Prospective Topography of Mobile Learning Solutions

Veronica Ștefan¹, Ioana Stănescu², Ion Roceanu³, Eugenia Mincă¹, Antoniu Ștefan²

(1) Valahia University of Târgoviște, E-mail: veronica.stefan@ats.com.ro
(2) Advanced Technology Systems - ATS, Târgoviște
(3) “Carol I” National Defence University, Bucharest

Abstract

The information era has changed the culture of education. The use of information technologies has resulted in new opportunities that are rapidly growing to include mobile learning. Mobile, wireless, and hand-held technologies are being used to re-enact approaches and solutions to teaching and learning used in traditional and web-based formats. This paper is based on the research framework of a knowledge-based mobile learning system developed within the MOBNET-Learning Project by Advanced Technology Systems in partnership with Carol I” National Defence University in Bucharest”. The authors present the development topography of an integrated mobile learning solution that provides access to various mobile users to knowledge databases in support of the Anyone, Anytime, Anywhere (AAA) paradigm. The resulting mobile knowledge management system (mKMS) aims to support knowledge acquisition and reuse and create the premises for optimising the virtual learning environment. The paper also takes into consideration the challenges and the limitations implied by the mobile world in terms of hand-held devices and mobile user interface design.

Keywords: mKMS, mobile interface, mobile SCORM, ASP.NET

Introduction

Mobile learning is an emerging field of educational research and practice both in university and business environments. It has started to attract the interest of practitioners in all phases of education as well as that of researchers. However, so far there is no comprehensive theoretical and conceptual framework to explain the complex interrelationship between the characteristics of rapid and sometimes groundbreaking technological developments, theory potential for learning, as well as their embeddedness in everyday lives of users.

In view of the increasing portability and functional convergence of technologies, as well as the reduction in their cost, and the cost of services available for them, mobile devices have become more and more central to, and at the same time invisible in the life-worlds of users. It is the growing significance of mobile devices in learners’ everyday lives, i.e. their ubiquity and personal ownership of them, as well as their increasing use for engaging with, and making sense of the world that motivates our interest in them.

The developments in mobile learning have often been driven by pedagogic necessity, technological innovation, funding opportunities, and the perceived inadequacies of conventional e-learning. Among the most relevant characteristics of mobile learning is that it can take learning to individuals, communities and countries that were previously too remote, socially or geographically. The mobile learning can also contribute to the enhancement of the concept and activity of learning, beyond earlier conceptions of learning (Sharples et al., 2005; Guy, 2009).

This paper details the research framework of a knowledge-based mobile learning system developed within the MOBNET-Learning Project by the company Advanced Technology Systems
in partnership with the Romania ADL Partnership Lab of the Carol I National Defence University in Bucharest. The authors present the development topography of an integrated mobile learning solution that facilitates the access of mobile users to knowledge databases in support of the Anyone, Anytime, Anywhere (AAA) paradigm. The resulting mobile knowledge management system (mKMS) aims to support knowledge acquisition and reuse and create the premises for optimising the virtual learning environment, while considering the opportunities and the challenges of the mobile technologies (Botzer and Yerushalmy, 2007).

**Education in the Context of Technological Transformations**

The basic principles of mobile learning are by no means new. The concept of ‘mobility’ has been the concern of researchers for a long time. What is new, however, is the capability and the functionality of the technology usually associated with ‘mobile learning’, in particular the convergence of services and functions into a single device, its ubiquity and abundance, portability and multi-functionality; abundance in particular in the sense of a shift away from educational institutions having to provide technological devices towards the learner doing so (Rogers et al., 2005). What is also new, and very significant in our view, is the boundary- and context-crossing mobile technologies and devices enable in relation to learning. Mobile learning is not only about delivering content to mobile devices but also about the processes of coming to know and being able to operate successfully in, and across, new and ever changing contexts and learning spaces. And, it is about understanding and knowing how to utilise our everyday worlds as learning spaces.

**Opportunities and Challenges of Mobile Learning**

Mobile technologies facilitate new learning practices and they translate in a cumulus of benefits for the learning communities. Yet, there are still significant challenges of scale, sustainability, inclusion, and equity in all their different forms, and of context and personalization, of blending with other established and emerging educational technologies. There is also the challenge of developing the substantial and credible evidence-base that will justify further research. New opportunities include:

- **Support ‘Anyone, Anywhere, Anytime’ paradigm:** One significant difference resides in the fact that through the use of mobile devices learners can gather, access, and process information outside the classroom. They can encourage learning in a real-world context, and help bridge school, afterschool, and home environments. Because of their relatively low cost and accessibility in low-income communities, handheld devices can advance digital equity (Carliner et al.; 2008; Guerin, 2009).

- **Improve twenty-first century social interactions:** Mobile technologies have the power to promote and foster collaboration and communication, which are deemed essential for twenty-first century success. Services like Facebook Mobile have millions of users and open up a new era of real-time interconnections.

- **Fit with learning environments:** Mobile devices can help overcome many of the challenges associated with larger technologies, as they fit more naturally within various learning environments. The learners tend to use their mobile device to connect to the Internet to access information when and where they need it and this practice complies with learning activities.

- **Enable a personalized learning experience:** Not all learners are alike; instruction should be adaptable to individual and diverse learners. There are significant opportunities for genuinely supporting differentiated, autonomous, and individualized learning through mobile devices.

The mobile environment presents many challenges that need to be addressed in order to sustain a friendly user experience.
Cognitive, social, and physical: These challenges must be surmounted when mobile devices are incorporated into learning environments. Disadvantages include: the potential for distraction or unethical behaviour; physical health concerns; and data privacy issues.

Cultural norms and attitudes: Though many experts believe that mobile devices have significant potential to transform learning, teachers apparently are not yet convinced and most teachers see cell phones as distractions and feel that they have no place in school.

No mobile theory of learning: Currently, no widely accepted learning theory for mobile technologies has been established, hampering the effective assessment, pedagogy, and design of new applications for learning.

Differentiated access and technology: Wide diversity among mobile technologies represents a challenge for teachers and learners who wish to accelerate academic outcomes as well as the producers who seek to facilitate such learning.

Limiting physical attributes: Poorly designed mobile technologies adversely affect usability and can distract learners from learning goals. Physical aspects of mobile technologies that may prevent an optimal learning experience include: restricted text entry, small screen size, and limited battery life.

Knowledge Management Tools

Knowledge management covers three main knowledge activities: generation, codification, and transfer (Rabin, 2008; Stănescu et. al, 2009). Knowledge generation include all activities which reveal knowledge that is ‘new’, whether to the individual, to the group, or to the world. It refers to activities such as creation, acquisition, synthesis, fusion, and adaptation. Knowledge codification is the capture and representation of knowledge so that it can be re-used either by the individual or by an organization. Knowledge transfer involves the movement of knowledge from one location to another and its subsequent absorption. Generation, codification and transfer occur constantly, and the role of knowledge management lies in allowing organizations to explicitly enable and enhance the productivity of these activities and to leverage their value for the group as well as for the individual.

Knowledge management tools are designed to ease the burden of work and to allow resources to be applied efficiently to the tasks for which they are most suited (Dourish, P., 2004). They go one step further beyond data and information management tools in an attempt to incorporate the "know-how" along with the "know-what" and enhance the users’ ability to make intelligent decisions. Under these premises, the development of a mobile knowledge management system is perceived as an opportunity to capture knowledge at the moment when it is generated and also to access it in real-time.

Mobile Access to Learning in Higher Education

Mobile contextual learning requires specific knowledge and, at the same time, generates valuable input data, which generally is lost due to the lack of adequate input collection systems. An important goal of the MOBNET Project is to develop a knowledge acquisition and retrieval system that operates as a mobile learning assistant, allowing users to access mobile knowledge when they need it (Roeceanu et al., 2008). The system will help mobile learners to fulfil their tasks more efficiently, as it exploits the learner’s context in order to filter information, which is of special interest in a specific circumstance.

The Development Framework of the Mobile Knowledge Management System

The system presents the following main functionalities:
- **Asynchronous channel**

  **Pushed E-Mail:** the users can choose to subscribe to receive individual e-mails or daily/weekly alerts. The alerts sent via e-mail concern new documents, new polls, messages, etc.

  **E-mail:** Users can suggest to their contacts links to articles published in the mKMS. The System composes the message automatically and then call the e-mail client of the mobile user in order to send it. The user can send the message to one or several contacts from his phone agenda.

- **Synchronous channel**

  **Who-is-logged-on-now:** the users can choose which status they display: visible or invisible.

  **Messaging:** the users can exchange messages in order to request information on certain subjects or problems they are faced with, they can display their interests or other real-time information directly by using the mKMS features or by sharing links to other public profiles (such as Twitter, Facebook, sites, blogs, moblogs).

  - **What’s new:** The user can visualize the latest articles: Since Last Log In, In the Last n Days, Customisation of Items Monitored
  - **Polling:** The user can set open other answer, can only vote once or can change vote. Polls have a pre-set closing time.
  - **Document Repository** (Metadata Required, PDF, Word Supported, Check In/Version Control, Comments can be directly associated with document, Directory Structure)
  - **Link Store** (Metadata required, Directory Structure)
  - **Help:** Customizable and context Sensitive
  - **Internal Searching:** includes full text of messages and metadata on documents/links, full text of all files and full boolean (“and”, “or”, “not”). The search can be limited by type of file, e.g. E-mails or documents.
  - **External searching:** the user can choose the search engine (Google, Bing) and benefits of an automatic expansion of internal search.
  - **Usability** (Server response; Time < 1 second)
  - **Security** (Encrypted sessions; Cookie-based password save)
  - **User tracking**
    - Total usage per individual over time
    - Analysis of usage by time of day
    - Paths taken through site
    - Most popular/least popular pages analysis
    - Data protection compliance

The system uses a common database for both the knowledge management system and the learning management system. This improves the results of the search and allows an easy administration of knowledge and learning objects and a unified access from the users’ standpoint.

The knowledge is accessed via a mobile Graphical User Interface that follows the above-mention recommendations. The mobile website is developed based on the Microsoft .NET Framework using ASP.NET and C#. For the backend, the developers have used Microsoft SQL Server 2008 as the database engine.

These are a few of the key features of the mobile knowledge management system that is developed by the MOBNET Project (Stanescu, I., et al., 2009). The system aims to build adaptive learning resources reconfigurable based on the device attributes and users’ preferences and to provide mobile learners knowledge in Romanian language, becoming a start-up project in this domain.
Main Sections of the System

The Header Section is displayed on each page of the application and it includes the following options:

- The “Homepage” button that allows the user to easily access the homepage no matter where he is in the application.
- “Login” allows users to authenticate in the system, access and update the knowledge database, based on the user rights that have been allocated by the system administrator.
- “Help” button displays the help content in a help window, allowing users to access the functionalities of the mKMS.

The Footer Section includes the following links:
- “Contact”: it displays the contact data that the users can access to address the system administrator or the system developers.
- “MOBNET”: connects to the web site of the MOBNET project.
- Social network access buttons: the user can connect to his/her Twitter, Facebook or other social network accounts to retrieve or publish information.

Search options

The mKMS provides advanced searching options: by keyword, full text search, by topic and by similar articles, to target the preferences of a larger group of mobile users. For a better user experience, the mobile knowledge management system allows the users to further refine search results by applying search criteria progressively, against the current result set (i.e. a search within a search). For example users could do a search for the term “engine” and if they are not satisfied with the results, they could further narrow down the list by search for “boat”. This would be the equivalent of searching “boat engine” from the very beginning and would prevent the user from writing extra keywords. To achieve this functionality, the system temporary stores search results in the database and performs further searches based on this list rather than on the whole database.

The results of the search are bilingual allowing the mobile users extend his/her access to a richer content. While reading an article, users are provided with links for terms on which the system can provide further information. This feature is valuable especially for mobile users which are constrained with regards to the input methods that their device provides. At the end of an article, users are also provided with links to other related articles and information on where to obtain further data.

Over time, users are likely to refer to the same articles multiple times. This is particularly valid for articles that include mathematic formulae and large tables that are impractical or hard to memorize. To speed up access for these articles, users are provided with a complete history of previously visited articles as well as with the possibility of creating multiple article favourite lists based on topics of interest.

The system developed also allows learners to capture new information by providing different forms of input such as text, sketches, recording of messages or photos. To use the potential of this data collection process, the system allows the user attach feedback to existing articles and also to create new articles. The user also has the option to automatically attach relevant information such
as localisation, or a history of the most recently accessed articles. Articles are published in the system, but to endure data consistency, all articles uploaded by mobile users must go through a peer review process. This method supports knowledge creation and diversity, but also provides knowledge certification.

**Mobile SCORM: The Power of Global Collaboration**

The developers of SCORM (Sharable Content Object Reference Model) aim to support accessibility, interoperability, durability and reusability. The purpose of SCORM is to facilitate the exchange of courses between Learning Management Systems and the reuse of content across different courses, and to sequence content tailored to the learner.

The implementation of SCORM (Sharable Content Object Reference Model) on mobile web applications represents a new challenge in the learning environment since mobile devices present limitations related to screen size, availability of required technology/software, a compatible browser; or availability of consistent Internet connection (Stefan V. et al., 2010).

The mKMS content is SCORM compliant and the SCORM implementation method that was used is JavaScript (JS). Mobile browsers now almost fully support JavaScript and this makes it possible to implement SCORM using JS support. Each mobile device has different configurations and it is always better to identify the device requesting content before rendering the HTML content.

Ideally, new content is launched in a new popup window, so that the content gets its own desirable window size. Since well known mobile devices browsers do not support pop up windows - the Blackberry is an example - and the best practices of the World Wide Web Consortium (W3C) do not recommend their use, the developers made changes in the SCORM implementation to accommodate both conditions. The users of low level mobile devices browsers that do not support either popup windows and frame structures cannot use such devices to run SCORM content on them.

The web/browser based solution chosen for the mKMS has a wide reach as every basic mobile handset has a browser but it also has one drawback – it requires a continuous internet connection. This isn’t a problem on a desktop PC as normally they have continuous internet connections. But on a mobile device there is no guarantee of continuous connectivity and this may lead to issues with SCORM tracking. At the moment, the mobile SCORM option has been integrated only in the version of the mKMS available in the Romanian language.

**Conclusions**

The learning environment evolves under the strong impact of emerging information and communication technologies, and the education system is challenged to keep pace with technological and social developments, both of which include, importantly, the shape of the media landscape.

The authors initiate approaches meant to help people to further develop their professional competences by using the
innovative powers of new media, mobile devices, and modern Internet services. They argue the need for a purposeful engagement with mobile learning in all sectors of education, among other things, in order to avoid a potential disconnection between the ways young people operate in their daily lives and the ways educational institutions interact with them.

The paper presents the development framework of a mobile knowledge management system and aims to contribute to one of the biggest challenges in our society: how to deal with the growing complexity, the growing quantity and the permanent changes in knowledge and technologies.

References


