Adult Multimedia Learning with PDAs – The User Experience

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Abstract

Can rich interactive multimedia learning experiences be created for adults to use on a Personal Digital Assistant (PDA)? This was the research question that prompted this exploratory work into creating mobile learning applications. The result is the development of two prototypes of multimedia learning applications for the PDA. The first is a mobile local history tour designed to support informal learning. The second is a learning object on Java programming for higher education students, which has been adapted for the PDA. The applications will be briefly described, with the underlying design and pedagogic principles. Both have been evaluated with representative target users, and the remainder of the paper will focus on the user experience of using the applications and the PDA in these two distinct learning scenarios. Despite their differences, a number of themes emerge. Some of these were expected such as the advantages afforded by mobility and portability and the new learning spaces that become available. Others not anticipated relate to the learning experience the PDA provides. Both user groups particularly liked the use of audio: for example "audio provided real depth to the tour", "I learn more by hearing". The students found the PDA object "much more interactive", "more understandable" and particularly liked it because it "is smaller than a book". The paper presents more of the in-depth and rich feedback from users, illustrating the success of this research.

Keywords

PDA, adult learning experiences, multimedia learning materials, learning objects

1. Introduction

This paper reports on the results of our initial work in developing mobile multimedia learning materials for the personal digital assistant (PDA). In particular, it focuses on the users' experiences of using the applications and the PDA. The impetus for this work came from a number of research questions that we wanted to explore and find answers for. Can rich interactive multimedia learning experiences be created for the PDA that will foster more mobile and flexible learning resources? We were also interested to know how adult users would respond to the PDA as a learning tool, and what (if any) benefits emerged. We had been working in developing innovative multimedia eLearning materials, using the benefits of multimedia to engage, stimulate and support the learning process (Boyle, 1997). Could the pedagogic and design principles employed in developing rich multimedia materials be applied to mLearning, utilising widely available mobile devices?

A number of benefits are associated with the PDA, encouraging its use as a learning tool. It is small, lightweight, portable and can be held in the hand. Users perceive PDAs to be novel, personal, and even cool, and consider them to be more like mobile phones than computers, with comparable ease of use. Whilst still largely viewed as a professional tool, they are becoming more prevalent. During our interviews with students, one mentioned that about 60% of his fellow students studying Business Computing had a PDA, suggesting that they are becoming more common amongst H.E. students. Several research projects have been implementing PDA learning trials with adults, and are now publishing the resulting conclusions and benefits. The European 'MOBilearn' project has explored new ways to use mobile environments to enhance learning in various contexts (MOBilearn Project Website). The 'm-learning' project used mobile technologies with young adults (16-24) to try to engage them in learning activities and promote lifelong learning. A trial of using PDAs with homeless learners reported an enthusiasm to continue with mobile learning, which could be considered to point towards its sustainability as a learning tool (Savill-Smith, 2005). The Tate Modern art gallery in London has trialed PDA-based multimedia

tours. They also found that users were enthusiastic about the service and the tour, and that visitors generally see this technology as an exciting and inevitable part of the future landscape in museums (Proctor and Burton, 2004).

Our research aimed to capitalise on the optimism and viability of using the PDA as a learning tool, and to start providing answers to our research questions. Two prototype applications for the PDA were developed. The first is a mobile history tour designed to support informal learning. The tour is taken on the streets of an area of London, and combines a series of walks with audio guides, and multimedia historical information (maps, photographs, illustrations, audio accounts). The second is a learning object on Java programming for higher education students, designed to support their campus-based learning. This object has been specially adapted for the PDA. The paper describes the two prototypes more fully, and then discusses detailed evaluation data gathered from users about their experiences of using them on the PDA.

2. The Mobile Local History Tour

The 'Lost Worlds of Somers Town' is a mobile local history tour of an area in London using a PDA. On the tour the user learns about, explores, and discovers the history of the area over the last 200 years. There are eight short walks. Each is highlighted on a map on the PDA, and has an audio guide that gives instructions on which way to walk, what to look out for, and provides historical information about the area. Each walk finishes at a 'dig', a location with specific historical significance. At each dig, users can explore the history of the location, by looking at photographs, illustrations and maps, and listening to historic accounts of the area from contemporary witnesses. These elements combine to give the user a glimpse into the 'lost worlds' of the area that no longer exist. The tour is interactive and users have full control over how they use it. A supporting website (Mobile History Website, 2004) provides materials and links for further learning. The tour can be downloaded and installed on a PDA, and it can also be tried out online from the web site.

Figure 1. A screen from the mobile history tour

A number of design and pedagogic principles have been incorporated into the tour. Multimedia is used to bring history alive, provide sensory richness and engage and stimulate the user, through images, text, and audio. The audio guides are an important part of the tour, and were designed to achieve a sense of intimacy and "act like a friend" guiding you around the area, inspired by one of the findings from the Tate Modern pilot (Proctor and Burton, 2003). Devising interesting ways to present local history, to allow users to carry out historical discovery and exploration was also a key aim. A tangible model of the past is offered, that users can imagine and compare with the present, and make their own interpretations. The tour provides opportunities for users to uncover many possible narratives rather than presenting "a God's eye-view of a subject" (MacKenzie, 2001).

The tour integrates a number of learning paradigms as advocated by Naismith et al (2004). It has been designed to support informal learning. It is context-aware: user's draw on the environment around them as they walk along the tour route, guided and informed by the PDA and its supporting material. Learning about the area's history is situational, rather than museum based or desk-bound. The tour also supports constructivist learning as learners are actively constructing their own view of this environment and its history as they progress through the tour. Learning should take place where visitors are allowed to discover things for themselves (Raiselis, 2002), a process that will involve the user in constructing a mental representation of the historical world (Russell, 1994).

3. Learning Object for Java Programming

A prototype of a learning object on Java programming for the PDA was developed by adapting an existing object designed to help first-year students to learn programming. These learning objects are part of a blended solution for students, and are delivered through a VLE. They are authored in Macromedia Flash, and are short, self-contained resources that focus on one small learning objective or topic and explain the often abstract key programming concepts that students find difficult to understand. This was achieved by employing a number of constructivist learning techniques that encourage active learning, but also support the student's progressive understanding. They are interactive, engaging and easy to understand. Java programming code is broken down into step by step sequences that is visually highlighted, and explained using simple text descriptions. Visualisation of abstract concepts is supported by the use of everyday familiar examples, animated where possible. Interactive models that illustrate Java code examples enable the students to change variables and see what happens. Scaffolding is used to provide learners with transitional support in learning a task, for example through interactive quizzes that allow programs to be constructed from fragments of code. The pedagogical design of the objects is discussed in more depth in Boyle and Cook (2003), and an online paper has further descriptions and links to some of the learning objects (Bradley and Boyle, 2004).

Our concept of learning objects as small, self-contained units or chunks of learning material offered within a broader structured pedagogic framework should naturally adapt to the PDA, where small, short pieces of learning can be fitted into available time slots whilst students are traveling, have periods of free time, etc. As such, our learning objects lend themselves naturally to the mobile learning paradigm - learning when and where it is appropriate for the learner. We have found from the evaluation of our learning objects that students at London Metropolitan University like the added flexibility afforded by having online learning materials. Students now are likely to have other roles in life, for example parent, carer, and many are working to support their studies. Mobile learning objects could extend this flexibility of use.

The research agenda was to see if one of the objects could be adapted to the PDA, whilst retaining the multimedia richness and pedagogy of the original, but offering a more flexible, mobile alternative. It was also important that the PDA provided comparable functionality and performance. A learning object on 'while' loops was selected for adaptation to a Pocket PC or Palm. The PDA screen dimensions of 320 x 240 pixels (full screen) meant re-thinking some aspects of content presentation and screen layout. Most of the explanatory text was replaced with audio commentaries, alleviating potential problems of screen overcrowding, text legibility and readability. In developing the audio for the PDA, careful scripting and tone of voice for the commentaries was crucial to ensure it was effective for students. Buttons for the audio explanations replaced the text on each screen. Animations were reduced in scale, and details were simplified to retain clarity. Some of the interactive elements had to be changed, to suit the 'point and click' method of user control on the PDA, for example in the self-test quiz, but the fundamental goals of the task were not changed. The underlying pedagogy was not compromised in the PDA version.

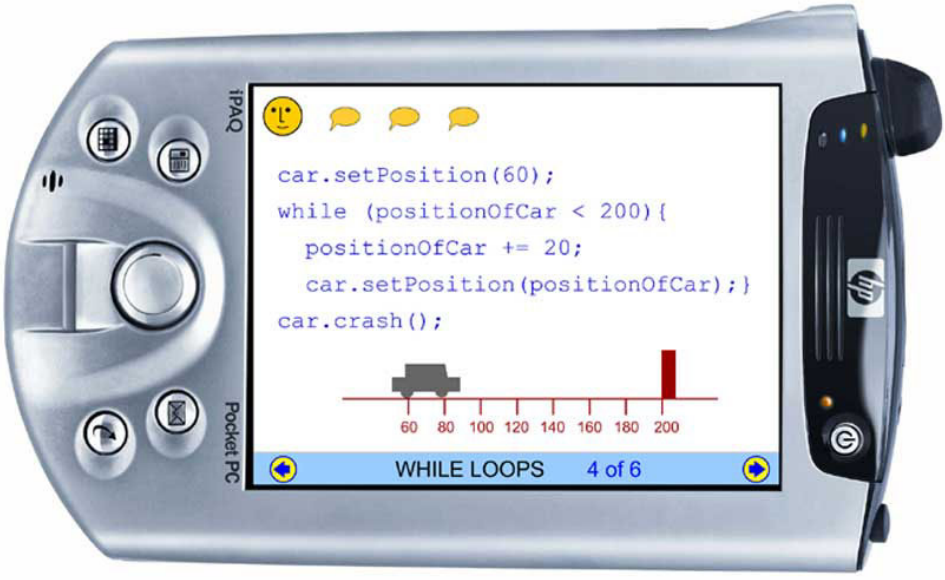

Figure 2. A screen from the 'while' loops learning object for the PDA

The completed PDA learning object can also be used online on a desktop PC (see Learning objects for introductory programming website). Another paper describes both of the prototypes in more depth, and the development and design process (Bradley and Haynes, 2005).

4. Users' experiences of learning with a PDA

Both of the prototypes have been evaluated in depth with representative users to provide feedback on the prototypes, the use of the PDA as a learning tool, and the resulting learning experience. The history tour was evaluated by 10 users, 5 males and 5 females, all over the age of 25 with some interest in local history. Half the users had some prior experience of using a PDA and half had none. In pairs, they used the tour around the streets of Somers Town for at least an hour, equipped with a PDA and headphones. On completion of the tour, each user completed a 4-page paper-based questionnaire designed to capture both quantitative and qualitative data.

The While loop learning object was evaluated in depth by 4 students studying computer science at the university. All were males, aged between 20 and 37, and had used the PC-based learning objects during the Java module. Only one had some experience of using a PDA before. The students attended individually, and each was given a PDA with the object installed and a set of headphones and instructed to take as much time as they needed to work through the object. They each used it for between 10 and 15 minutes. Afterwards, each student was interviewed using a standardized set of questions. They then completed a paper-based questionnaire, comprising 22 questions designed to capture both quantitative and qualitative data, and provide triangulation with the interview data.

Data from both studies has been analysed using grounded theory (Strauss and Corbin, 1990). The data has revealed a number of recurrent themes that are common to both user groups and their respective learning scenarios on their views of using the PDA as a learning tool. This is the data that we will focus on in this paper.

4.1 Benefits of the PDA for learning

Much of the anticipated feedback related to the nature of the PDA and the advantages afforded by mobility, portability and the new learning spaces that become available as a result.

Our student users were comparing the use of PDA and PC applications, and made many comments about the mobility and portability of the PDA. Being able to use it anywhere and everywhere was an advantage cited by all of them. Examples given ranged from at university, on the way to and from university, on a bus, tube, train, in a car, at work, at home, on holiday, anywhere in the world, wherever I am. Convenience is confirmed by comments such as "It provides an opportunity for the learner to learn at their own time and at their own pace". Another said that one of the advantages of using a PDA for learning and support for a course was that it was "flexible". Size was an important issue for all the students. Two students described the PDA as "handy", and another "compact". Two students spoke of the PDA being "comfortable", something that you can easily hold and use. One of them said that he didn't like to study sitting down at a desk in front of a computer, preferring to study when relaxing, such as lying on his bed. The other said "This is really comfortable because even if I'm just walking down the road I can just have a quick look at it if have an exam etc. It is smaller than a book or A4 paper with your lecture notes." The use of the PDA device also attracted positive comments. All of them agreed that they found the PDA easy to use and control the learning aid (3 strongly). The performance of the PDA was also not a problem for them, all agreeing that the responsiveness of the PDA was satisfactory (3 strongly) and that reliability was satisfactory (2 strongly).

The students identified few disadvantages of using the PDA for learning. Any disadvantages mentioned centred on the device itself: the cost, security and limited storage space. High costs for students were a barrier to them using a PDA for learning. One student was concerned about the risk of being mugged when using it. Another was concerned about possible radiation from devices using radio frequencies. Adjusting to the smaller screen was not mentioned as a problem.

The history tour users gave more varied responses. The tour relies on a mobile device, but carrying it and using it on the streets of a city caused problems for some users. 7 agreed with the statement 'I liked the portability of the handheld, and you could hold it in your hand, and easily slip it into your pocket' and 3 disagreed (1 strongly). One said of portability, it "doesn't go in female pocket". Of the 3 things not enjoyed about the tour, 5 reported problems with carrying and using the equipment, ranging from "stylus too fiddly", "no strap on handheld", "I found the handheld plus headphones cumbersome", whilst one said that they kept accidentally

unplugging the headphones. 3 users reported problems in being able to see the screen in bright sunlight. 2 were concerned about their personal security in using the PDA, "I felt vulnerable in busy places". Other comments were that it's "not easy to use when walking (moving)", and "felt very conspicuous". Two users however did not seem to have any difficulties "never used a handheld before, but found it straightforward", "impressed as first time with handheld it was easy to use".

4.2 The learning experience

When we started this work, we did not know how users would react to the learning experience from using the PDA and application. We hoped they would not only find it a stimulating experience, but that it would also provide another dimension to alternative methods for learning. Of the themes that emerged here, many were not anticipated, and we were pleasantly surprised by the feedback we received.

Both user groups felt that their respective applications offered added value to their experience. 9 users agreed that the Mobile History Tour brought the history of the area alive (4 strongly), and all agreed that the technology of the handheld enhances a local history guide book or oral history tour (3 strongly). Comments included: "Fascinating, and different from anything I've ever done before. Very impressive."; "For those interested in local history I'd say it's an attractive way to gain local knowledge whilst enjoying yourself."; "Pointed out areas of interest I'd not normally notice." For the Java learning object, all users agreed that it made the concept of the 'While' loop clear (2 strongly) and that the technology of the PDA enhances the learning aid (2 strongly). They all strongly agreed that they could imagine using PDA-based learning aids in their own time. One user found it "more effective" because of its ease of use and interactivity and "because it's easy and understandable". Another particularly liked the combination of interactivity, sound and the fact that it was nicely presented – "for all these reasons, I think it gave me a better learning experience". In the interviews, one said that they had never seen such a sophisticated learning aid, another said that "it is really good to do this for the PDA" and another "I really didn't imagine this on a PDA".

We underestimated the impact that the use of audio content would have on the user experience. The majority of users have reacted very positively to this in both applications. Audio is an integral part of the history tour. 9 of the users agreed that the audio guide for each walk was very useful (3 strongly). When asked for their first impressions of the tour and for 3 things they enjoyed about it, audio was mentioned 7 times. Reasons include "Voices describing social history brought it to life."; "I liked the different voices, the variety"; "I didn't have to look to read anything". Not only did the users like the audio guides and accounts, but they found them to be an effective medium of communication in a mobile situation. A comment relating to using the tour was that "Audio provided real depth to the tour, and highlighted areas of surprising interest." The main negative comments about the audio were that you should be able to pause it, and that some walk instructions could be clearer.

For the Java learning object, all users strongly agreed that the quality of the audio is high and it is easy to understand. One said that the sound "made the PDA version more fun and less stressful to use". When asked which 3 things they particularly liked about the application, all of the users cited sound. One said "it enforced a form of realism", and another "the sound is really effective for understanding it better". We asked about their opinion of the use of audio rather than text in the application. The first student said that "I learn more by hearing", "reading is a longer process I think, it is part of the learning process as well, but I prefer listening and interaction". The second said that "I like things that help me learn without me reading too much". "I find it easier to learn by listening, but obviously you have to concentrate and understand what you hear". He thought that the audio has more realism, and is more like someone speaking to you. The third student did not mention the lack of text, but liked the combination of audio and graphics. The fourth student said "the sound is really effective", "it's really helpful" and that "the audio is more interactive". He thought that audio played a big role in helping people to learn, especially if you are learning by yourself. Two users specifically mentioned that they thought that the audio contributed to an enhanced learning experience in the PDA version.

Some users liked the combination of multimedia content: being able to listen to the audio, whilst also looking at visual information or their surroundings. The "combination of map and audio worked well". Two students said that the PDA version of the learning object was more complete, with its combined multimedia elements and simple easy to understand audio explanations.

On user interactivity and control of the application, the mobile history tour users provided little feedback. One did say that one of the three things they most enjoyed was being "in control of information". Another said of the PDA "its use as a tour guide was rewarding in that there is an element of control in being able to look at visual reference and audio information at your leisure". For another user this was a barrier "an audio tour would have

suited me better, less stopping and clicking and having to get the handheld out on the street". However, three of the students volunteered many comments about interactivity, with the words interaction and interactivity used positively 33 times in the interviews and questionnaires (one did not mention them at all). These three students all cited interactivity as being one of the three things they particularly liked about the PDA application. They said it was "better than a book because of its interactivity", the learner can learn "at their own pace", "the interactivity in the learning aid plays a big role". All three students also thought that the PDA version was more interactive than the desktop one. The use of audio was thought to be instrumental in this, as it explains every stage of the while loop, and because "you listen and you take part in it". Two students also cited the self-test quiz at the end in which they test their understanding. Two students also said in the interviews that interactivity helps them to learn. One said "I can assimilate much faster and better with interactive learning support like the PDA". Another said he preferred to learn from things that were interactive.

User engagement and making the applications more interesting and fun to use was an important factor in making them more effective for learning, and we thought that the novelty of the PDA would enhance this. Both user groups were asked if their PDA applications were enjoyable and stimulating. For the history tour 9 agreed it was enjoyable (2 strongly) and 9 agreed it was stimulating (3 strongly). They all thought that the tour was memorable, and agreed that the design of the tour was attractive (5 strongly). Comments included that there were "interesting facts", "the idea of the digs, they give detail and interest to the tour", and that the tour was an "interesting and innovative idea". The feedback on the Java learning object was also very positive. All agreed it was enjoyable (2 strongly), stimulating (3 strongly) and that the design was attractive (1 strongly). Of the 3 things they particularly liked, one said it was nicely presented, another liked the overall graphic style because it was not dull, and another mentioned its attractiveness. Each student gave more expressive comments in the interview, "I think this kind of aid is amazing, it's wonderful", "overall I feel that it's really nice", "this is brilliant, this is really good", "it's really great though, it's a nice thing".

5. Conclusions

Whilst the scope of this work is limited to the development of prototypes and in-depth evaluation with a small number of users, it has shown that rich multimedia learning materials can effectively be produced for the PDA. Both our user groups consider that the resulting applications provide an enhanced learning experience over alternative learning methods.

The students were excited about the opportunities afforded by the mobility and portability of the PDA, in being able to learn anywhere and everywhere, at their own convenience. The only disadvantages mentioned for using it as a learning tool were cost, security and limited storage space. The history users also liked the portability of the PDA, but some users encountered problems in carrying and using it on the move on the streets of London. Some were also concerned about their personal safety. In spite of any difficulties, all users in both groups felt that the PDA applications enhanced their experience over alternative learning methods. The use of audio in the applications was highly rated by the majority of users. For the history tour it provided depth, variety and brought social history to life. Several of our student users expressed a preference for learning from audio, and the PDA version of the object is seen by them to be much more effective and interactive because of this. The feedback shows that using audio rather than text suits some user's preferred learning style. On the PDA, audio can be an easier medium to assimilate; it enables the user to be able to look at graphics or animations on the screen (without having to concentrate on reading text), and is easier to concentrate on when the device is used in a mobile situation. But it was the combination of multimedia content that some users liked. User interactivity and control was also mentioned by most users to be important for them. The students felt that the PDA version of the learning object was more interactive, saying that interactivity not only engages them more in the learning process, but it also helps them to learn more effectively. Some of the history tour users mentioned that they liked being in control of the tour and information. All the users bar one considered that their PDA applications were enjoyable and stimulating, and many positive comments were made about them being memorable, innovative, interesting and attractive. Such comments suggest that the PDA may encourage user engagement and make learning applications more interesting and fun to use.

A number of benefits of using PDAs for learning with adult groups are becoming apparent, and the results of our studies can contribute to this work. We can certainly report user enthusiasm for learning with PDAs, as found by other projects. An important benefit is that mobility adds another dimension to the flexibility and experience of learning, allowing a truly learner-centred approach to learning, in which the learner has more choice over when, where and how they learn. McLean says the ultimate assumption behind the mLearning paradigm is the transformation of learning (McLean, 2003), and there are many opportunities to explore the extent to which this can be taken, for both formal and informal learning

So far we have focused on delivering multimedia content, and there are opportunities to combine this with the communication and networking capabilities of mobile devices to provide more holistic learning environments and collaborative and sociable learning experiences. It is clear that mobile technology used within appropriate pedagogical frameworks offers many educational benefits.

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