MOBILE LEARNING: THE NEXT GENERATION OF LEARNING EXPLORING ONLINE SERVICES IN A MOBILE ENVIRONMENT

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Introduction

This paper is written as part of the European Commission's Leonardo Da Vinci project "Mobile Learning: The Next Generation of Learning"[1] in collaboration between three of the project partners. The paper profiles three separate research areas undertaken by the partners addressing trends and practice of integrating new media and ICT applications in education. The future is wireless. The project proposes that the next generation is the provision of education and training on wireless devices: Personal Digital Devices (PDAs), Mobile Phones and Smart phones.

The aim of this project was to develop and adapt courses for current and future mobile handsets where mobile learning is defined as the provision of training courses via wireless devices. Courseware was developed as part of a fully functional mobile Learning Management System (mLMS). Technologies available to mobile device platforms were evaluated to develop the courseware as well as the mobile devices themselves. The courses were tested and evaluated, and the results widely disseminated.

The three undertakings examined a variety of mobile device options and subjects and included

- Exploring online services in a mobile environment using PDAs. [1]
- Developing learning materials for smart phones using Macromedia Flashlite. [2]
- Mobilizing a contemporary art course for a smart phone using ATutor. [3]

1. Exploring online services in an mobile environment

Development undertaken by NKI during the EU Leonardo project "Mobile Learning: The Next Generation of Learning", investigated online services in a mobile environment. Enhancements were made to their LMS - SESAM, to provide services and web pages for any mobile device with a Hyper Text Markup Language (HTML) compatible browser. The course was tested in a controlled environment with 18 people.

The services found interesting and useful were IP Telephony by the use of Skype and messaging services such as MSN Messenger (Skype also has this feature). The development of Opera's Small-Screen Rendering™ browser for the PDA is highly anticipated and is expected to enhance the readability and screen rendering on small screens. In its absence Cascading Style Sheet (CSS) were chosen to make changes in the layout and providing the appropriate style sheets based on the clients accessing the page.

[1] The Leonardo Da Vinci Project - *Mobile Learning: The Next Generation of Learning http://learning.ericsson.net/mlearning2/index.shtml*

Among the most important findings was that if the structure of the document is good, the challenge of transforming content to the small screens or different layouts actually required less effort than expected. Difficulties were experienced with large illustrations that contained too much information for the small screens as well as large Flash animations with fixed width. The work-around is to zoom in and scroll on the illustration that needs a certain size to be understood.

1.1 The need for adapting to mobile devices

To better serve the increasing demand for different formats as well as mobility it is necessary to give the mobile user a better experience with existing web pages. The reason for targeting mobile devices at this point is because there are more and more users who acquire mobile devices and want to use them with our services enhancing the need to adapt the existing web pages and services to the mobile devices.

One of the biggest challenges concerning the mobile devices was to find acceptable solutions adapted to the small screen. There is simply not enough space for all the information found on a traditional web page on a small screen. Another problem was the limited data transfer rate and processing power found in mobile devices. When people use a mobile device with Internet connectivity, the connection speed is traditionally lower, for instance, via a mobile phone. The courseware design incorporates online high-speed access wherever you are.

1.2 Always-online test environment

A wireless, broadband community counting 5 users of mobile learning at home and at work was established using a wireless 802.11b base station connected to a broadband Internet connection that provides the basic “always online” infrastructure. The users are equipped with PDAs that have wireless access to an Asymmetric Digital Subscriber Line (ADSL). A test with 18 people to see how they experienced the mobile environment was also undertaken.

This environment allows the users to explore wireless applications considered to be widely available in the future. Several applications were developed for the PDA using Macromedia Flash, streamed video, synthetic speech and synchronous communication such as Skype and MSN messenger. The applications were tested through the “always online” environment utilising:

- Synchronous communications, chat
- Mobile access to e-mail which might generate a quicker response
- High bandwidth gives fast downloading of course content and use of audio, video and advanced graphics.
- Use of Flash, Java etc due to high storage capacity in future PocketPC
- Access to the resources at the Internet at all times
- ADSL gives you control over cost
- Not dependent on synchronization with desktop pc
- Online assessments and assignments
- Opens for collaboration between mobile learners

The wireless technology was tested at home and at work to see how it influenced the users and how they utilized the Internet as a source for information as well as the benefits of studying wirelessly. The LMS server was modified so that web pages and content could fit the small screen of the PDA (240x320). This was done mostly by CSS but some structural changes have also been made to make it easier to adapt the pages to the small screen. The goal was to provide the mobile users with the same information already provided to traditional clients by the LMS, but with a different layout better suited to the small screen.

Figure 1.1 : Video Clip Screen Shot

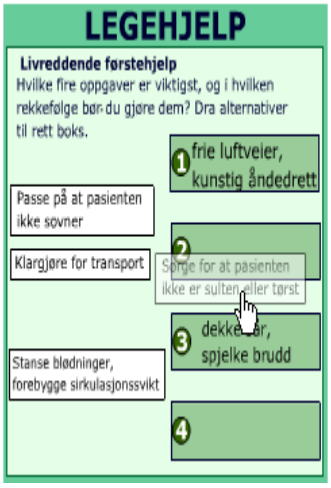

Figure 1.2 : Drag and Drop assignment

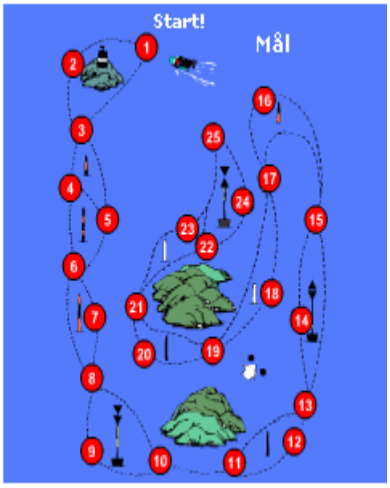

Figure 1. 3 : Boat Operators Certificate "Game

Table 1 Screen layouts for the applications created.

2. Developing Learning Materials for Smart phones Using Macromedia Flashlite

The modern day mobile phone user is experiencing dramatic change in what services are possible for use via the mobile phone. The mobile telecommunications industry is undergoing a transition as mobile phone usage moves towards data services operating on mobile handsets and networks. Device capability and sophistication has greatly increased allowing subscribers to enjoy premium content and data services on their mobile devices. The technical aspects experienced in developing a learning application specifically designed for smart phone users Macromedia Flashlite

2.1 Developing the Application

The application was based on an instructor led technical snapshot series and re-designed for the mobile environment and implemented using Macromedia Flashlite. The aim of the snapshot series is to provide an insight to new business areas, concepts, technologies or hot topics and it is believed this effort to disseminate this information, create awareness and encourage further study would be greatly assisted by mobile learning.

The course content was designed with less formal education requirements and learning objectives for example, than the web based WCDMA overview course[2]. The aim was to provide useful, fun and appealing learning options to cater for all users on "nice to know" information. By creating material based on the snapshot series of presentations and making it available in a blended environment, it was anticipated the material would be used by students at times that were convenient for them, such as work commutes, airports etc and when in transit.

Awareness of the learning materials available is promoted through a *content portal*, through e-mail, communication with colleagues and device interaction, for example messaging, USB memory sticks and using the mobile device in conjunction with the PC and other devices.

The course material is part of self-paced learning, which runs continuously as part of career and professional development. Some assumptions are made surrounding the usage of such learning materials and the devices used for testing.

[2] Courseware produced by Ericsson as part of the Leonardo Project - http://learning.ericsson.net/mlearning2/files/workpackage3/ericsson_technical_workingpaper_2004_pa2.pdf

• The material, mobile device and m-learning environment is generally geared towards short and spontaneous study periods.

• A basic understanding of subject matter is already established before accessing the mobile courseware and the context of the courseware or learning material is understood.

• Users have an understanding of how a smart phone operates.

• The courseware is designed as an introduction, to prompt investigation and further blended learning by the user and is viewed as a catalyst in the learning process.

The course material consists of screens displaying text, audio and graphical content implemented in Macromedia Flashlite for mobile devices. Macromedia Flashlite facilitates content rich animation and multimedia on a mobile operating system. It has a compression algorithm which greatly reduces the file size and overcomes the memory and hardware limitations currently presented by mobile phones. An interactive help feature is available by allowing the user to click on a diagram or graphic for further explanation. A self-paced interactive quiz accompanies the material as a separate module.

Information and knowledge sharing would be a result of the material being developed and made available and then being shared with friends and colleagues. The user would build up a knowledge network consisting of available courseware and a group of peers or colleagues with similar interest areas. Information could be exchanged through MMS, e-mail and PC distribution. The user simply "loads up" their device with courseware which is available for instant use with mobility.

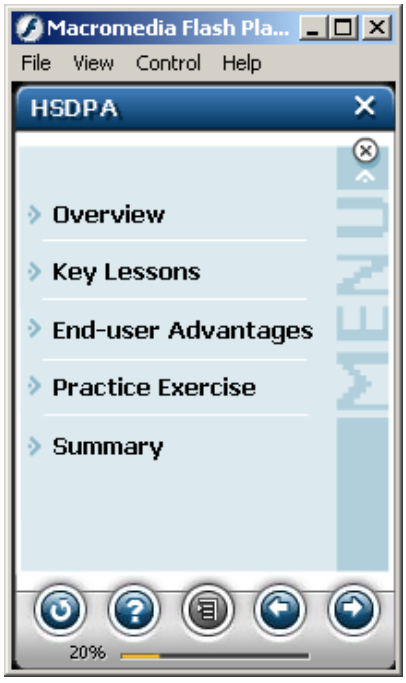

Figure 2.4 Navigation

Figure 2.1 The Help Menu

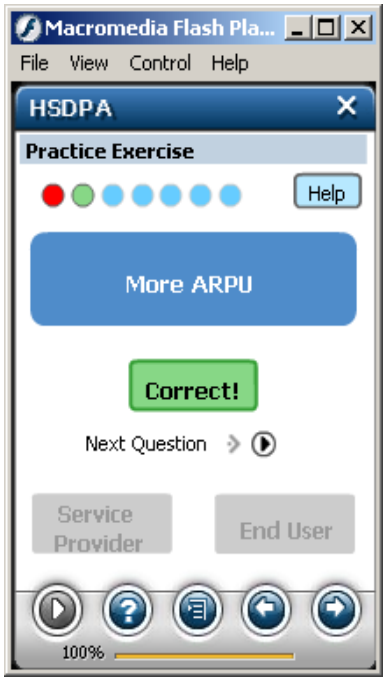

Figure 2.4 Interactive Exercise

Table 2 Screen layouts for the Flashlite application.

3. Mobilizing a Contemporary Art Course Using ATutor

Courseware featuring contemporary art for the smart phone has been developed. The course was retro fitted to suit the needs of a mobile application. One of the goals was to ensure the compatibility of the course to the SCORM standard. The structured and converted courseware was published on the web

using an open source learning management system called ATutor. This software was also modified to be able to use it on the screen of a smart phone.

3.1 The courseware

The original courseware itself was developed by an art student at an art college in Budapest. It contains an overview of the modern art branches; moreover it goes deeper with the review of three larger art directions and with the review of specific styles and artists in these areas. The courseware transcript is written in the Hungarian language as Hungarian art students are the target group for this material. It contains approximately 50 pictures as examples for various art directions. These pictures are sourced from a partner, the VirtuartNet Gallery, which is well known among galleries dealing with contemporary art and has a web page with appropriate digitized pictures and materials about painters. These pictures and data were used with the expressed permission of the Gallery.

After the realization of this course on a paper-based form it was analyzed and restructured during a consultation process between the author and an e-learning expert, who is familiar with the SCORM standard. The result of this consultation was the course material being divided into three packages depicting the three main part of the course. The metadata required by the SCORM standard was then created, which described the internal structure of the material – so describing sections and subsections contained by various files.

3.2 Packaging

The SCORM standard suggests a content packaging methodology about the creation of content entities in the course. This simply means that only a relatively small part of information can be shown on one page, or in one file in our case. As a result of this, the content was separated into plain HTML files containing a small amount of information. Using this technique maintaining the appropriate structure of the course was possible, allowing easy navigation. It is also better for the content management system to manage user progress by bookmarks – which simply means the storage of current part (file) of the material, but not the current page when the text is long and it has to be scrolled. As a result, three content packages have been made with their appropriate metafiles describing the structure in a specified XML format[3]. The final packages were created simply by zipping the packages into standard ZIP files.

3.3 Publishing on the web

After creating the content package a web service provider was chosen to host the material in ATutor. Atutor was chosen because of its SCORM conformance, which was considered important, and the relative easy usability. A localization of the ATutor learning management system was created, so it can communicate with users in Hungarian. However the findings are that ATutor does not fully comply with the SCORM standard. It does not implement the Run Time Environment, which does not pose any problem to the courseware as we do not use this feature of SCORM (it is only necessary for interactions between the material and the learning management system, as by tests for example). Moreover there are other minor differences in the metadata interpretation of ATutor and the standard. So two kinds of packages were designed: the first package suitable for using in ATutor, the second package conforming to the SCORM standard. The SCORM conformance was tested with the open source testing suite available from Advanced Distributed Learning[4] and it results that our packages are well-formed, valid and complies with the standard.

Since the packages contain plain HTML pages with pictures they are published as normal web pages and a Table of Contents created for them, which follows the structure of the course described in the SCORM metadata files. This way the two representations of the course are identical. This webpage is also hosted by our partner, but it is separated from Atutor.

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[3]The appropriate XML schemas can be downloaded from ADL (http://www.adlnet.org/xsd/adlcp_v1p3) or IMS (http://www.imsglobal.org/xsd/imscp_v1p1)

[4]http://www.adlnet.org/index.cfm?fuseaction=license&fileid=1110&libid=735

3.4 Mobilization

Since the original material was divided in to small textual parts according to the SCORM standard, the original larger body of material is now represented by three smaller packages, with smaller file sizes and as a result each package can better fit the smaller screen and memory of a smart phone and mobility is better achieved. However we have had troubles with the pictures. The original pictures of the VirtuartNet gallery were large in the sense of pixels and bytes as well. So they were converted to a smaller form, but the problem of relative sizing remains unsolved.

This leads to the troubles with smart phone browsers. There are two browsers available for our testing smart phone: Opera and the integrated browser from Symbian[5]. Each browser interprets and displays differently the relative size of the given picture. The picture width sized 60% is interpreted by Opera as 60% of the visible page width, by the internal browser as the percentage of the picture width (in pixels). So it was decided to directly convert pictures to a small form in order to reach optimal visibility on small screens. There was another issue with browsers: the internal browser supports special Hungarian characters[6] while Opera does not. As a future experiment we have to try some other type of encoding like Unicode and the almost outdated HTML encoding.

Next issue with mobilization was to change the appearance of Atutor, since it uses a horizontal arrangement, which is quite optimal for large PC screens but does not fit on small screens. Since Atutor can have so called Themes, layout was arranged to a vertical form. The course could not be tested in on-line forms due to connection issues, but it was tested it with PDAs and it is quite usable

3.5 Being on-line

Since the test device was a smart phone, namely SonyEricsson P900, on-line usage was stated as a requirement. Due to connection and browser issues on-line testing was not tested. Of the two browsers available for our smart phone, the internal browser is WML browser capable of interpreting HTML pages as well. This browser can connect to the internet by using the GPRS features of the smart phone. The features of this browser are much more moderate than Opera, which is maybe going to be a de-facto standard in the market of pocket browsers. But Opera cannot connect through the test device, it cannot use the GPRS features, therefore it cannot reach the internet. The reason for this is maybe the lack of TCP/IP stack in these kinds of phones (other smart phones are affected as well). The phone connects to the internet through a WAP gateway, which requires another protocol than plain TCP/IP, however it is based on it. The on-line version of the courseware is not accessible through a mobile internet connection but the HTML package files can be stored on the memory card of the smart phone and can be viewed with every browser on the phone. It can be studied in spare times or in front of pictures in a gallery or museum. This situation will be the basis of future tests.

References

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4. Kukulska-Hulme, A and Traxler, J (eds), (2005) *Mobile Learning: A Handbook for Educators and Trainers.* London: RoutledgeFalmer

[5]SonyEricsson P900 works with Symbian 7.0 operation system.
[6]These characters are double accented 'u' and 'o'.