Analyses and Review of M-learning Feasibility, Trends, Advantages and Drawbacks in the past Decade (2000 -2010)

Bekim Fetaji1, Majlinda Fetaji2
1,2 South East European University, Contemporary Sciences and Technologies Faculty, Ilindenska bb, 1200 Tetovo, Macedonia
b.fetaji@seeu.edu.mk, m.fetaji@seeu.edu.mk

Abstract: - The focus of this research study was the investigation and analyses of the feasibility of m-learning by doing a review of published research in the past decade (2000 - 2010) on successful m-learning projects and m-learning in general as well as analyses of advantages and the pitfalls and issues. Based on this analyses provided are recommendations for improving m-learning in general. Findings are presented and recommendations for approaching and improving m-learning are discussed.

Key-Words: - M-learning, e-learning, mobile devices, learners environment

1 Introduction

Research into mobile learning also known as m-learning is thought to place Universities and institutions at the forefront of pedagogical excellence of practice, answering student requirements for flexibility and ubiquity: ‘anywhere, anytime, and any device’ access to information.

It is a fact that m-learning, has not yet seriously impacted education and the projects addressing the adoption of mobile ICTs in schools can still be regarded as spearhead [12] . Although, there are a lot of successful projects for mobile learning documented in the research literature [11], and mainly the outcomes are positive, but yet not even scratched the high potentials it has.

Even though mobile learning is still in its beginnings (just more then a decade) and there are many aspects which still need to be justificated. In this analyses and literature review, we will try to investigate these aspects of mobile learning.

Thus, the focus has been set on investigating and reviewing m-learning.

Many reviewed researched studies [8], [6] and [17] have given encouraging results for using mobile technologies to support students in the teaching and learning process.

With the advancement of mobile devices and technologies presented during 2009 and 2010 especially with the introduction of new iPhone 3Gs and 4, then iPad tablet the m-learning opportunities have increased highly. Schools and Universities embrace the use of iPad tablet as well as iPhone mobile devices as in [20].

2 Analyses of M-learning Projects and Trends

According to [7] an increasing number of colleges and universities are adopting mobile wireless technologies as teaching and learning tools. According to [7] more than 90% of public universities and 80% of private universities in the US have some level of mobile wireless technologies, such as mobile wireless devices and networks.

Table 1. Mobile Wireless Technologies Uses in Higher Education [7]

<table>
<thead>
<tr>
<th>School</th>
<th>Users</th>
<th>Tool</th>
<th>Key Uses</th>
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| North Carolina State University College of  | Students         | PDA             | ● Accessing to medical records  
| Veterinary Medicine, Raleigh, NC            |                  |                 | ● Participating in webinars during class                                  |
| University of Central Oklahoma College of   | Faculty and      | PDA             | ● Accessing to databases  
| Education, Edmond, OK                       | Students         |                 | ● Supporting innovative teaching practices                               |
| UC Berkeley School of Education             | Students         | PDA             | ● Enhancing collaboration and task methodologies                         |
| University of California, Los Angeles, CA   | Faculty and      | Windows LAP     | ● Offering students mobile content delivery tool                         |
| Florida State University, Tallahassee, FL   | Student          | Windows LAP     | ● Allowing for new types of remote activities                           |
| Wake Forest, Winston-Salem, NC              | Faculty and     | Windows LAP     | ● Helping students understand difficult science concepts                 |


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474
According to [2] and [3] mobile wireless devices, tablets, PDAs and handheld devices are used most often in the learning environments.

Table 1 summarizes [2]’s findings about how 17 institutions of higher education have been using mobile devices.

According to [20] The New York City public schools in year 2010 have ordered more than 2,000 iPad tablets, 300 went to Kingsbridge International High School in the Bronx, or enough for all 23 teachers and half of the students to use at the same time.

More than 200 Chicago public schools in 2010 year applied for 23 district-financed iPad. The Virginia Department of Education is overseeing iPad initiative that has replaced history and Advanced Placement biology textbooks at 11 schools. And six middle schools in four California cities (San Francisco, Long Beach, Fresno and Riverside) are teaching the first iPad-only algebra course [20].

In Europe a research conducted by [8] involved mobile blended learning technologies to support HND computing students at the University of Wolverhampton.

The objectives of this project were to develop, deliver and evaluate blending learning opportunities that exploited SMS, WAP and VLE technologies. Initial research indicated that students used SMS text messaging promptly and effectively, and that they would prefer to receive notice board information such as room changes, appointments, feedback and exam tips via SMS rather than via e-mail or notice boards. SMS-based interventions took place over the second semester of the 2002-2003 academic year.

Initial test messages gauged the effectiveness and the level of timeliness of student responses to SMS text messages. A second set of messages was sent as feedback following the marking and moderating of assessments. During the trial, the students provided considerable positive informal feedback to the course leader, and a questionnaire administered to the students revealed that the majority of students thought the experiment was worthwhile.

Regarding to m-learning projects it has been found that the majority have been focused on improving interactivity in the classroom [4], [15] or on increasing students’ access to learning materials anywhere, anytime as described by [1].

A smaller number of projects have focused on supporting on-the-job training in the field, largely for medical and nursing students in hospitals [8] & [5].

A few projects have included teaching students some aspect of mobile technology, such as programming mobile devices or using stylus technology, usually in connection with ubiquitous delivery [15]. Occasionally projects have combined ubiquitous delivery with a focus on interactivity with a single pedagogical focus. Several m-learning projects focus on how to apply e-learning techniques and content on mobile platforms. Several other free and commercial mobile language learning programs have recently become available [10]. Te BBC World Service’s Learning English section offers English lessons via SMS in Francophone West Africa and China (cited in [10]); BBC Wales has similarly offered Welsh lessons since 2003 [10] and an EU-funded initiative known simply as ‘m-learning’ provides English lessons directed towards non-English speaking young adults.

A small number of projects span over more than one discipline area, for example [4] interactivity study in computer science and education.

Most projects focus on only one type of mobile device. Such project’s need to expand into multi-institutional, multi-disciplinary approaches so that the outcomes are relevant to the widest community possible, using actual case studies in real class situations over a variety of subjects and education environments. The UniWap [14] project for developing and testing purposes use smart-phones and WAP phones.

Under the auspices of the European Union, the ‘e-learning to m-learning’ project establishes the first stage in the creation of the global provision of training on the wireless Internet [17], promoting and reinforcing the contribution to be made by vocational training. “From E-learning to M-Learning” is a long-time project that seeks to put in place a new virtual learning environment for wireless technologies and to develop course materials for a range of devices in this learning environment. The main pedagogical problems of developing mobile learning for PDAs [15] were solved in the project. The authors discuss the devices characteristics that are proper for learning and underline the move from d-learning (distance learning), e-learning, to m-learning. They attempt to predict which methods and technologies should be used for successful m-learning. ‘Specifically and practically, this project will map the evolution from the wired virtual learning environment of today, to the wireless learning environment of tomorrow’.

3. Analyses of the Advantages of M-learning
Many studies have given encouraging results for using mobile technologies to support students in the teaching and learning process.

Students can use cellular phones (mobiles) for many purposes: smart card usage, browsing and accessing information in Internet or browsing electronic content from computer networks, databases and distributed file system; from anywhere, anytime, with minimal technical requirements. Mobile technologies help in optimizing the learning processes and services by means of added flexibility [14] in order to access information anytime, anywhere and promise the access to applications that support learning anywhere, anytime [6]. Learning can be available and immediate at appropriate time and from any location.

Opposite to computer technology, mobile technology is not connected to physical location. It is unique in allowing ubiquitous learning and mobility in learning according to [1].

Mobile technologies can offer “just enough, just in time, just for me” model of flexible learning [6]. “Just-in-time” instruction via mobile devices is very important and giving opportunity for education to distance students. Online access to information “just-in-time” rather than searching for hand taken notes makes the leaning process more efficient.

The high portability, flexibility, immediate reachability, personality, and accessibility are very appropriate and enhance the learning process [1]. Mobile devices are easier and lower cost to supply than a computer. They are ease-to-use, supply connectivity, interactivity, providing information on real time when needed increases user accessibility and satisfaction of the offered services in real time. Portability and versatility make mobile devices a powerful medium for teaching and learning [17]. The portability features of mobile devices and portable and wireless technologies enable learning from anywhere, anytime without time and location constraints enable students to use their time more efficiently. Their portability and low cost offer surprising technical capabilities for the development of new systems [18].

Mobile devices perform many of the functions of desktop computers, with the advantages of simplicity (being easier to learn and use) and improved access (being usable anywhere, anytime), except the bandwidth, cost and input capabilities [18], which in most cases are the documented limitations of using mobile devices for learning. [11] identify five properties of mobile devices (handheld computers) which “produce unique educational affordances” and those are:

a) Portability
b) Social interactivity
c) Context sensitivity, the ability to “gather data unique to the current location, environment, and time, including both real and simulated data”
d) Connectivity, to data collection devices, other handhelds, and to networks
e) Individuality, “unique scaffolding” that can be “customized to the individual’s path of investigation”

In their review of mobile technologies [2] and [3] have identified the advantages of handheld devices, where is stated that ‘these devices: i) are increasingly able to carry media-rich content and thus to support a conception of teaching focused on the teacher and on the content, ii) increased interaction with educational materials, for example the capacity to bookmark and annotate them, will strengthen this’. Mobile devices, besides supply text functions, Internet access, audio and video capabilities.

There are advantages in using a mobile device offering individual, private and learning at own pace and learning within specific contexts which can provide ‘reliable cultural and environmental indications for understanding the uses of information which may enhance encoding and recall and enable learners to access relevant information when and where it is needed’ [19].

4. Identified Issues and Drawbacks

Mobile devices can be more easily integrated across the curriculum than desktop computers [17] and in a classroom environment without any extended requirements because of the environment infrastructures and the context of use. But, many obstacles in mobile usage which directly influence mobile devices’ and applications’ usability are encountered. The diversity and size of the screen, the low performance, limited memory (for images and multimedia content), limited display resolution and storage capacity, limited file types supported, and reduced input method, small keypads and keys; different platforms and operating systems used by different models [19], directly influence and make the usage of mobile devices (in the learning process) difficult.

In [13] that the technological capacity of all mobile devices has increased dramatically in the past three years. Screens are bigger and better, systems have more memory, and have more multimedia capabilities; as well as there are more sophisticated methods for inputting data” [6].
Mobile phones, tablet computers, and other handheld devices are no longer just for chatting and organizing contacts and diaries, they are now pocket-sized computers and as such have the ability to deliver learning objects and provide access to online systems and services.

The arrival of multimodal handheld devices such as the iPhone, android based mobile devices, and the enabling of GPS are continually adding to these learning capabilities’. The ongoing development of broadband wireless networks and the quick increase of power and capacity of the up-coming generation of cellular phones strength the potential of mobile technologies in education [2].

Technology is rapidly advancing and the documented limitations will not be obstacle in the near future for using these devices and having better learners experience.

Because of continuous advances in mobile hardware technology and communication, evolution of functionalities and the ubiquitous availability of wireless networks, mobile devices are getting increasingly more powerful in terms of computing power, memory storage, and network capabilities.

Still, obstacles exist and directly influence the usability of m-learning, which is limited and driven by the hardware and software constraints of mobile devices:

- small screen size or the form factor, low screen resolution [10]
- low storage capacity and network bandwidth [10]
- limited processor performance [2]
- short battery life
- compatibility issues
- lack of data input capability [18]
- high - cost browsing through GPRS and 3G / 4G technologies

These limitations make use of mobile devices and application a bed user experience, consequently not usable. The mobile screen is not equal to desktop screen. It is not sufficient space on the screen to display greater amount of information. Users’ need to focus on the environment rather than the interface so output is limited [18]. It is not sufficient space on the screen to display lot of graphics either. The mobile application interface shouldn’t become a scaled desktop application interface. The information may not appear properly. A vast amount of information in a small screen might affect the users’ recognition. Due to the low graphic resolution and limited greyscale (number of colours), the interface objects and multimedia information may appear despoiled and not obvious with the disgraced display quality. Due to degraded visual appearance of interface elements in mobile screens, the quality and efficiency of acceptance and understand-ability of the learning content suffers.

Desktop applications cannot be accessed via mobile devices and be displayed same in a mobile screen. “What works well on a large screen does not necessarily work well on a small screen” [10]. Most existing computer based learning management systems still do not have access support for mobile devices, and there are deficiencies in cross-platform solutions of LMS [4].

Even more, many mobile browsers do not support scripting or plug-ins, and do not have available memory to display desktop pages and graphics. This directly influences the usability of mobile learning systems. Web content that is mostly the format of electronic learning content is poorly suited for mobile devices [18]. The ability to display information in various multimedia formats is limited.

The small and limited display size and resolution of these devices and interaction styles impose new interface designs. In this context, the interface has many constraints, needs to be simpler and might contain less number of components and objects. It needs to fit all in one small screen. Usually, the human computer interaction in designing mobile applications is left behind without consideration. In order to address these issues a case study experiment in the scope of this thesis was initiated. It involves development of a web-based mobile application that students can use and learn within a particular study program.

These usability issues of mobile devices and learning must be considered and carefully examined during the usability testing of a mobile application in order to select an appropriate research methodology and reduce the effect of contextual factors in the usability testing’ outcomes [8].

5. Conclusion and Recommendations

In the near future, it is expected that learning will move more and more outside the classroom and lectures halls into the learners environment both real and virtual negotiated by mobile devices.

There are identified specific problems in university learning that mobile technologies can help overcome, for example, limited real world context, limited access to learning resources, low student engagement in classes, and lack of practical experience in learning about mobile technologies. Instead of assuming the importance of m-learning, these problems together with the gaps uncovered in the existing m-learning body of knowledge as
discussed below, have informed the choice of our research suggestions that address our overall aim of enhancing student learning.

Some findings show that introducing new forms of learning and teaching (even if this means just using a standard tool for drawing) improve the overall students’ results [18].

The use of mobile and handheld devices within different modes of learning has made an impact in work-based learning (learning through work) which is an important way to acquire knowledge and skills today.

As discussed by [17], handheld devices: i) allow learners to distribute, collect, and share information with easiness, resulting in more successful collaboration; ii) can be applied as academic support for learners; and iii) the portability of devices coupled with wireless connectivity is bringing significant benefits to learners in terms of flexibility of access to learning materials. Even more, mobile devices can also be used for other generic learning activities such as gathering information, evaluation by ranking or rating, reflection, problem solving or skills acquisition [8] and [5].

In the research of [10] about supporting mobile learners, they claim that mobile devices are good tools to engage non-traditional learners; they remove the formality, which is considered among the most frightening aspect for those who have not engaged with learning; and that the use of mobile devices improved retention of learners.

[12] stated that mobile devices can be engaged as tools to allow learners to construct their own understandings of a matter, thus to promote deep learning and critical thinking. Whilst [18] have explored the use of mobile devices and concluded that they support hands-on scientific experimentation and learning.

According to the report on Researching mobile learning [14] as valued by students’, employment of mobile device include that it:

– facilitates individual, co-operative and interactive work in class
– enables the sharing of ideas and responses and the building of knowledge
– increases participation in whole-class settings
– enables learners to revisit areas for consolidation and reflection out of the classroom – this helps to increase understanding
– provides opportunities for autonomy and independence
– provides work and resources in one place, and to hand

– gives the ability to transfer work between digital devices and to and from other areas such as shared drives and learning platforms,
– Alleviates pressure on the computer rooms and makes learning more flexible.

Mobile devices have become tools to serve simultaneously teaching and learning alongside with work and leisure, in both formal and informal settings; the authors found out that mobile phones were generally used for contact, coordination, interviews, thus motivating learners; while mobile devices are presented as enormously resourceful tools that enabled access to a wide range of information [8].

[7] in their investigation of the use of handheld devices to support adult learners, found out that the ‘anytime, anywhere’ access to learning resources is an important advantage of the handheld computer, enabling learners to integrate their learning and other activities according to their time schedule.

Investigating the impact of mobile technologies in teachers’ practices, from the findings show that devices serve teachers’ personal purposes and considerably planning their teaching with dairy and address functions and preparing teaching recourses using recording function of devices.

Mobile devices are often mentioned as mediums which also facilitate personal and learning activities of people with handicaps or special needs. [10] recognize that mobile computer-like handheld devices would have the advantage of a graphical interface which would facilitate persons with physically distributed cognition.

6. References


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