Towards a Methodology for Semantic and Context–Aware Mobile Learning

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INTRODUCTION

Internet and mobile devices open the way towards mobile learning (m-learning), offering new opportunities to extend learning beyond the traditional teacher-led classroom.

M-learning is not only any form of teaching or studying that takes place when the user interacts with a mobile device. It is more than just using a mobile device to access resources and communicate with others. It should take account of the constant mobile situation of the learner.

The challenge here is to exploit this continually changing situation with a system that can dynamically recognize and adapt educational resources and services to the "context" in which the learner operates (localization, surrounding environment, learning time, goals, etc.). However, it is often difficult to identify relevant resources and to organize them into a coherent training course, especially when the learner context is continually changing. M-learning needs a better organization of knowledge, to deliver better in a mobile situation.

A way to address this problem is to create a pedagogical repository of Learning Objects (LOs) and to model learner context. A semantic approach using ontologies provides a semantic organization of learning information and the personalized situation.

This article presents ongoing research about a context-aware system for Mobile Learning based on ontology. This work is partially funded by CrossKnowledge[1], the European leader in remote development of leadership and managerial skills using new technologies.

BACKGROUND

Before any discussion on m-learning, we need to look at the main steps of evolution in the learning domain.

As a first step, learning became distant and moves away from the traditional teacher-led classroom. In the mid-to late 1800's, home study became a legitimate form of education with the development of inexpensive postal services in Europe and across the United States. In 1840, Isaac Pitman used the new postal services to provide a correspondence course, which was in fact the first distance education program. The University of London claimed to be the first university to offer d-learning degrees, providing its external program in 1858. Since 1920, educational programs including academics have been broadcasting in Europe. In 1995, Keegan defines distant learning (d-learning) as education and training resulting from the technological separation of teacher and learner, which frees the learner from the necessity of traveling to a fixed place, at a fixed time (Keegan, 1995).

Then with the emergence of computers and the World Wide Web, distance learning evolved and became a critical part of modern education. These new technologies have made d-learning distribution easier and faster. In 1999, during a CBT Systems seminar in Los Angeles, a new word was used for the first time in a professional environment "e-learning." Associated with such expressions as online learning or virtual learning, this word was meant to qualify a way to learn based on the use of new technologies allowing access to online training through the Internet or other electronic media (intranet, extranet, interactive TV,

CD-ROM, etc.), so as to develop competencies while the process of learning is independent from time and place. Early e-learning systems, based on computer-based learning, often tried to copy autocratic teaching styles whereby the role of the e-learning system was assumed to be for just transferring knowledge. This is opposed to systems developed later, based on CSCL (Computer Supported Collaborative Learning), which encouraged the shared development of knowledge and collaborative work. So in 2001, the Commission of the European Communities defined e-learning as "the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration."

We cannot separate e-learning from the technology that enables it, which is the Learning Management system (LMS). A LMS is a software application in which training programs are assembled and made available for the learner. Typically, a LMS provides the trainer with a way to create and deliver content, learner participation, and assess learner performance. A LMS may also provide learners the ability to use interactive features such as threaded discussions, video conferencing and forums. Hundreds of LMSs platforms have been developed, the most known are Moodle and Blackboard.

These LMSs support Learning Objects (LOs). There are many descriptions for LOs (Wiley, 2000) (Robson, 2001), but the mostly used definition of a LO was defined by the IEEE-LTSC Learning Object Metadata group as "any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning" (IEEE 1484.12.1, 2002). A LO can be a piece of a lesson that has educational content like a simple image, audio or text file, video, simulations, digital pictures, or web pages that include text, image and media, etc. By LOs, educators can use these modular and reusable pieces instead of developing a new lesson from the beginning to the end. In this context metadata (data about data) are tailored towards describing these pieces, making LOs easy to update, search, manage and reuse. There exist a variety of metadata initiatives in the domain like IEEE LTSC's Learning Object Metadata LOM[2] or ADL's Sharable Content Object Reference Model SCORM[3]. These metadata form pedagogical repositories and can help to catalog LOs to make easy searching and reuse (Wiley, 2000).

Furthermore, every LMS should support tools to help learners, and trainers to manage their learning resources. There are two types of tools: synchronous tools and asynchronous tools. Synchronous tools (chat, shared applications, whiteboard, webcast, video conference, games, simulations…) are interesting pedagogical tools because they promote interactivity. Trainers and learners are simultaneously in front of their respective computers and share live, orally or by script. Asynchronous tools (email, forums, wiki, blog…) are also interesting because they can often structure communities, besides, they do not need trainer presence at the moment of exchange.

A few years later, advances in mobile computing, intelligent user interfaces, context modeling applications and recent developments in wireless communications including Wi-Fi, Bluetooth, multi-hop wireless LAN and the global wireless technologies such as GPS, GSM, GPRS, 3G and satellite systems have created a wide array of new possibilities for technology users. When these technologies started to be used with e-learning, a new learning paradigm, called mobile learning (m-learning), emerged. This has important didactic dimensions as it frees the learner, who may have spent much of his working day in front of a wired computer. M-learning holds the promise of offering interesting new opportunities for learning as shared, ubiquitous, collaborative, fluid and with an integral access to applications that support learning, anywhere and at anytime (O'Malley, 2003).

Understanding the differences between e-learning and m-learning begins with first defining m-learning. While there are many opinions and ideas surrounding this, the Mobile Learning Consultants Float Learning defines m-learning as: "the use of mobile technology to aid in the learning, reference or exploration of information useful to an individual at that moment or in a specific use context."

The primary differences between m-learning and e-learning fall into two main categories: time and place and devices.

The first major difference between e-learning and m-learning is the time when learning is expected to take place and the anticipated duration of the learning session. Most e-learning is designed for the learner to sit at a computer at a fixed time and progress through a specified amount of material for a period of time. But m-learning, by its nature, can be done anytime and anywhere. In addition, the small screen sizes of

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