M-Learning with Mobile Phones

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INTRODUCTION

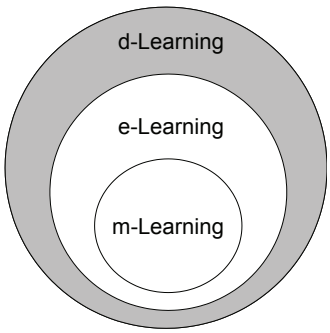
The Internet is a major driver of e-learning advancement and there was an estimate of over 1000 million Internet users in 2004. The ownership of mobile devices is even more astonishing. ITU (2006) reported that 77% of the population in developed countries are mobile subscribers. The emergence of mobile, wireless and satellite technologies is impacting our daily life and our learning. New Internet technologies are being used to support small-screen mobile and wireless devices. In a field marked by such rapid evolution, we cannot assume that the Web as we know it today will remain the primary conduit for Internet-based learning (Bowles, 2004, p.12). Mobile and wireless technologies will play a pivotal role in learning. This new field is commonly known as mobile learning (m-learning).

In this article, the context of m-learning in relation to e-learning and d-learning is presented. Because of the great importance in Web-based technologies to bridge over mobile and wireless technologies, the infrastructure to support m-learning through browser-based technologies is described. This concept represents my own view on the future direction of m-learning. An m-learning experiment, which implemented the concept, is then presented.

BACKGROUND

Many researchers and educators view that m-learning is the descendant of e-learning and originates from d-learning (Wikipedia M-Learning, 2006; Georgiev, Georgieva, & Smrikarov, 2004). The m-learning space is subsumed in the e-learning space and, in turn, in the d-learning space, as shown in Figure 1. This may be true chronologically. D-learning has more than hundred years of evolution starting from the printed media of correspondence (signified by carefully designed and produced materials by specialists to support the absence of instructors and independent study [Charles Wedemeyer] and the industrialization of teaching [Otto Peters]), to mass and broadcast media (marked by the opening of British Open University in 1961 [Daniel, 2001]), and to the telecommunication technologies supporting asynchronous and synchronous learning through teleconferencing, computer mediated communication and online interactive environments for students to create and re-create knowledge individually or collaboratively. In d-learning, the teacher and students

Figure 1. M-learning space as part of e-learning and d-learning spaces



are separated quasi-permanently by time, location, or both (Keegan, 2002; ASTD Glossary, 2006). With the advent of computer and communication technologies, e-learning covers a wide set of applications and processes, such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration (ASTD Glossary, 2006). The delivery of content is through a media-rich and hyperlinked environment utilizing internetworking services. M-learning can be considered as learning taking place where the learner is not at a fixed, predetermined location, or where the dominant technologies are handheld devices such as mobile phones, PDAs and palmtops, or tablet PCs. It can be spontaneous, personal, informal, contextual, portable, ubiquitous and pervasive (Kukulska-Hulme & Traxler, 2005, p. 2).

In my view, new concepts in teaching and learning can be generated from m-learning. For example, mobile phones can be used as voting devices for outdoor learning activities or in classrooms without computer supports, as interactive devices in museums, positioning or data logging devices at field trips or in many pedagogical situations. The justification of m-learning being descendent of e-learning and d-learning is rather thin, and Figure 2 is better represented. Furthermore, not everything can be delivered through m-learning. The small form factor, one-finger operation in some cases—slow computational and communication speed, short battery life and limited multimedia capabilities in contrast with computers do not really suit applications requiring heavy reading, high over-the-air communication and a lot of typing or texting.

Figure 2. Overlapping and differential spaces of m-learning, e-learning and d-learning

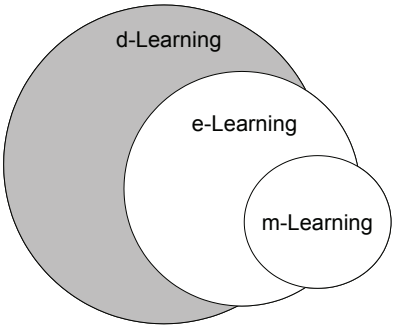


Table 1. Different teaching and learning contexts

	Salient characteristics
d-learning	• Separation of teachers and learners • Learning normally occurs in a different place from teaching • Formal educational influence and organization
e-learning	• Multimedia-rich • Hypermedia • Independent • Collaborative
m-learning	• Mobile • Portable • Ubiquitous • Pervasive

In summary, m-learning is restricted and expedited by its nature. Different teaching and learning applications require different approaches, whether it is in d-learning, e-learning or m-learning. We must keep in mind their salient characteristics in different teaching and learning contexts, as shown in Table 1.

M-LEARNING INFRASTRUCTURE

In order to support m-learning, mobile devices such as PDAs, mobile phones and tablet PCs, together with servers such as Web servers, streaming servers and database servers on top of applications such as specific adaptation of LMS must be employed (Horton & Horton, 2003; Chen & Kinshuk, 2005). Despite the rapid development in mobile technologies, Figure 3 provides a typical browser-based architecture to support m-learning. It represents a full-scale implementation of any learning system formally. Processing and logic are controlled from the server-side and the mobile devices act as interfaces (Hodges, Bories, & Mandel, 2004, p. 2).

It is also possible that the learning applications are run locally on mobile devices with or without accessing network resources. Applications can be built using Java, such as mobile information device profile (MIDP), C++ on Symbian or native OSs, and Adobe Flash for mobile devices. Feature-rich applications can be implemented to take advantage or avoid limitations of the hardware.

Many researchers believe that, in order to support m-learning, a mobile learning management system (mLMS) is necessary. The logical derivation of mLMS is through the extension of conventional LMS (Trifonova & Ronchetti, 2003; Trifonova, Knapp, Ronchetti, & Gamper, 2004). Direct presentation of materials from computers to mobile devices is likely not legible, aesthetically pleasant, or technically not feasible. Adaptation according to the hardware and device profiles is required. This view is also supported by Goh & Kinshuk (2004). CSS, XSLT and XSL transformation in XML technologies are used to support WML, XHTML and HTML through server pages (Shotsberger & Vetter, 2002). Open standards, including e-learning standards such as SCORM (Fallon & Brown 2003), are the keys for the success of any mLMS.

M-LEARNING WITH MOBILE PHONES

To illustrate the concept discussed above, an m-learning experiment using phone simulators with one of my classes

Figure 3. Browser-based support for m-learning