# PORTABLE ASSESSMENT: TOWARDS UBIQUITOUS EDUCATION

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## ABSTRACT

This paper reports on the progress of a project, conducted at the University of Glasgow, to investigate of the benefits of Personal Digital Assistants (PDAs) as teaching, learning and formative assessment tools and the practicalities of deploying PDAs and assessing their use.

Benefits we have recorded in the study include;

- Ubiquitous access to course material, formative assessment and course information allow opportunities for learning outside campus environment, under the control of the student.

- Students quickly engage in the new learning process through a sense of PDA ownership, which aids a perception of owning the learning experience. This is strengthened through automatic, personalised and non-judgmental feedback. The sense of ownership ensures that the resource is used responsibly, and moulded to each students lifestyle.

- Paradoxically, we note that collaborative learning increases, as students are more likely to transfer data between PDAs, and discuss the results of their work one with another. Transferable skills in IT, team work/interpersonal and both written and verbal communication are thus fostered.

- Particular benefits were discovered for Wider Access students, where PDA use engaged students in the course material, built self esteem, and fostered a new attitude towards learning.

The one year pilot project was funded by a Learning and Teaching Support Network (LTSN) mini-project grant. The mini-project was titled "Portable Learning and Assessment - Towards Ubiquitous Education". The budget of £3000 was used to purchase 25 basic PDAs plus spare parts, software and batteries.

The students involved in the project were from a level three course in electronic system design which is part of the degree of electronics and Electrical Engineering. In addition the PDAs were used during the University summer schools for school leavers.

## INTRODUCTION

For several years staff in the Departments of Electronics and Electrical Engineering and the Robert Clark Centre for Technological Education at the University of Glasgow have been collaborating on projects to enhance access to, and provide effective delivery of, university course material. The work has previously focused on the application of computer-based learning and assessment methods to a range of undergraduate courses. The results have demonstrated that the use of regular formative assessments and appropriate student feedback can have a marked effect on overall course results.

We wanted to enhance access to assessment and learning materials by utilising portable devices to increase accessibility and flexibility of learning for students.

With many students needing to work part time their available spare time for study has been reduced. Any learning resource that can be utilised during the rare gaps in a contemporary students busy schedule is a valuable asset to them.

The handheld computer or PDA is an ideal platform to facilitate such a task. The immediate readiness of PDAs (switch on and use, no boot up time) makes them ideal to grab a few moments useful working time at times and in locations where even a laptop would not be useful. A PDA may bring additional benefits to a student. The organisational, diary and note taking tools that are built into most PDAs may help the student to develop better organisational skills.

Portable devices are becoming increasingly important within education and it is recognised that *"mobile devices can become efficient and effective teaching and learning tools"* Roibas et al.(4). PDAs provide computing performance comparable to previous generation laptop PCs, with constrained display size, whilst benefiting from battery lifetimes measured in weeks, and

prices some twenty times less than modern desktop systems.

Assessment is an important component of education as it provides feedback to the student *"The role of assessment in the learning experience is crucial."* Brown et al.(1). Computer aided assessment can provide the opportunity for rapid feedback while additional benefits of PDAs are "on demand" assessment with which a student can test their knowledge in a regular and flexible manner enabling them to direct their studies to areas where they have identified a gap in their knowledge.

Other studies have noted the importance of portable systems to provide opportunities for learning. *"Our team carried out a detailed study of how radiology is taught and practised. One clear finding was that trainees have very little spare time. They cant take the time to sit in libraries or computer labs, and so any computer-based learning must fit into the gaps in their busy schedule - in the hospital, at home, when travelling - which means a personal and portable system."* Sharples(5)

The importance of PDAs being at hand has been highlighted by users in other studies, a typical student comment being a PDA is something that is *"unobtrusive and neat and that could always be ready at hand"* Waycott et al.(7)

**PROJECT DESCRIPTION**

As well as evaluating the PDA's potential as a CAA platform the other benefits that the PDA may bring are also important. We also considered it essential to evaluate the research process and the performance of the measuring tools used in the project.

- Evaluate whether a PDA can help student learning.
- Monitor when PDAs are used by students and for what purpose.
- Investigate interface and usability limitations within the educational context
- Identify mechanisms to evaluate the use of PDA's in education
- Identify practical problems of PDA use in education

In other studies, reports of how and when PDAs are used have relied on observations of how the PDA appears to be used and on feedback, via questionnaires, asking participants what

applications they used. The reliance on questionnaires makes the data potentially unreliable as it relies on the participants' memory. We choose to use an automatic logging mechanism. Automatic logging also allows the collection of other information such as when the PDA has been hotsynced to a desktop machine, or when the student has used the "beam" facility to exchange items with another PDA.

Having objective data allows quantitative analysis of student learning styles - how often students break from the CAA tool, how long breaks last, and what they do with the PDA during those breaks. In later stages of the project logging will also be enabled within the Quiz application. This will enable further analysis of learning styles within the controlled environment of the CAA question set.

The PDAs used in our project use the Palm OS operating system. There are a number of companies who manufacture compatible machines that can run Palm applications. Among the practical factors which influenced the choice of Palm OS were:

- Palm OS PDAs are less expensive than competing products
- My familiarity with writing Palm OS applications
- Palm OS based PDA's currently have the biggest market share

**Application Logging**

There are a number of applications available to journal the amount of time applications are used on the PDA, but none of these record enough detail for our purposes so we wrote our own. AppLog Ninelocks(3) is an application-logging tool which was written to assist researchers studying the use of PDAs. Applog records the time, date and application identifier whenever an application is used.

When the PDA is synchronised with the desktop application the log file on the PDA is processed to produce a text file on the desktop system containing:

- Application identifier
- Date and Time the application was started
- How long the application was used

The file produced is in tab-separated format suitable for use with spreadsheet and database programs. The log files were post-processed

using custom written applications to produce usage reports and visual representations of the data.

Objective analysis technique such as the logging can be time consuming to analyse and cross reference Traxler et al.(6). To make our task easier we automated some of the processing of the log files produced by AppLog to give summary reports and pre-process the data for analysis using a custom graphing package. The graphing application enables use to view the data as:

- The number of times an application has been used.
- The total amount of time for which an application has been used.
- The session history for an application.

**Progress to date**

Two groups of students have been involved in the project. The first group consisted of 14 students, in advanced level electronic engineering classes, were issued with PDAs. The students chosen had already worked together for a term and knew each other. They were mix of joint honours computer science students described as being well motivated and with a good electronic systems background. It was thought that these qualities would mean only the most critical technical problems would need any assistance from support staff.

The second group were 5 "summer school" students. The summer school is for school leavers and is part of the universities wider access program. Summer school ran for ten weeks and consisted of two 3 hour sessions per week. The students used the PDAs during lecture and practical laboratory sessions and were allowed to take the device home.

Each student was loaned a PDA which contained a logging application to record when the PDA was used along with a quiz application to deliver formative self- assessment questions. Additional applications were pre- installed on each PDA, the applications included chemical tables, a scientific calculator and document readers. The students are encouraged to install their choice of additional applications on the PDA's.

The students were only given minimal training in the use of the PDA and its applications. This enabled us to discover how capable the students are of finding out how to use the PDA without training. If PDAs are to be deployed in larger numbers training could be a significant overhead so we were interested to find out how minimal the training could be.

The students who were not selected to use the PDA have been issued with the same study materials in printed form; this is also intended to give us a control group of students to compare performance against.

It was impractical and undesirable in the initial phases of the project to issue PDAs to an entire class. It was more practical to work with a smaller group as this made support issues easier to handle.

**Results**

The first data collected from the PDAs was after the PDAs had been used for approximately 2 weeks. The PDAs were initially supplied without any content for the quiz application, this was to give them time to get used to using the PDA. The first quiz questions were beamed to them 5 days before we collected the first data.

The first log data was collected two weeks after the start of he project showed that the students were using the PDAs and were installing applications on them. Most had connected their PDA to a desktop. All had installed at least one game. What is not certain is whether all the applications were installed from a desktop machine or if they beamed the application to each other. The logging software has now been modified to record when beaming occurs.

Although the students used the PDA's for a further two months we only managed to collect a limited amount of data. The students repeatedly failed to turn up at specified times to synchronise their PDA to our server. We did receive a few additional log files but as the data was for different users at different phases of the project, it was of limited use. All the students were given a questionnaire to fill in to give us feedback about the project. Even though the students were reminded on numerous occasions no feedback forms were returned.

To avoid the poor return of feedback forms a different strategy was with the summer school students. The summer school students were issued with questionnaire at the end of the project, but this time they were handed it after their final exam and were asked to complete it before leaving. So we had a 100% return of questionnaires.

It appears many users stay within one application, then wake the device up periodically to resume their work. This mode of operation was not very well indicated in the logging application so this has also been modified to record these events more clearly.

**Benefits.** Beaming of the quizzes was seen as an easy way for the tutor to distribute materials.

Two students from the first phase of the project bought their own PDAs.

The course tutor reported that the quiz application had acted as a useful catalyst for discussions with students. E.g. One student thought that one of the questions was incorrect until it was pointed out that they had failed to consider other aspects of the question. The discussion with the tutor assisted the students understanding of the subject.

Students also commented that they liked the mixture of questions, from the easy ones that "could be done on the bus" to the more difficult ones that required additional time and calculation to answer.

One complaint about the quiz questions made by the students was that there were not enough of them!

The summer school students were particularly hooked by reading ebooks on the PDAs. This had an interesting side benefit; As the tutor had a large collection of free ebooks he was able to beam these to the students. Their tutor was very positive about this aspect stating that; "We don't normally get to know the kids beyond our own subject area, so this put a whole new slant on the summer school". The work with the summer school students was reported in more detail in an Times Education Supplement article Caldwell(2)

The comments made by the students were of mixed level of enthusiasm;

"When you're just walking down the street and you get an idea, at least you've got somewhere to note it immediately"

"The screen is just too small and the font is too small. I find it quite uncomfortable to look at for any length of time"

"....If I wanted to work on the bus I'd just take out my books"

**Reflections**

In each phase of the project we lost useful usage logs as the batteries had been allowed to run out. It is therefore essential that the students synchronise their PDAs regularly. Failing to replace batteries in adequate time or loosing data whilst taking too long to change batteries was seen to be more of a problem during the holiday break.

We believe that if the students were given rather than loaned the PDAs then they would use them more whole-heartedly. With both sets of students interest in using the PDAs waned towards then end of the project, this occurred with both sets of students.

We have received additional institutional funding so that we can extend this work to a full, four year trial. This will allow a cohort of 50 students studying for a Batchelor of Technological Education, portable, ubiquitous access to learning, assessment and administrative materials via PDAs. The project will provide students with access to the latest technology, provide a new amenity for learning, and enhance the University campus.

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