PERSONAL LEARNING ORGANISER: DESIGNING A MOBILE LEARNING EXPERIENCE FOR UNIVERSITY STUDENTS

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This paper reports on a the design of a mobile learning experience that aims to assisti university students to organise their learning activities. The development of the system applied an M-learning design framework to identify appropriate design requirements in practice. Preliminary usability testing on the system revealed the usefulness of the M-learning environment for university students. A practical account of this exercise is also described.

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1 Introduction

As mobile technologies have begun to cost substantially less than a conventional desktop machine, we have seen increasing opportunities to apply these mobile or wireless technologies to the learning environment, particularly for accessing pedagogical applications on hand-held devices in any location, even on the move (Kukulska-Hulme & Traxler, 2005). The benefits that mobile learning (M-learning) can provide would be firstly that learners can take learning opportunities directly in the situation where they occur. For instance, if you visit the Sky Tower in Auckland, you may be interested in who designed it, how long it took to build and so forth, but it is very unlikely that you will make a note to research it when you get back home. With mobile devices there is an opportunity to put virtual post-its on the object, read post-its from others, and suddenly you are part of a location aware community (see more details of this example at www.mobilearn.org). The Ambient wood project carried out by Sussex university (Rogers *et al.*, 2004) also showed a more practical value of mobile devices, moving teachers and learners from a classroom setting to group-work, through to individual work and back to a following classroom discussion. While there are many different levels of engagement proposed for this new learning environment, as described above, most M-learning applications still make use of mobile devices to deliver the same learning content that is currently being provided by electronic learning (E-learning), an approach that which may undermine the development on M-learning in its own right. Kukulska-Humes and Traxler (p.14, 2005) puts it:

> "Mobile learning is certainly concerned with learner mobility, where learners should be able to engage in educational activities beyond the classroom… However, to some extent, learners outside a classroom have nothing more than the motivation to do so wherever the opportunity arises"

That is, they claim that there is a major tension that comes from the fact that most mobile devices in current use are not designed specifically for education or training but rather for personal information management or personal communication, largely

within work contexts or home. This conception of mobile devices might prevent both educators and learners from seeing them as a future learning medium. Indeed, it is also true that we may not develop an independent pedagogical application without traditional learning activities (e.g., face-to-face learning), because M-learning has some unique characteristics that differentiate it from the traditional learning context (Kukulska-Hulme & Traxler, 2005; Leung & Chan, 2003; Liu & Khooshabeh, 2003; Liu et al., 2003).

What we intend to explore in this article is extending the concept of the personal organiser (i.e., diary or reminder systems on mobile devices), which has already been a huge success, into an M-learning environment, by reviewing university students' contexts and requirements. Of course this is not a new idea. A previous M-learning application in a university context showed some of the potential benefits of the approach we are taking in this paper. Portable Help Desk (PHD: Smiailagic & Kogan, 2002) demonstrated the usefulness of context-awareness support, providing appropriate information to support students' school life at the right time and in the right place. Also, the student learning organiser project carried out by Sharples *et al.* (2005) explored how a mobile learning organiser could help students manage their studies and assist their learning activities further. However, an early test of both PHD and the student learning organiser revealed that there was either a lack of functionality related to learning activities or little contextualised information for illustrating the potential of M-learning experiences. This paper replicates the approaches of both PHD and the student learning organiser project, but provides a versatile mobile learning environment using a task-centred design approach (Taylor, 2004), so as to ensure that the system meets university students' requirements.

2 First Stage: Understanding the work and work contexts of university students

We began by interviewing ten university students to identify what types of work contexts, tasks, information and design features would suit university students' expectations. The interviewees were Massey University students, aged between 18 and 32. The data collected were mapped to a mobile-learning design framework developed by Parsons *et al.* (2006). This framework serves to specifically identify the design requirements of M-learning in terms of four perspectives: Generic mobile design issues, Learning contexts, Learning experiences, and Learning objectives. Firstly, 'Generic mobile design issues' examines four sub-features: *User role and profile, Mobility, Interface,* and *Media*. At this level, one is mainly concerned with the reliable and supportive functioning of software and hardware and with a design that is based on good practice for the user's role and profile (see Table 1.) The interview data revealed that new students had little idea of where the classrooms and laboratory facilities were located in a widely distributed campus (actually, there are three separate precincts at Massey University in Auckland). Because of this, new students are often unsure of where their next meeting or lecture is to take place. In contrast, senior students are already aware of this type of information, but require more in-depth information about their personal studies. Their concerns during "school life" revolve around the organisation of their studies, such as being aware of assessments, while also being up to date with messages and resources from lecturers and/or other students involved in their programme of study. The new students' requirements were relevant to aspects of interface design, such as map support (visualisation software)

for the new students, while the requirements of the senior students related to the personalisation of their learning environment. The design of the prototype of Massey Mobile Helper in Stage 2 (as described in Section 3) follows these different generic design concerns.

Table 1. Summary of the interview data, in conjunction with Parsons *et al.*'s M-learning design framework

Generic Design issues	Learning contexts	Learning experience	Objective
User roles and profiles o New students - few ideas of where the classrooms, facilities etc. are located o Senior students - aware of locality information, but require more depth into personal studies, and assistance in multi-tasking. **Mobility support** o Students roam the campus to attend all their different learning activities **Interface design** o Visualisation software (Map) o Mobile software o Avoid information overload **Media** o Images, Sounds, Text	**Identity** o Junior students o Senior students **Learner** o Students **Activity** o Navigation of the campus o Obtaining contextual knowledge o Social communication **Spatial-temporal** o Location awareness, so the information given on the PDA is really relevant to their current location. o Morning: the lecture or tutorial information that they must attend; Afternoon: more individual study organisation	**Organised contents** o Lecture, tutorial, and lab information o Assignments, assessments, library, and recreational information **Outcome & Feedback** o Locational references o Various sound alerts o Images and text in particular parts of the campus o Web links to the current learning modules **Goals and objectives** o To discover the locations of lecture, tutorial, and laboratory rooms (Junior students) o To be aware of the information that is relevant to organising their school life (Senior students) **Social Interaction** o Discussing the current learning module (Senior students want to discuss directly with lecturers)	**Improving learning situations**

The next consideration is the students' 'learning context', and how it would be supported by the generic mobile design issues described above. This aspect stresses the needs and intended outcomes of specific learning activities. For this, the interview data identified four sub-features: *Identity, Learner, Activity*, and *Spatio-temporal*. The first three of these would establish the situational contexts of M-learning, and the last would be associated with the environmental context. In particular, spatial awareness is very important for the junior students, but temporal issues were more relevant to the senior students, for example relating the time of day to their study schedules. Some of the interview data showed that when a senior student arrives on the University campus, the contextual information that they are searching for may be related to their course schedule for the day, room changes, or important messages from lecturers. Towards the end of the day, when the senior student leaves the University, the context may change. Their need to be aware of assessments that are due will take priority over their class schedule in helping them to organise their studies. These different activities define different design requirements. As noted above, the junior students want more navigational support on the campus, but the senior students require more contextual knowledge and social interaction.

We also obtained information relevant to users' learning experiences. This supports the pedagogical approach, such as the content of a course, relationships to other media

and expected learning experiences. The interview data reported the four aspects of expected learning experience within the framework; *Organised contents, Feedback, Goals and objectives*, and *Social interaction*. The data demonstrated that the users would expect information such as lecture or laboratory locations in the case of the new students, while the senior students would prefer assessment information with links to in-depth data, library records, and the ability to communicate with others. Table 1 summarises the findings from the interview along with the framework proposed by Parsons *et al.* (2006).

The key point to note from Stage 1 is that the success of any M-learning application relies on taking into account the contexts of use for different learner groups, who have different expected learning experiences, as we have identified from the responses above.

3 Second Stage: Design of the Massey Mobile Learning Organiser

To address these design requirements, the Massey Mobile Learning Organiser (MLO) was developed on a PDA phone (HP™ IPAQ 6700) with a Bluetooth GPS device (GlobalSat BT-338). The system is able to locate the current position of each learner on the university map, and to access the server using a mobile network (Vodafone New Zealand). The aerial photos of the campus were obtained from the North Shore City Council, and calibrated for use with a GPS device by constructing software for the task. Microsoft™ SQL server was used to relate the contextual information and the location data. Each component of software was built using Microsoft™ Visual Studio 2005.

The assumptions of typical users and the physical environment for the development of MLO were that a student was concurrently studying four or more courses and that activities related to their daily study routine included accessing learning content and returning books to the library. In terms of their coursework, most courses include lectures, tutorials, and/or laboratory sessions. In terms of the physical environment, the Massey University campus consists of three separate areas, presenting spatial-temporal issues related to a student's locational context. For instance, most lectures take place in theatres in the upper precinct of the campus, while many of the tutorials and laboratory sessions are some distance away in the lower precincts. Therefore, students need to be constantly aware of the spatial contexts of their learning activities. Figure 1 illustrates a screenshot from the MLO system. There are indicators representing the user's current position, and a path to their selected location. The map is synchronised with the users' location, moving and rotating in line with their movements. This type of feedback provides the user with the necessary navigational information. In addition, the user can select their next destination from the course calendar, and the path to the location appears on the map.

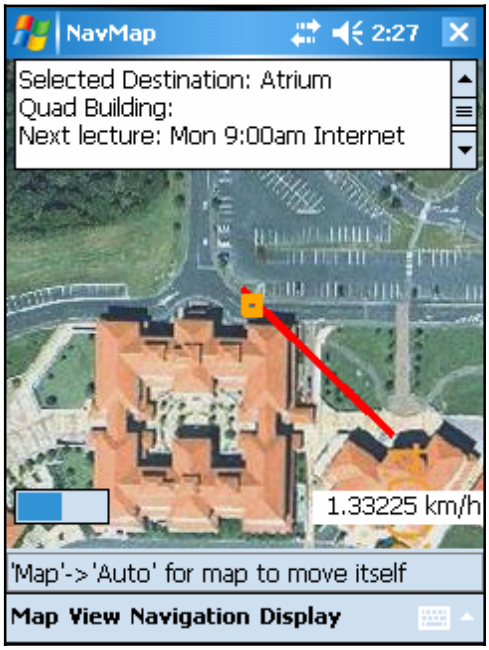
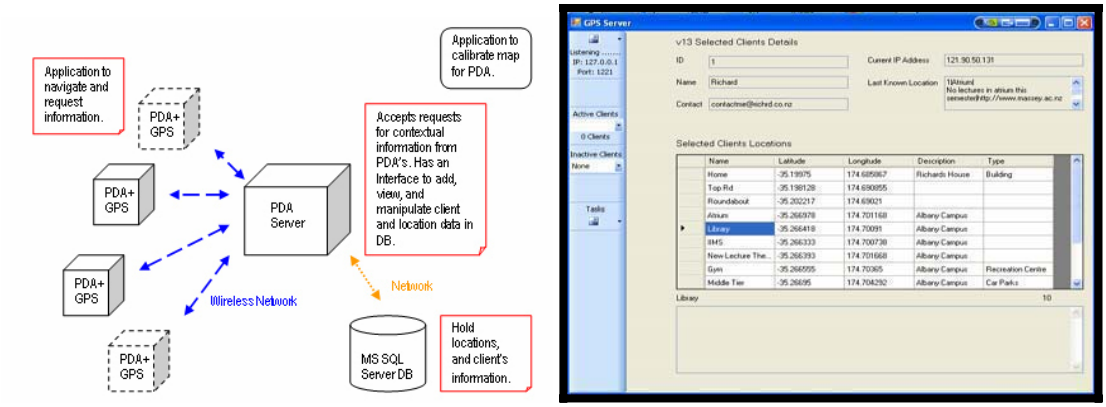


Figure 1. Screenshot of navigation software for a user who wants to get to the Quadrangle building for her or his next lecture



(a) *(b)*

Figure 2. Mobile Helper system architecture (a). The system receives the user's query and matches it to an appropriate contextual help, accessing the SQL server database (b)

Figure 2(a) shows Mobile Learning Organiser's system architecture. Mobile Learning Organiser sends the user's request for information, with their current location, to the PDA server. The server builds the query for the SQL server (as shown in Figure 2(b)), which retrieves the client's information from the database. The PDA server returns the information to the user's Mobile Learning Organiser. As users move through an area, the PDA server delivers contextual information relating the current position with the predefined user's profile. Therefore the user can request information, providing new knowledge and assisting their activities related to study at University.

Because Mobile Learning Organiser knows the user's current location, and the server holds user profiles, the system can answer questions such as "what is my next lecture and where is it? Mobile Learning Organiser delivers information to the user in both a

proactive and user-driven manner. A user receives proactive information when important notices are available such as new assignments or a cancelled lecture.

In terms of user-driven information, a user could use Mobile Learning Organiser to find what books have been placed on reference in relation to their course of study. As the user walks past the library, they can request this type of contextual information. Figure 3 demonstrates the type of contextual information a user may receive while walking close to a lecture theatre. In addition, if the user clicks the 'Assignment 1 available' link to their learning environment (see Figure 3), they can see what the assignment is. Also, they can access the whole M-learning module as shown in Figure 4.

Figure 3. Contextual information presented to the user. If a user clicks 'Assignment 1 available' on the system, they can access the M-learning module.

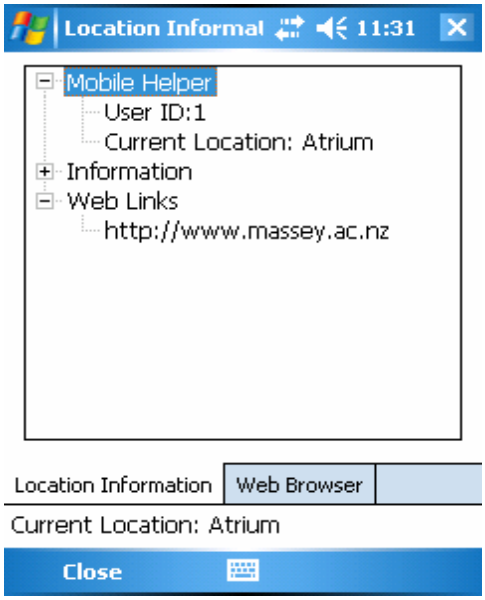


Figure 4. Learning module design for Massey Mobile Learning Organiser. It provides their current location and additional learning modules students can download

4. Third Stage: Evaluation

To see the benefits and usefulness of Massey Mobile Learning Organiser, we evaluated it with four representative users. For the contextual help information, participant's profiles such as their interests, coursework, and library information were collected before the evaluation. Based on these profiles, contextual information for each participant was added to the system database. To evaluate the system in use, the participants roamed the campus for fifteen minutes, where they experienced the two major functions of Mobile Learning Organiser, finding the location of their classrooms, and contextual help. The first function is user-driven information, and the latter is proactive information by the system. Each user was first asked to find the location of their next lecture with Mobile Helper, and then get to that location. As they approached the location, relevant contextual information appeared. For instance, if the students were passing the library, the system proactively displayed library

information, for example if there was a new book based on their interests or books due for return.

Table 2. Results from initial evaluation with four students

Statement	Strongly Disagree **1**	**2**	**3**	**4**	**5**	**6**	Strongly Agree **7**
Using the device would help me find unknown areas of Massey.					50 %	50%	
Learning to use the device was difficult	25%	25%	50%				
Interacting with the device requires a lot of mental effort	25%	25%	50%				
I think the device would be very useful in my university life						75%	25%

Table 2 presents the perceived usefulness and ease-of-use data collected. It showed the students efficiently utilised the system to discover new locations while feeling confident in themselves using the technology. They were also attracted to the contextual information. However, the small sample size made it hard to identify any behavioural differences between the new university students and the senior students.

To explicitly see how the students would interact with the system, we further assessed the system using the think-aloud technique. Three students were recruited from the campus, and the same task procedure was applied. Verbal protocol results concurred with Table 2, placing emphasis on ease of use and the ability to learn from contextual information. All the participants were able to complete the tasks in a straightforward manner. They would create an objective to either find a location, acquire some contextual information while moving around, or a combination of the two. In each occurrence the participants interpreted new contextual information, assisting in their purpose of studying at Massey. Also, they appeared to find the contextual information both useful and informative in relation to their goals of being at the location, such as "library books due" messages when they were near the library. The participants with specific information appeared to feel more satisfied with the system, and its abilities. Therefore they were more likely to have a positive attitude to and respect for the system, gaining and learning more.

5. Conclusion and future work

There have been recurring questions raised about the applicability of M-learning from a pedagogical perspective, such as; is it really possible to learn with such small device? What sorts of people use mobile device for teaching and learning? and what sorts of subjects and situations are appropriate for mobile learning? Following from these concerns, we assumed that a more informal learning activity support, such as the Mobile Learning Organiser described in this paper, would be more situated, experienced, and contextualised within specific domains. Of course, we are beginning to witness significant adoption of mobile technologies in further and higher education, in schools and the community, and in training and upskilling. They are having an impact on teaching, learning, and on the connections between formal and information learning. However, it seems to be slow on the uptake. That is why this paper sees the informal aspects of learning activities or experiences as the base-line for mobile learning activity.

The authors are planning to further extend the Massey Learning Organiser to identify a particular pattern of requests, and location sequences to enhance the degree of contextual information provided by the system. Indeed, this paper is not the final result of this research activity; the main objective here is to foster a wider discussion of M-learning design practices, based on an analysis of current research and future challenges.

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