

Emerging Issues in m-Learning

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SUMMARY: The benefit of plugging mobile technology into e-learning is its potential for increasing productivity within the scope of the new m-learning paradigm: “anytime, anywhere (e)learning”. Several aspects of m-learning can be considered, from technological issues and didactic themes through to human factors that can influence the m-learning process and its effectiveness. This article gives an objective view of the advantages and disadvantages of m-learning, describes a number of issues from various points of view and suggests an outlook for the application of the technology in the near future. A very promising combination of m-learning with augmented reality is outlined as probably one of the most relevant future paths.

1. TECHNOLOGY ASSISTED LEARNING - DEFINITIONS

In the area of technology-assisted learning, a number of buzzwords have emerged that are often misunderstood, misinterpreted or arbitrarily exchanged. Even serious treatises on the problem deliver barely acceptable definitions that only serve to make people more confused. Different letters like “e”, “t” or “m” are added to the word “learning”, standing for different learning-relevant areas and/or activities. The “t” in t-learning is often used to refer to television-based learning, which is in fact a subset of tele-learning activities and thus finally of e-learning. The “m” stands for “mobile”, representing the back-stage mobile delivery technology, and should be seen as a subset of e-learning. This in turn generically describes learning supported by electronic media. It is also important to notice, that the “e” of e-learning refers to electronic information/content. However, not only the internet is “electronic”. A widely used description of e-learning as “internet-enabled learning” is therefore not completely correct.

A true e-learning environment resembles in principle a sophisticated content and data management system, with development, delivery and version control of the content, learning progress, and testing, as well as learning progress certification [JOH,2001]. The objective is the learning of material. Based on this definition, m-learning would have to be described as part of an integrated global learning strategy, encompassing a variety of instructional methods, learning content management and services that supply a learner with electronic information and educational content regardless of location and time.

2. M-LEARNING - TECHNOLOGICAL ASPECTS

Mobile technology has become fairly ubiquitous in the last few years. Wireless developments in e-learning services focus on themes such as the integration of data and voice functionality in a single device, concepts of digital collaboration (blending instructor-led classroom training with e-learning), wireless access to data applications, the transmission of learning modules and synchronous (communication in real-time) and asynchronous learning modes. In all of these, it is irrelevant whether a mobile phone with internet access or a handheld data device with phone capability is meant

A number of varieties of mobile technologies suitable for training and education may be recognized: interaction with learning materials via a detached device (such as a laptop or PDA) physically connected to the network, wireless WANs (Wide Area Networks), PANs (Personal Area Networks) that allow the creation of ad hoc networks, WAP (Wireless Application Protocol) phones, pocket PCs, palmtops and other devices. The specific type of device which is used for m-learning services is basically irrelevant as long as it is wireless. Wireless in this case does not necessarily mean that a constant connection to a server or network is required.

Today, PDAs and handheld computers feature capabilities that provide a training experience similar to that offered by conventional laptop and stationary computers. Technology standards like MP3 or Flash ported to wireless devices empower the m-learning applications with multimedia capabilities of sufficient quality. Technologies like speech and handwriting recognition make mobile devices unique in the area of wireless communication. Nevertheless, the most common use of wireless devices for learning purposes today (2002) is limited to the uploading and downloading of data, and synchronization with the server back at home. Theoretical possibilities still outnumber concrete implementations.

For the time being, technical difficulties, unacceptable speeds and costs hamper the implementation of m-learning environments. The new 4(G) wireless standard – which would allow for the transmission of full streaming video as well as supporting a high degree of interactivity – has not yet been widely accepted. Unfortunately, many complex technical obstacles still lie ahead. Information access via a mobile device is plagued by low bandwidth availability, poor security, poor connection maintenance, delay factors and addressing problems [AIT,2002]. Access via modems over standard telephone lines is still too slow for video or audio. Applications need to be highly optimized for space, in order to fit in the limited memory on the mobile devices. Software design for these devices must consider resource limitation, battery power, display size and also other hardware relevant aspects like suitable device fonts for better text readability. It is too hard to read from small PDA screens, and it is also hard – if not impossible – to take notes without an extra foldable keyboard. Extremely desirable features like active note taking, text highlighting and other (e-book) functionalities are still not ubiquitous. But these are still early days for wireless learning. In the near future, handhelds will be challenged by a new generation of electronic books which have larger screens – more suitable for diagrams and paragraphs of text – and will probably be equipped with a far more intelligent keyboard derivative for faster and more comfortable typing with minimal finger movement [ALP,2002]. The question is whether learners and teachers will accept the technology and if it will really enhance future learning arrangements.

Having access to the application anytime, anywhere increases daily attention to learning material, makes learning pervasive and certainly boosts the learner's motivation for lifelong learning. Moving from stationary to mobile learning makes ad hoc collaboration and informal interaction between students possible. Analysts say that online training saves time and money when educating employees, and helps them learn new skills quickly. Companies using online training can save an

average of 50% training time and up to 60% of the cost compared with conventional classroom learning [BRA,2002].

In today's world it is no longer possible to allow people to be solely responsible for their own knowledge acquisition. It is important to keep track of one's learning progress. For this purpose, learning environments require a learning management system (LMS [SUN,2002]). The LMS serves to track learning and manage skills and corporate knowledge, as well as recording and certifying the learning progress. More complex LMSs also make possible diagnosis in learning and include pre-tests, attitudinal surveys and also information of the coach's experience and qualifications. This avoids wasting learning time when the learner already knows the material. It also makes it possible to redirect the student's requests to the appropriate coach or expert in those learning environments where several specialized teachers coach a virtual class.

Efforts to standardize learning technology have resulted in the development of Learning Objects [REU,2002] and interoperable systems to manage device-independent learning with these objects. Learning objects are reusable building blocks of learning which enable its granularity. Industry standards, including AICC [AIC,2002], SCORM [ADL,2002], LRN [MIC,2002] and IMS [IMS,2002], open APIs, and a powerful XML interface make it possible to gradually develop learning material in terms of the (java) paradigm "write once, run everywhere".

3. MOBILE LEARNING – THE HUMAN FACTOR

Most probably it will not be the technical aspects that determine the future of m-learning. It is not the aim of this article to enter into a philosophical discussion on the human factor in m-learning, but human aspects do seem critical. Communication with others is an anthropological necessity. According to Dewey a community must always remain "a matter of face-to-face intercourse" [DEW,1927]. Mobile telephony thus brings back a world that very much fits our anthropological structure, based on ubiquitous multimodal communication [DON,1991, NYÍ,2002]. A need to acquire knowledge and explore the world is characteristic of human beings. However, learning as a process is normally very sensitive and subjective. It requires an emotionally safe and supportive environment. Learning activities may challenge and engage some learners while others may feel pressured and insulted. The human factor may thus considerably decrease learning and diminish its effectiveness, especially in times where motivation to learn is suffering in conditions of general economic downturn.

A major human issue is the fear factor: people tend to fear technology and thus have difficulty using new devices that they are not familiar with, and which require them to learn new proprietary tools. Most consumers do not yet (will they ever?) fully understand the benefits and the potential of wireless learning. Also, there seems to be a considerable mismatch between the user's expectations of mobile learning goals (driven by the vendors' marketing messages about the devices) and the recognition of mobile content limitations. Older people prefer learning with pencil and paper, both for note taking and reading. And even young people who are normally enthusiastic about new technologies sometimes prefer to read from paper printouts and write in front of a real PC, rather than use small mobile devices. In most cases they also prefer face-to-face, live interaction with both the instructor and the classes. A very interesting summary of the students' relationship to wireless learning is given in [REK,2002].

It is not realistic to expect that many people who are not exclusively engaged in learning will invest time in non-essential job-related training in their own spare time. In order to function "normally" as members of human society, it is very important to get away from regular work sometimes and to maintain a certain degree of privacy.

A number of human issues in m-learning arise from technological obstacles. Repeated voice recognition misunderstandings due to poor cellular connections or flaky and expensive mobile phone connections, failed menu navigation and incorrect responses to learning interactions – all these affect users, leading to frustration and a reluctance to continue the lesson. Trust in the technology is reduced, and the system may be perceived as ineffective as a result.

Content relevant m-learning aspects like overloading learners with interaction (overloading m-learning applications with interactions) may also have a negative impact on the overall learning effectiveness. People do not like to feel pressured by the system – they want to be able to take a break if they need to, and re-enter later where they left off. Complex, large mobile applications, as well as highly discrete learning chunks to work with may result in an environment too frustrating for learning. Another important content issue is the ability to personalize the learning experience and make it dependent on particular learning styles and degrees of distraction, for example. Mobile learning needs to be scalable and user customizable. The mobile learner should be able to choose between a quiz, a lecture, instruction or voice-controlled assistance – for instance in cases where he cannot pay attention to written instructions and learning needs to coincide with other activities such as car driving.

When considering human aspects, we usually think of students. But what about the teachers managing the learning content? Wireless, overall communication and the tele-coaching capabilities of learning environments can saturate communication channels between the teacher and learners, so that their capacity to coach in real-time (in the simplest case, respond to students' emails) may be exceeded.

4. M-LEARNING – WHAT WILL “M” REALLY STAND FOR?

One of the main goals of the technology driven education is to deliver effective and affordable learning. The cost of maintaining expensive technology is prompting some schools to shut down their computer labs. The Canadian Broadcasting Corporation reports that teachers are going back to basics, to teach the basics [CNN,2002]. River Oaks used to be Canada's high tech school of tomorrow. Today, schools just cannot keep up with the changing technology, things are outdated since they have been purchased. In early 90s most researchers and teachers were struck by the enthusiasm in every classroom. The media considered River Oaks to be a model for the future of learning. Kids were given the label “knowledge workers”. Spending 60% of its budget on technology and using equipment donated by Apple, the school had 1 computer for every 3 students, and planned for many more. A decade after launching the bold experiment, the equipment sits in cupboards or on the floor waiting to be fixed or cannibalized for parts by students. The school can't afford the technology any more. River Oaks annual budget is about \$70,000. The cost of keeping up with the technology is about \$500,000 and the benefits have turned out to be far from priceless. No proof was found that technology could considerably speed-up the student's acquisition of knowledge. Technology helps – especially in motivating students – but the curriculum is no longer built around it. Now, technology is considered to be only a small part of the classroom. The general opinion seems to be that if all the computers were taken out of the classroom, teachers would still be able to teach. One computer per student is no longer the goal. The introduction of mobile technology will probably be rejected, and m-learning may turn out to be “meddling” rather than “mobile”. Despite doing a lot of homework on how to use technology, River Oaks is going back to the drawing board, and is quite possibly once more a model for the public school of the future. Just not in the way anyone expected.

5. OUTLOOK

E-learning solutions are needed that are not only on track to address issues of expense and convenience, but also the primary issue of effective learning. Mobile/electronic education should not attempt to replace traditional education with tutors and instructors, but to support both students and teachers by providing services that facilitate teaching, learning and education-related administrative tasks [REG,2002]. The basic approach is integrative, combining a variety of devices (mobile and non-mobile) via a variety of transmitting techniques (wired and wireless) which allow migration path to future technologies. The relationships between learners and teachers must be improved and optimized via efficient use of the new technologies. Learning environments must allow learners to personalize their experience to match their own learning styles and expectations. The same goes for the teachers. A lot of work needs to be done, motivating not only learners but teachers as well, encouraging them to (re)use the learning technology. These are the teachers who will create the learning arrangements and educational systems of the future using new technologies. They must be supplied with intuitive, easy-to-use systems for learning, administration and authoring, and these systems must gain their acceptance. In the end, it is always a human who chooses to accept or reject a particular technology.

It will be very important to endow schools with up-to-date equipment and ready-to-use tools for (re)-introducing e-learning into traditional learning environments. Mobile devices must be convenient for learning uses, and the technology must be within a typical school's budget. M-learning consortia discussing the problems should thus be multidisciplinary, involving learners, teachers, technology providers, experts, educationalists, sociologists and investors as well. The consortia must also be appropriately structured to solve complex problems and ensure the best possible effectiveness of technology supported learning.

Today, it would be probably wrong to claim that sophisticated LMS tracking of learning progress will stay part of mobile learning in terms of handheld-assisted learning. However, m-learning has the potential to remain an important add-on in global learning environments, helping users to gather information and to acquire knowledge by means of new technology, and much more besides. A more precise prediction concerning the future of wireless learning and its impact on learning effectiveness is almost impossible to make.

One of the very promising uses of mobile learning is its combination with augmented reality techniques. Augmented Reality is a new form of interaction between humans and technology in which the user is given supplementary visual information (for example via data-glasses) in terms of virtual images superimposed on views of the real world. [USC,2002]. This supplementary information is context dependent, i.e. drawn from and fitted to the real object being viewed [ARV,2002]. The technology is capable of replacing the old-style handbook. Its combination with wearable computing and wireless technologies may considerably change the way in which future specialists will learn to maintain complex products and systems on-the-job, and also help drastically reduce the time needed to acquire particular knowledge and skills. For students, the technology might primarily provide virtual images to supplement lessons [ESC,2002]. Mobile augmented reality should be ready for consumer use in about a decade, and it could be ready for educational application even sooner [COL,2002].

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