

# A Mobile Learning Organiser for University Students

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## Abstract

*This paper describes the trial of a Mobile Learning Organiser, developed for use by university students. Based on a wirelessly-enabled Pocket PC, the Organiser makes use of existing mobile applications as well as tools designed specifically for the context of learning. The trial set out to identify what are the key tools for such a learning device. The primary uses of the Organiser were communication and time-management as well as access to content. No single application took precedence. The students' feedback demonstrated that there is a clear demand for institutional support of mobile learning, in particular course content and timetabling information. Wireless connectivity is crucial to the usefulness of the Organiser. Usability issues relating to the hardware and software had considerable impact on the students' usage and satisfaction with the system.*

## 1. Introduction

Typically, students embarking on a University course bring with them one or more mobile computing devices, including smart phones, PDAs (Personal Digital Assistants) and laptops or Tablet PCs. The software on these devices is designed predominantly to support the world of work; typical applications include time management, communication and productivity tools. Whilst these are of use to students, they are not designed particularly to support their activities: attending lectures, reading course content, revising and meeting course deadlines.

As these mobile devices gain prevalence it will be necessary to understand and harness them, as well as provide appropriate institutional support for their use. As focus shifts from static mass teaching to personal mobile learning, it is also the responsibility of educators to ensure that students have the relevant

skills and environments to succeed as individual, mobile learners.

Focusing on PDAs, the study described below has investigated whether students would find a handheld computer useful for supporting their learning, and in particular whether a specially designed, integrated learning organiser would be more suitable for supporting learning than the existing set of 'mobile office' tools, such as the calendar, contacts list and to-do list. A Student Learning Organiser has been developed at the University of Birmingham [1] and was evaluated as part of this study. The study aimed to look at the patterns of use of the various software tools and the impact on students' learning habits.

A group of seventeen MSc students at the University of Birmingham were equipped with wireless PDAs. The department in which the students were studying has complete wireless coverage. The trial lasted for one year.

In addition to the standard Pocket PC applications, the integrated Student Learning Organiser included specific tools for students to access course material, view their timetables, communicate via email and instant messaging and organise ideas and notes. Two concept mapping tools were also evaluated. Map-it! [2] formed part of the original integrated organiser and CCM [3] was added later. A comparison of these two tools can be found in [4].

The aims of this study were to:

- Discover whether students benefit from an integrated learning organiser
- Find out which applications are of most value
- Observe whether patterns of usage emerge
- Compare the concept mapping tools
- Determine what institutional support is required to make good use of the technology

Plans for the next phase of this research are also discussed.

## 2. Method

### 2.1. The setting

The study was carried out during the academic session 2002/3 in the Department of Electronic, Electrical and Computer Engineering at the University of Birmingham. Seventeen students on the Human Centred Systems MSc course were recruited to the trial, together with a number of their lecturers. One student dropped out after a few weeks, but another joined about half way through.

The trial began with a training session to familiarise the students with the hardware and software.

### 2.2. Equipment and Software

The participants of the study were each equipped with a Compaq iPAQ 3760 handheld computer, running Pocket PC 2002, with 64MB memory. Each was supplied with an expansion sleeve and an 802.11b wireless network card, able to transmit data at up to 11Mb/sec. When attached, the sleeve and card roughly double both the size and weight of the device.

Pocket PC 2002 includes cut-down versions of Word, Excel, Outlook, Internet Explorer and Media Player. To this was added the integrated learning organiser, consisting of:

- Time Manager with timetable showing teaching periods for the day and course deadlines
- Course Manager with course material in Microsoft Reader format
- A Communication Centre for email, internet messenger and contacts
- Map-It!, a concept mapping tool to create a visual map of notes and documents

Later, a second concept mapping tool, Concise Concept Mapper (CCM) was provided to the students. Throughout the year, students were encouraged to also use the iPAQ for their leisure and entertainment and to add any software they wished.

The integrated learning organiser's components include:

- A modified 'Today Screen', with timetable-specific data (fig. 1)
- A timetabling tool with downloadable course timetables and deadlines. This allows the user to specify the type of learning event taking place and see information relevant to it (fig. 2)
- A course navigator, organised by module (fig. 3)

Both concept mapping tools were designed for Pocket PC with a stylus input, and both assist

information recording through visual semantic association. However, they differ significantly in operation. Map-It! (fig. 4) uses a logical tree structure that the user navigates by clicking on an outer node which brings it to the centre, displaying the related topics. Clicking on the centre node displays any document associated with it. The user adds a new node by selecting a document from file.



Figure 1. Screenshot of modified 'Today Screen' of integrated Student Learning Organiser

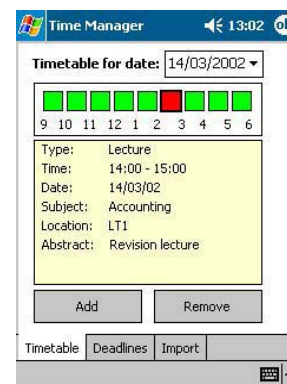


Figure 2. Screenshot of timetable feature of integrated Student Learning Organiser

Concise Concept Mapper (CCM) (Fig. 5) provides a free-form concept map [3]. Interaction is by pen gestures; dragging and scrolling the map as necessary. Usability trials found this to be an intuitive way to interact with the maps.

Search and zoom facilities reduce usability problems inherent in working with large maps on a small screen.

The choice of software tools was made on a pragmatic, rather than empirical basis. The organiser and content elements were based around the standard Pocket PC suite, which suited the developers' constraints of time as well as providing familiarity to the student users. Timetabling was assumed to be an important issue for the target student group owing to

the nature of their course which is taught in short, intensive modules and where the schedule and assignment dates for each module are often not publicised long in advance.

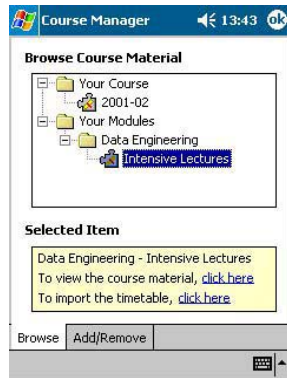


Figure 3. Screenshot of course content feature of Integrated Learning Organiser

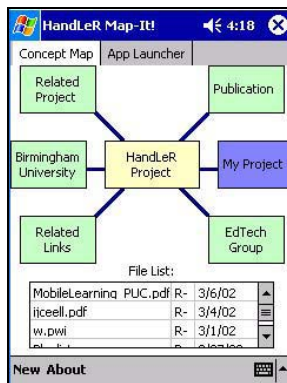


Figure 4 : Screenshot of Map-It! concept mapping tool

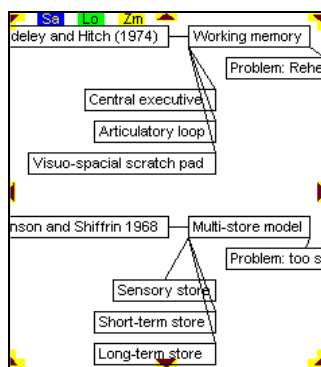


Figure 5 : Screenshot of Concise Concept Mapper (CCM)

The concept-mapping applications were picked because of the evidence that tools for desktop computers, such as SemNet<sup>®</sup>, can aid studying and notetaking [5]. Despite the obvious limitation of screen

size, it was considered that the advantage of being able to make maps wherever learning is taking place may be of benefit. The detailed study of the concept map usage [4] shows benefits of each application with respect to the students' learning, with CCM best designed for note-taking and Map-It! for delivery of content.

Content was packaged on a per-module basis, in PowerPoint and eBook format. Both formats were optimised for the small screen, and would allow the students to annotate, save and share their notes.

### 2.3. Results collection:

Results were collected in four different ways:

1. Questionnaires at 1, 4, 16 weeks and 10 months.
2. Focus groups after each of the questionnaires.
3. To compare the concept map tools, three students were videoed carrying out an exercise, which they later commented on after reviewing the video.
4. Log books, kept for six weeks. The results from this data are presented in [6].

Each of these means was designed to reveal:

- Students' attitudes to the technology
- Students' attitudes towards the learning organiser
- Patterns of usage of all the various applications (including any they had downloaded themselves)
- Patterns of usage of the technology, particularly with respect to wireless connectivity
- Ease of use issues
- Issues relating to institutional support for mobile learning devices

## 3. Results and discussion

This paper draws largely upon the results collected at the final questionnaire and focus group, although some reference will be made to the earlier findings, with respect to change in usage patterns and attitudes during the course of the trial.

### 3.1. Usability of the hardware

One of the most reported issues was the usability of the hardware itself. At the final focus group, unanimous discontent was expressed regarding form-factor, memory size and battery life:

- Form factor. Although students were content with the size and weight of the basic iPAQ, the sleeve and wireless PC card made it both too heavy and too large for comfortable use and the ability to store in a pocket. Whilst in the Department however, students regarded the wireless sleeve as

indispensable since it gave considerable added functionality to the device

- Memory size. This issue increased in importance through the course of the year, as students continued to download content to the devices, without wishing to remove any existing materials. 64MB was not considered sufficient to hold the course resources, additional PDF and media files and added software, whilst leaving any space for games and music files. As the participants were required to return the iPAQs at the end of the year, they were not willing to invest in additional memory modules
- Battery life. Although a recharged unit would generally perform sufficiently for one day, if left uncharged for a number of days, the units lose all data and programs added by the user since these are stored in volatile memory. On a few occasions (generally during the vacations), students unwittingly left their devices disconnected from mains power for longer than a week, and as a result had to reinstall all the software they were provided with, including the wireless card manager. They also had to copy all their data back, and on occasions lost data that had not been synchronised with a PC

The backup process (part of the standard synchronisation software) was reported by a number of students as being slow and unreliable. Thus, participants backed up infrequently, compounding the difficulties experienced when the memory was erased.

Screen width, general crashes and applications not fully closing (and therefore slowing the device unnecessarily) were also cited as annoyances about the device. All students agreed at the final focus group that a foldaway keyboard would make a big improvement for text entry on certain occasions.

### 3.2. Usability and usefulness of the iPAQ as a learning organiser

No one tool stood out as the ‘killer app’ that was likely to revolutionise the students’ learning or personal organisation. A number of measures were recorded including frequency of use and perceived usefulness. Table 1 shows the perceived usefulness of the various tools at three stages of the trial. Students were asked to rate each tool as ‘very useful’, ‘useful’, ‘possibly useful’, ‘probably not useful’, ‘not useful’ or ‘don’t know’. Communications tools and the timetabling features were consistently amongst the most useful. They were also the most frequently used. At the 10 month stage, 7 or more students (out of 17) were using these communications and timetabling

applications at least twice a week. This compares with between 2 and 4 students using the applications relating to course content more than twice per week. Course content and the concept mapper show a trend of decreasing usefulness over time.

Table 1. Perceived usefulness of tools (‘useful’ or ‘very useful’) after 4 weeks (n=17), 16 weeks (n=14) and 10 months (n=17).

	4 Weeks	16 Weeks	10 months
Timetable	59% (10)	64% (9)	82% (14)
Web browser	65% (11)	64% (9)	71% (12)
Instant messaging	59% (10)	50% (7)	71% (12)
Email	76% (13)	79% (11)	65% (11)
Course materials	59% (10)	43% (6)	41% (7)
Supplementary materials	53% (9)	43% (6)	24% (4)
Concept mapper	35% (5)	14% (2)	0% (0)

It should be noted, however, that the students were provided with less content and materials later in the course and at the time of the 10 month survey, most students were concentrating on project work.

Participants were asked to name the tools that made the greatest impact on their learning, personal organisation and entertainment. The freeform answers were collected under generic headings. Table 2 shows that for learning, course materials are regarded as having most impact despite the lower perceived overall usefulness. Despite the wireless connectivity in the department, web browsing and email facilities did not feature highly. Concept mapping was not considered of greatest importance by anyone in any category.

Comments made in the freeform survey and at the focus group brought to light the following usability issues:

- The Student Learning Organiser software frequently ran too slowly to be usable
- Content and timetable information would have been easier to download had it been deployed online rather than through the synchronisation tool
- Much of the content made available by lecturing staff over the web was not optimised for Pocket Explorer, making it difficult to read

- The concept mapping tools were difficult to use without further instruction
- Participants were reluctant to use the concept mapping tools since the content was not storable in an upwardly compatible format

Table 2.: Perceived impact of tools on learning, personal organisation and entertainment. Number of students naming tool as having greatest impact. NB. Not all participants answered all three questions.

<i>Learning</i>	Personal Organisation	Entertainment
Course materials (6)	Timetable and deadlines (6)	Media player (7)
Browser (3)	Calendar (5)	Games (3)
Timetable and deadlines (2)	Writing/note taking (2)	Messenger (2)
Writing/note taking (1)	Email (2)	Browser (1)
Calendar (1)	Task manager (1)	Writing/note taking (1)
		Reader (1)

### 3.3. Patterns of use

The study aimed to find out where and when students would use not only the device, but also its constituent tools.

As can be seen in Fig. 6, use of the iPAQs overall declined over time. However, the number of participants using the devices many times per day stayed much the same. Starting with a more even spread, usage became more polarised between those who used them very frequently and those using them very infrequently.

Participants were asked to say how frequently they used the iPAQs in four different locations, and whether this was for MSc-related work or other activities. Table 3, shows the rank order of these locations throughout the study. At home and in the department were the locations shown to be the most used early in the study for both MSc and unrelated activities. For unrelated activities ‘travelling’ outranked the department towards the end. It is worth noting again that more project work is carried out towards the end of the course, so it is likely that students will spend less time in the department. However, this result may also suggest that the students were finding more uses for the devices and beginning to see their value as mobile tools.

Students were invited to describe their own patterns of use. Some interesting observations include:

- Although email is synchronised to the device, students only tended to use this when in an area covered by the wireless LAN
- Email and instant messaging were frequently mentioned together as if they were complementary tasks
- Participants used the calendar and timetabling in any and every location as they had need. The iPAQ became a replacement for traditional diaries
- In the 4 week survey, there were many references to using the device for listening to music and playing games. By the sixteen week survey, these activities had been largely replaced by email and instant messaging
- A number of students reported regularly reading course materials, offline web content and e-books when at home or in their dormitories. This was surprising, since the final focus group revealed that all of the participants had their own desktop or laptop computers in their apartments
- For a few students, this was the first time they had kept their personal organisation information in an electronic format. Amongst those, some only made use of this information through the PDA, even though it was synchronised to a laptop or desktop

A separate question on how students’ use of the iPAQs had changed over the course of the year did not yield any noticeable trends. Some students attempted to use it for everything in the early stages before accepting that some tasks were better done on a normal PC. Others, who were sceptical at first, later became frequent users of the devices. Either way, after ten months, students had evaluated the capabilities of the PDAs, adapted them to their needs and settled into a personal pattern of use. Few students gave up using the device altogether.

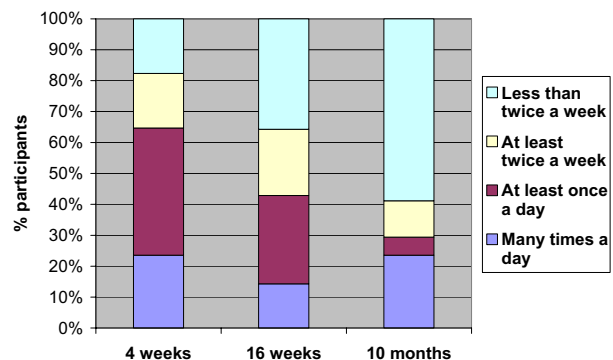


Figure 6: Frequency of use of the iPAQ through the course of the trial

Table 3: Rank order of frequency of use for 4 locations for MSc-related work and (other activities)

	4 weeks	16 weeks	10 months
Home	1= (1)	2 (1)	2 (1)
Department	1= (2)	1 (2)	1 (3)
University (elsewhere)	3 (4)	4 (4)	3 (4)
Travelling	4 (3)	3 (3)	4 (2)

### 3.4. Other tools that students chose to use

Participants were encouraged to use the devices for their own personal activities and to install any software they wished. A number of them chose to develop software for iPAQs as part of their project work.

Not surprisingly, amongst the most popular downloads were various games and an additional media player. Several different PIM (Personal Information Manager) applications were tried as alternatives to the ones included with Pocket PC or the integrated learning organiser. Other installations included a money manager and a photo album.

Two students used Microsoft Portrait (a Pocket PC equivalent of NetMeeting). One of these students reported to have used this to contact his family living on another continent. He received audio and video of them, and was able to speak to them, using the iPAQ as a mobile internet phone.

Several of the students installed Chinese character support for their communication with one another and their friends and family at home. In the focus group they requested that this should be included as standard in any later projects, since finding and installing a suitable package had taken some time to do.

Only two online services were subscribed to by any students. Three students used AvantGo on a regular basis to synchronize web content including news.

In total, just eighteen pieces of additional software were installed, and these by only eight students. This result was explored further in the final focus group, and two reasons became apparent:

- 1) Most students saw all the value of the iPAQs being either in time management or in email/messaging. These were already catered for with the standard software.
- 2) Because the devices had to be returned within the year, participants were reluctant to invest much of their own money or time in personalization.

### 3.5. General Attitudes

An attitude survey was conducted as part of the final questionnaire. Students were asked to rate

statements on five-point Likert scale from 'Strongly Agree' to 'Strongly Disagree'. The responses were then weighted from 2 to -2. The sum of weighed responses from each question was then used to measure overall agreement/disagreement. Table 4 summarises the results.

Table 4: Sum of weighted responses on a five-point Likert scale (weighted from -2 to 2). Respondents = 16. Maximum/minimum potential score = 32/-32

Statement	Sum of weighted responses
a) I think the iPAQ has assisted my overall learning process this year.	3
b) I think I planned better for my learning with the iPAQ than if I had not had it.	6
c) Having to use the iPAQ hindered my learning	-11
d) I would have used the iPAQ more had there been fewer technical problems.	0
e) I found battery life a significant problem.	17
f) I felt uncomfortable using the iPAQ because I didn't know how to use it.	-13
g) I felt self-conscious using the iPAQ in public	0
h) The advantages of having an iPAQ outweighed the drawbacks of taking part in the trial (attending meetings, doing questionnaires etc.).	9
i) I have changed the way I plan for learning as a result of using the iPAQ.	3
j) I have changed the way I take notes as a result of using the iPAQ.	1

Only four statements have significant results associated with them:

- 1) Using the iPAQ did not *hinder* learning (c). However, neither did it greatly assist (a).
- 2) Battery life was a significant problem (e), as discussed elsewhere.
- 3) Students were not put off using the devices through difficulties in knowing how to use them (f).
- 4) The perceived advantages of having a PDA outweighed the disadvantages of taking part in 4 questionnaires, 3 focus groups, 1 training session and keeping a log book for six weeks (h).

It was never intended to conduct a quantitative study into the learning gains brought about by using mobile technology. However, in the students' eyes, the technology has been useful to them, but has not revolutionized or improved their learning to any great degree. It seems simply that the learning organiser is just *another* resource amongst many.

A separate question was asked, that assuming students had access to a PC at home and one in the department, would they prefer a laptop or a PDA as their *only* mobile device. The responses were 9 to 6 in favour of a laptop. This is far from the unequivocal preference that could be expected from 1), the quantity and variety of negative issues raised about the PDAs and 2), the obvious advantages of a fully-functioning portable PC. This question was pressed further in the final focus session where students were demonstrated a Tablet PC. Even with a Tablet PC as the alternative, the same proportion of students preferred the PDA.

Six of the students claimed there were never any times whilst using the PDA that they would have preferred the use of a laptop. This could suggest either that the PDAs sufficiently met their mobile needs, or simply that they made judicious choices as to when to use them and so were never disappointed.

Asked in the group interview, nobody felt compelled to buy their own PDA following their course.

### 3.6. Institutional Support

The questionnaires highlighted issues with institutional support for the mobile learning organisers, which were explored further in the final focus group.

Students' complaints and suggestions were the following:

- Not all lecturing staff used the learning organisers themselves, thus there was no standardized provision of content and course dates throughout.
- Timetable information was not provided consistently throughout the year, and was not always in time to be useful
- The PDA added to the modes of communication between the department and the students. This made it harder to find relevant information quickly. It was suggested that *all* information, including administrative should be provided via email so that students had a single reliable source. This was of particular importance to the MSc students who were new to the University and had more background information to find out
- In order for wider adoption of the technology to take place, students felt that it would be necessary to offer more training sessions and drop-in clinics on using and extending the devices. In particular,

concept-mapping should be taught as a skill before students are expected to use the mapping tools

- Technical integration with other departmental systems should include printing, a backup system, synchronization cradles or similar at PCs in the department and a means for easily transferring paper materials to the Microsoft Reader format

### 4. Next phase

The authors plan to continue using PDAs as mobile learning organisers for students, and will take on board many of the suggestions made by the students in this trial. Students used their devices predominantly at home and in the department because this is where they could be connected to receive live or up-to-date information. This is clearly of importance to the user. As the University continues to install wireless networks across the campus, there will come a time when students are not limited to access in the department and library, but also in the bars, shops and other public spaces.

The next study to be conducted by the authors is an extension of this research, where Tablet PCs will be provided to a cohort of students, with iPAQs as an optional extra for comparison. It is already planned that the mobile technology will be further integrated with the department's activities, incorporating Tablets into mentoring, assessment and seminars. The number of participants will be double that of this study. Addressing the issues raised by this study, the new trial will offer:

- Increased connectivity (at home as well as in the department)
- Better training and support for new modes of working through workshops and mentoring
- A portal, linking students to institutional information as well as course content and timetabling
- Applications aimed at utilising the wireless Tablet's affordances including real-time collaboration, electronic logbooks and fully pen-based concept-mapping

Through an iterative cycle of requirements gathering, development and evaluation, the offering will be continually improved and will drive a full specification of the tools and services required by a mobile student in the context of this Department and others like it.

## 5. Conclusions/summary

This study was designed to discover the patterns of use of a mobile learning organiser (wireless Pocket PC with appropriate and useful software installed) when used by students in a wirelessly networked study environment and other locations of their choice. Impact on learning itself was not measured, nor would it have been possible to measure meaningfully when the devices were used for such diverse purposes.

A few clear modes of use did emerge. Students made considerable use of the calendar and timetabling features as well as the communications tools. More use was recorded in their department of study than elsewhere. Study materials were also well used, and participants did request that more content could be delivered in this way.

PDA-optimised content was well used, and there was a clear request from students that more resources be made available in PDA format, including administrative information.

There is no conclusive evidence of the need for a specifically designed suite of tools in addition to those already included in the device, although the time management tools were well received. The ensuing study will work to systematically elicit a set of requirements for an integrated learning organiser, to see what, if any, tools need further development.

The concept mapping tools were not widely accepted. This is not proof that they are not required or are not helpful. Rather, at this stage, the evidence simply suggests that the specific tools had usability issues and that students were not well acquainted with the skills of concept mapping. Participants were also concerned that maps could not be easily transferred to other software and devices after their course. Each of these problems will be addressed in subsequent studies.

Ownership of the technology is clearly important. Whilst the PDAs are loaned, students are reluctant to invest time and money in personalisation and extension. Despite this, several of the students were able to see future benefit of the devices as learning aids and invested time as part of their projects in developing software for them. A higher specification of device is also likely to increase use. If students can download more music and other content, they are likely to become more embedded in their whole lifestyle.

Only one student made use of the wireless network card in another location (home and at a train station). As wireless networks become more prevalent then the device will become fully functional in more settings. It is likely that acceptance and patterns of use would change considerably

Institutional support needs to be greater to allow the learning organisers to be used more fully. Regular

updates of timetables and content, as well as adequate training and hardware provision are needed. It is clear that the environment as well as the hard and software must be well designed for the purpose. It is difficult to commit much organisation resource for a small scale trial, but it is hoped that more can be assigned to subsequent trials. As more students bring the technology with them, change will most likely be driven by their demands as consumers.

It has been shown that the mobile learning organisers used in this study did not 'revolutionise' students' styles or patterns of learning. However, they did have some impact on the way the students worked, and on the demands placed on their lecturers. As mobile technology becomes a more intrinsic part of everyday life, it is important that these patterns and demands are known and understood.

This was also a first attempt at designing an integrated learning organiser. Further designs are underway and are being shaped by the findings of this trial. We still hope to find the 'killer app' of mobile learning!

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