

MOBILE LEARNING – EDUCATIONAL REVOLUTION

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ABSTRACT

Mobile learning (m-Learning) is an exciting art of using mobile technologies to enhance the learning experience. A key design goal of mobile learning is that its built-in-experiences are enjoyable and proactive. It empowers the learner with the knowledge and ability to self management. The paper reviews the current definition perspectives of m-Learning, its affordances and challenges. Mobile learning projects, which are classified into three categories based on different mobile technologies, have also been reviewed.

Keywords: Mobile Learning, PDAs, e-Learning, Knowledge Management

INTRODUCTION

Mobile learning is learning on move while harnessing personal and portable technologies for effective education. The term also covers research into technology-enabled learning across contexts and learning in an increasingly mobile society. m-Learning is dynamic, operates in real time, collaborative, individual and comprehensive.

The first phase of mobile learning, originated more than 60 years ago [1], was to equip classrooms and lecture theatres with handheld response systems to aggregate individual responses from students and to provoke discussion based on differences in answers to open response questions. The more recent technologies of graphing calculators and wireless handheld devices offer new learning opportunities for rapid sharing of data and knowledge, simulations and visualization, and computer-managed group work [2].

The second phase was strongly influenced by two major projects funded by European Commission, MOBIlearn and m-Learning [3], with related efforts occurring across the globe. These projects explored the opportunities for learning with mobile technologies in non-formal settings including homes, museums,

workplaces and outdoors. The emphasis of these projects was on the mobility of the learner and support for learning across contexts and life transitions. Studies by Livingstone [4] and colleagues have shown that adults, on an average, engage in 13-17 hours per week of active learning and this is maintained throughout their lifetimes. Yet, less than 5 percent of the learning is within a school or formal education setting. So, we have a significant opportunity for personal technology to support the other 95 percent of lifelong learning.

During the course of this second phase and continuing into the present, a huge wave of mobile technology adoption has swept throughout the world. Now, almost every adult and adolescent child in industrially developed countries owns a multimedia communicator with more computing power than that guided the first landings on the moon. For many people in developing countries, the personal mobile phone is their only means of distance communication, automated calculations, precise time keeping and increasingly, image and sound recording.

In an emerging third phase of mobile learning, learning becomes embedded into everyday life. Two general requirements for effective learning

are, the ability to use the device across multiple contexts, for informal as well as formal learning, and to support both individual and group use. Learning with mobile devices arouses greater curiosity, and interest than its paper equivalent.

The paper reviews an important and necessary phase of mobile learning technology research and development that emphasizes the growing pervasiveness of learning technology through our lives, along with the thoughtful attention to learning theory and implementation needed to harness the technology to address important societal trends and needs.

CONTENTS OF MOBILE LEARNING

Computer technology has been applied to learning for decades, but with the advent of the World Wide Web it has really flourished [5]. Educators have embraced web-based learning which extends study beyond physical classrooms. In recent years, a new learning revolution has come with the quick growth of mobile technologies, which promises continued extension towards anywhere and anytime learning [6]. It is known as mobile learning (m-Learning) and has been considered as the future of learning or as an integral part of any other form of educational process in the future [7].

Popular definitions of mobile learning have grown up along the lines of technology available for mobile devices [8]. If desktop and laptop computers are the primary devices used for e-Learning, then mobile devices like cell phones and personal digital assistances (PDAs) are primarily used for mobile learning.

A more general approach to define mobile learning, such as learning while away from a desk, is less linked to specific technology, because a mobile device can include a camera, audio receiver, even a laptop or just any device small enough to be carried throughout the day without being obtrusive [9]. Some describe mobile learning as distinct from traditional e-Learning, suggesting that it not be defined by technology or device, because of the continuous

morphing between devices [10].

In common man language, mobile learning is defined as: any activity that allows individuals to be more productive when consuming, interacting with, or creating information, mediated through a compact digital portable device that the individual carries, has reliable connectivity and fits in a pocket or purse. Vishwanathan and Blom [11] defined that mobile learning is the learning delivered or supported solely or mainly by handheld and mobile technologies such as PDAs, smart phones or wireless laptops.

AFFORDANCES IN MOBILE LEARNING

From the start of modern distance education, researches have examined the strengths and weaknesses of a learning situation where the teacher and learner are in separate places [12]. Mobile learning has its own set of distinctions from more stationery e-Learning. A number of studies have looked at what kind of trade-offs are involved with taking learning to mobile devices.

The primary affordance of mobile learning is that the devices used are small. Since they can be carried anywhere, learning is available to the user in a ubiquitous fashion [13, 14, 15]. Mobile learning users have access to real-time data whenever and wherever they need it, in addition to gathering features like note taking, imaging, audio recordings, videos, teacher lecture notes, books, encyclopedias, simulations, worksheets, etc. [16, 17, 18].

A. Mobile Device as a Representation Tool

Mobile device can be used to gather information, hand in, or demonstrate homework through various media. Collecting data helpful for knowledge building was demonstrated in a case study [19], where students went on a field trip and were assigned to learn specific properties of various plants and both took an assessment and created a report when they got

back to the classroom. Similar learning was measured when some students were given a mobile device for data gathering while a control group used paper and pencil. In another case study, business people gather data related to their jobs for just in time decision making [20]. In this case, learning was not designed, but user-determined in the time that they needed the information.

In a case study, advantages for using PDA's included taking less time with the image afforded more pictures and more investigation. Most students preferred picture taking compared to drawing, though merits of hand drawing of observations was noted. Students using the handheld devices generally felt freer from their tools to explore the learning activity [17].

B. Mobile Device as a Communication Tool

The ability to communicate at any time or place is an important item among the affordances of mobile learning. As a discussion tool, the device is convenient to contact other people whenever an idea is fresh. Though communication can be instantaneous such as a phone call, it can also involve posting or some form of broadcasting the idea so participants can access it when it is convenient to them [19].

C. Limited Learning vs. No Learning at All

In some developing countries, mobile users far outnumber wired users [21]. If students are not able to attend a class on the topic they want to study, and they don't have access to a computer for extended periods of time, then mobile learning affords delivering a limited form of instruction verses no instruction at all. Because of the pervasive deployment of mobile devices in the developing world, mobile learning is often used as a leap-frog over existing e-Learning [22].

D. Framing Affordances

Some leaders in distance education research say affordances have yet to be determined [23],

stating that educational researchers have not yet seen persuasive arguments for the affordances of mobile learning [24]. Nevertheless, some of the uses of mobile devices for education are well documented in the research, but need to be measured against previously existing methods.

KNOWLEDGE MANAGEMENT AND LEARNING COMMUNITY

Mobile learning is proving to be increasingly useful and powerful, pushing and inspiring developments for the web and mobile networks as these areas include content information, and knowledge management; community building; publishing and journalism; teaching, learning and collaboration; and course management systems.

The power of mobile is to put the thoughts immediately into practice. One can get ideas of others and in seconds share it with the world. You get feedback, refinement, stories, and so forth. Also, mobile learners are easily linked and cross-linked to form learning communities. Innovative teachers can encourage students to maintain class and personal mobile web sites. Enthusiasm grows as learners take ownership of the content. They write, edit, review and publish content. Teachers make articles available to read on the wireless networks. Learners may learn by assembling personal digital portfolios.

All learning is social. In the past, people learnt by conversing with one another informally. Mobile learning gives learners freedom, unstructured time and encouragement to learn. Learning styles and multiple intelligences are diverse. Howard Gardner [25], says about differences in learning style "challenge an education system that assumes that everyone can learn the same materials in the same way." Mobile learning does not determine the right method to present this particular lesson to this individual but it does increase the chances of success by providing multiple paths for learning. Its credo is learner-focus, learner-centric, and learner-obsession.

Knowledge management includes the capability to collect, archive, manage, evaluate,

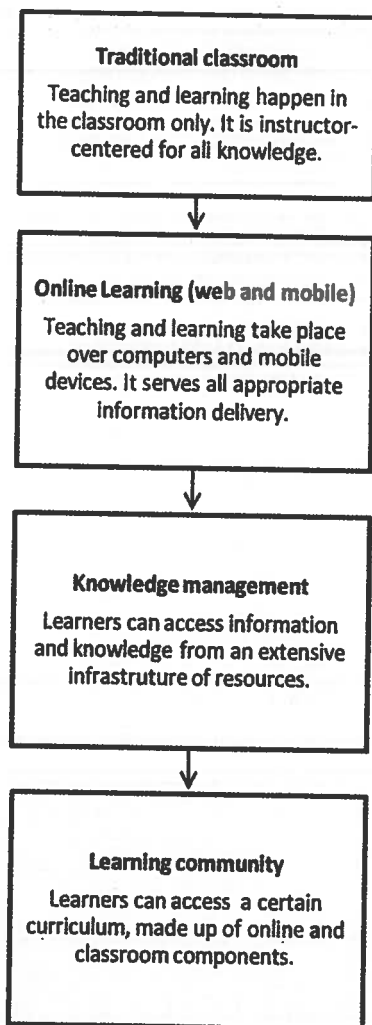


Figure 1. The change of learning paradigms

and distribute information across the learning community. It uses technology but depends mainly on human interaction to succeed. When a learner is searching for some information or knowledge, there is a central human component. It is the need to know something. Mobile learning technologies for searching, document management, and collaboration are creating knowledge networks across learners in the learning community.

In a learning community, learners have a pragmatic approach and they like to learn what they need for completing certain tasks. Each learner has a personal style or set of preferences and learns at his/her own pace. Not everyone learns in the same way. Their interest in learning new things varies widely. They want to be in-charge of their learning rather than yielding to an instructor. Transfer of learning in a learning community is largely a function of the quality and strength of personal relationships.

Mobile learning extends the reach of teaching and learning beyond the physical limitations of classroom and instructional resources. Knowledge management brings instantaneous and real-time information and expertise to everyone, everywhere. Together, they define mobile learning in ways that make it more acceptable and more a part of learning culture than an adjunct to it.

In the mobile learning community, when a learner needs information, the learner can get it by working with others. From this perspective learning is less about taking in new information than it is about connecting with people who help put that information in context and suggest new ways of understanding it. This social aspect is central to the way people learn in the mobile learning community. In fact, it is the central feature of a learning culture.

Electronic communication has brought on a shift from the place-based community to an online learning community where new online personas and identities have emerged. It is likely that more time is spent processing information internally rather than interacting in face-to-face settings. By taking simple humanistic approaches such as discovering common interests, discussing personal issues, and exhibiting flexibility on the part of instructors, a more effective online learning experience will subsequently emerge. It will lead to a stronger and more vital mobile learning community.

CONSTRAINTS OF MOBILE LEARNING

Some of mobile learning constraints are similar to areas of e-learning, including lack of contact between students and teachers, isolation issues, and technical support problems. But to look further into specific constraints of mobile learning, let us compare it to traditional e-learning.

A. Size of the Mobile Device

Though the main affordances of mobile learning have to do with the small size of the device, the primary limitations to mobile learning are also due to the small size. Several constraints are

related to size, including short battery life, small screen size, and slow text input [13,24,26].

Instructors could communicate with students in synchronous mobile learning contexts, but could not ask for substantive feedback from students due to text input limitations. The lack of convenient input tools pushes the research in exploration of new forms of user interfaces including sound or mobile scanning tools as input and output [5,27].

Small screen size is another size-related constraint. Though colors are now available, users cannot view content in the same format as on the smallest of laptop computers. New approaches to formatting are needed. The Internet itself is designed for interaction with a larger screen and keyboard, so rethinking of how data is stored and retrieved will be necessary for mobile learning, and may even be driven by market forces in mobile use of technology ahead of mobile learning.

B. Connection Issues

In most cases, mobile learning requires connection with a server. Some researchers [5] have suggested engineering, a pure connection and pure mobility mode for the mobile device so that it can download and store what is needed for most of the learning process and be able to function with minimal or no connection for long periods of time. In this case, the mobile device turns into a small computer with no communication function.

C. Inconsistent Platforms

The effort in developing an application that can be used for a broad selection of mobile devices is nowhere near that of a developing for regular computers. The lack of cross platform consistency in mobile devices is a drawback in developing mobile learning applications, unless an entire industry or university is using the same device [13,24]. Mobile learning development has tended towards applications of the lowest common denominator rather than using all the features of a device.

D. Distracted Mobile Learner

Multi-tasking is not always a productive way to learn. A team from the Virginia Tech [24] researched the extent to which mobile learner could be distracted while trying to learn with their mobile devices while going about other task. The researchers conducted a comparison study using 76 students and compared their retention of content from different means. One group sat at a desk with a computer and went through the same learning content as a group with a walking assignment while learning through a mobile device. As it turned out, the group that sat at a desk with a computer significantly higher on an assessment than the group that walked with a mobile device.

REVIEW OF m-LEARNING PROJECTS

Mobile technologies have been using in various learning environments, and many m-Learning projects have been set in universities, elementary schools, corporate training programs and distance learning programs. These projects have experimented with a wide range of educational activities from foreign language vocabulary lessons to business-oriented problem learning modules. m-Learning projects start with the most ubiquitous and stable mobile technologies, namely Short Message Services (SMS) texting, then develop to more technologically sophisticated examples based on PDA technology, currently, it moves on to even more technologically complex technologies, such as Wireless Application Protocol (WAP).

A. SMS Texting

SMS texting has assumed a vast social importance over the last many years and has transformed cultural life and social behavior with the take up of mobile phones in many parts of the world [10]. Since the idea of mobile phone's potential for supporting learning occurred, SMS has become most straightforward application of the usage of mobile phones as an educational supporting tool

[8]. Many different educational bodies have experimented in this area.

Learning on the Move [28] was an m-Learning project conducted at Japanese Universities. Because the students only had one class per week, the repeated practice of foreign language vocabulary was difficult to facilitate. But most Japanese students constantly carry a mobile phone, thus this project sent short, daily lessons to students by SMS messages, providing repeated practice of foreign language vocabulary.

Research to test the effectiveness of a two-way SMS campaign has been done at Kingston University (UK) [8]. The team has developed a system that sends SMS to students, registered to the service, about their schedule, changes in it, examination dates and places, student's marks, etc. After registering, the students were automatically separated into five different groups. One group was receiving announcements via e-mail, another three groups via SMS (but different interaction was necessary in every group) and the last via the web. The conclusions of the experiment were that the students in scenarios where a certain type of response is required preferred SMS as a medium to email or web based announcements. They felt the data is more personal and they like this. SMS could be efficiently used in education (m-Learning) as a complementary medium. As the technology improves (i.e. EMS and MMS, potential more user-friendly interfaces), the potential increases too.

B. PDA Technology

Some educational programs for m-Learning with PDAs have been developed by American Researchers [29]. These programs were designed for elementary schools, where educators and students experienced m-Learning using PDA. These programs included the concept map editor PiCoMap, which allows students to create, share and explore concept maps on their handheld computer. This program allowed users to create multiple nodes and relationships leading to elaborate concept maps for brainstorming, visual outlining or

assessment purposes.

A similar project has been undertaken at the Tampere University of Technology (Finland) [30], where PDAs were used for lifelong learning (mathematical education) of children. The study content was presented in the form of a game where the pupils could communicate and help each other and the electronic device was used to measure the average student's knowledge level and to adapt the speed of presenting new material to the learner's speed.

C. WAP Portals

Ultralab (UK) m-Learning project [31] is one of the projects that have a special section dedicated to the creation of a WAP Portal for educational purposes. The technical aspects in the creation of a WAP portal for educational purposes do not differ from a common WAP portal. As the target users for this project are young people (age 16-24) with literacy problems, the group studies the problem of keeping the interest of the young adults to the useful learning materials, by exposing them to exciting subjects.

At the University of Helsinki (Finland), LIVE (Learning in Virtual Environment) experiments have been undertaken using the SMS system and WAP phones [32]. The project introduced digital imaging and sharing photos between the participants (teachers), and was mainly used for teacher training. This enabled the introduction of NMS and other 3G services for m-Learning. Also, other notable WAP Portals used in m-Learning projects can be found such as HyWeb at Griffith University (Gold Coast, Australia), NAIT m-Learning in Canada.

CHALLENGES

Nowadays, mobile learning has been employed in various fields; it still faces several challenges for its future development. In addition to the technology issues, such as the convergence of wireless infrastructure with handled devices, the smoother delivery of learning content and the innovations in content creation, some cognitive challenges of mobile learning are discussed.

The first challenge originates from the concept

of adaptive learning, where the instructional strategies and learning content should be designed to adapt to learner's profile and personal needs. Since the wireless network enable the learners to be engaged into the learning anytime anywhere, the learners may pursue learning at any location, where the learners hold various mood and motivation. Under such circumstances, the learner's location should be taken into consideration for the design of adaptive learning. For examples, if a learner requests for the topic of the third generation (3G) wireless network while he is at the subway, the adequate learning content for the learner might be the definition for such terminology. However, if the same request is submitted by a learner in the library, the replied message should include advanced reference for such terminology.

The second challenge is the limited text display in support the learning. An exploration of methods need to be done; hence, the communication technology can support the learning content in guiding learners to be involved in active learning process without the support of rich or multiple external representations for providing the cognitive functions of complement, constrain, and construct [33]. Therefore, the mobile learning should play a supportive role in providing continuous learning activity during the learning courses, or a self-clear and stand alone learning module. For example, spacing multiple opportunities of studying, learning, and being tested on the learning subject over time is a powerful method of enhancing learning performance [34]. Mobile learning can extend such opportunity from the instructor's lecture to the learner's daily life.

The last challenge is due to the characteristic of instant communication in mobile network. For the issue of cooperative learning over the Internet, the web learning not only supports better academic interaction among learning peers, but also provides individual learner with higher satisfaction. The related factors are the location and response time. Location means where the learners use their computers to access the web learning. Tu and McIsaac [35], stated

that learners have the senses of privacy, relaxing atmosphere, and familiarity with their personal computers, and greater control and flexibility of their own schedules. As to the second issue of response time, it is also critical to the asynchronous mode of cooperative learning. If the message sender does not receive the comment within the expected time frame, he might feel frustrated and perceive less social presence, which in turn resulting in less engagement in learning. Such problem can be solved by mobile communication network by utilizing the prompt notifications of message reception. That is, the learning management system or personal email server can send SMS to notify the learner upon the receiving of specific email. From this perspective, the prompt interaction among learning peers will benefit the learners in building their positive social presence. However, the overall evaluation of such instant notification mechanism should be conducted to fully understand its effect upon the learning interaction among instructor, peers, or invited exporters over the Internet.

CONCLUSIONS

With the evolution of computer network and wireless network technologies, the learning has evolved from face-to-face learning, distance learning, to mobile learning. It is clear from this paper that one of the factor fostering the evolution is not the learning itself; instead, it is the service needed for utilizing the mature information technologies and wireless networks.

As the mobile devices expand in their capabilities and research deepens, educators should be able to more accurately grasp the degree to which mobile learning can enhance the learning experience. The developing research will have to keep in mind that the mobile devices are rolling out in a broad spectrum, and will continue to add new features and new possibilities along with them.

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