about losing their PDAs. However we hope that mobile learning may become a more common learning technique in higher education in the future.

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