The developments in mobile learning and its application in the higher education including libraries

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Abstract – As technological devices become more present in education, more researchers and educators are looking into different aspects of technology enhanced learning. Most recently, focus in technology enhanced learning is put on use of mobile devices i.e. mobile learning or m-learning. Mobile learning promotes concept of anytime anywhere learning which is important for students who frequently change places of learning and need access to the learning material as they move from one place to another. Such concept of learning is possible because more and more students have some type of a mobile device and mobile devices are mostly cheap, portable and flexible, have no start-up time, and require virtually no maintenance. While the mobile technology seems to be very attractive to students and usable in the learning process, there are also problems which burden further development of mobile learning or at least they are not helping its development: technological problems and obsolesce, lack of digital content made for use on mobile devices, lack of training of proper use of mobile devices in the learning process etc. Most of these and similar problems could be overcome if universities put more effort in adoption of mobile technologies among students and teaching staff.

I. INTRODUCTION

"Mobile and communication technologies are increasingly impacting the lives of individuals and are a major factor in helping reshape our culture and societies" [1]. As technological devices become more present in education [2],[3] more researchers are looking into different aspects of technology enhanced learning. Most recently, focus in technology enhanced learning is put on use of mobile devices i.e. mobile learning or m-learning. Mobile learning is learning delivered or supported solely or mainly by mobile technologies [4]. Mobile technologies enable people to be mobile and yet accessible [5].

The mobile technology i.e. mobile devices "(...) are generally defined as units small enough to carry around in a pocket, falling into the categories of PDAs (personal digital assistants), mobile phones, and personal media players" [2]. Mobile learning and mobile devices are directly connected as mobile learning is hardly possible without use of some kind of a mobile device. Therefore, mobile learning if often described as "the intersection of mobile computing and e-learning which offers: accessible resources wherever you are, strong search capabilities, rich interaction, powerful support for effective learning, and performance-based assessment, e-learning independent of location in time or space" [6] i.e. anytime and anywhere learning. Anytime anywhere learning is central to the concept of mobile learning. For Martin and Ertzberger [7] mobile devices open "(...) the door for a new kind of learning and performance support in the field, providing anytime and anywhere access to information, processes, and communication". For Tatar, Roschelle, Vahey and Penuel [8] "Mobile learning holds the promise of offering frequent, integral access to applications that support learning anywhere, anytime". Generally speaking, mobile learning is important in education for achieving academic goals while its final goal is helping the development of the knowledge society [3].

In the education sector, mobile technologies are becoming crucial because they "(...) can provide frequent and comprehensive access to systems and applications that support formal and informal learning" [9]. Mobile learning is present in higher education institutions as mobile devices have become ubiquitous at universities [10]. This widespread use of mobile devices has become possible because they are cheap, portable and flexible, have no start-up time, and require virtually no maintenance [8]. As a result, use of mobile phones and other mobile devices that allow data collection anywhere and anytime has become a routine [1].

Based on these facts and the current educational practice in higher education institutions, mobile learning seems to be generally attractive, especially to younger generations of students during their daily education related activities, it remains to be seen how strong it will influence programs of study and individual courses at universities. This paper will discuss potentials of use of mobile learning in higher education based on characteristics of mobile learning.
Mobile learning is defined as "any sort of learning that happens when the learner is not in a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies" [11]. According to Brown and Metcalf [12] "mobile learning (commonly referred to as m-learning) as all "knowledge in the hand." It includes the use of mobile/handheld devices to perform any of the following: deliver education/learning; foster communications / collaboration; conduct assessments / evaluations; provide access to performance support/knowledge. Mobile learning uses the benefits of smaller and faster computing which enables learning anywhere and anytime [13].

Mobile learning comes in several "flavors". In their chapter on learning design with mobile and wireless technologies, Kukulska-Hulme and Traxler [14] enumerated categories of mobile learning with description for each category:

- Technology-driven mobile learning – some specific technological innovation is deployed in an academic setting to demonstrate technical feasibility and pedagogic possibility
- Miniature but portable e-learning – mobile, wireless and handheld technologies are used to re-enact approaches and solutions already used in ‘conventional’ e-learning, perhaps porting some e-learning technology such as a VLE to these technologies or perhaps merely using mobile technologies as flexible replacements for static desktop technologies
- Connected classroom learning – the same technologies are used in classroom settings to support collaborative learning, perhaps connected to other classroom technologies such as interactive whiteboards
- Informal, personalized, situated mobile learning - the same technologies are enhanced with additional functionality, for example location-awareness or video-capture, and deployed to deliver educational experiences that would otherwise be difficult or impossible
- Mobile training/performance support - the technologies are used to improve the productivity and efficiency of mobile workers by delivering information and support just-in-time and in context for their immediate priorities
- Remote/rural/development mobile learning - the technologies are used to address environmental and infrastructural challenges to delivering and supporting education where "conventional" e-learning technologies would fail, often troubling accepted developmental or evolutionary paradigms".

Cheon, Lee, Crooks and Song [10] offered another view on mobile learning in which mobile learning facilitates four type of learning: individualized learning, situated learning, collaborative learning, and informal learning, which is excellent for a rather new technology.

Each type of learning can benefit from use of mobile technologies; however, mobile technologies are not available to all students in all type of learning, so the actual use of mobile technologies depends of individual student’s financial abilities to acquire a mobile device and knowledge to use it properly for learning. Finally, Lippincot [15] investigated the influence of mobile technologies on higher education and suggested that mobile devices with compelling new features and wireless connectivity are almost ubiquitously available and that we may be on the verge of a revolutionary phase of mobile device impact on higher education and libraries.

III. BENEFITS OF MOBILE LEARNING

Popularity of mobile devices and increased use and reliance on broadband networks have marked the beginning of a new era of education. Everyone wants to benefit from fast access to the internet and digital content available online for learning, both formal and informal. Some of the most obvious and direct benefits of mobile learning are equal-opportunity access, ubiquitous connectivity, multigenerational users and uses, expanded services for mobile workers and enhanced access to services for mobile learners" [16]. As mobile learning is becoming more popular, its benefits become more visible: cost savings, ubiquitous communications, study aids, and location-based services [10]. Mobile learning offers expansion in terms of the learners’ experiences with an emphasis on device ownership, informality, movement and context [14]. Additionally, Klopfer, Squire and Jenkins [17] singled out features of mobile devices that can further enhance quality of mobile learning:

- Portability – students can take the mobile device to different sites and move around within a site
- Social interactivity - students can exchange data and collaborate with other students face to face
- Context sensitivity - students can gather data unique to their current location, environment, and time, including both real and simulated data
- Connectivity - students can use mobile devices to connect their handhelds to data collection devices, other handhelds, and to a common network that creates a true shared environment
- Individuality - mobile devices can provide students unique opportunity of scaffolding that is customized to the individual’s path of investigation.

"Mobile learning can enhance and support more traditional learning modes, making it more portable and accessible. Mobile devices can also serve as powerful data collection tools and cab also facilitate the capture of user created content [12]. Mobile learning depends of access to
digital content. This access is made possible by wireless mobile and wifi networks at universities. However, it should be pointed out that the quality of digital content used in education can vary and in such cases university libraries could play an important role of facilitator to quality content for learning.

By using their mobile devices, students can learn at any time and at any place; they can learn as if they are in a real classroom environment; the learning environment is equipped with sensors and other tiny devices embedded in learning objects; mobile devices are capable to identify the current context and other learning objects of the students so the students are provided with services according to his/her context and situation; the communication between students and instructors has become more ubiquitous [1].

Mobile learning supports individual learning as well as collaboration learning [18] which makes it applicable in different learning environments and situations. Mobile devices can be used in laboratories to gather and control data; in field trips mobile devices can be used to collect pictorial and textual data; in distance learning mobile devices support incidental and accidental learning [18] which makes it applicable in his/her context and situation; the communication between students and instructors has become more ubiquitous [1].

IV. DOWNSIDES OF MOBILE LEARNING

In addition to benefits, mobile learning has met some obstacles. From the technological point of view, mobile devices are different according to their specifications and usability (limited memory, screen size, battery life, storage space, and backlighting making use over long periods uncomfortable, formats such as Adobe Flash are not always supported and PDF or graphics may not display clearly on the screens, input methods are often not user-friendly), the lifecycle of the devices (with each new mobile device, users must continuously learn how to use it and may not have time to exploit the full functionality of the particular device), the diversity and lack of standards in this area, cost could be an issue for users, especially because of the rapidly changing technology and short lifecycle of the devices [2],[19].

Some authors like Keough [20] think that there are serious reasons why mobile learning will not work: it is technology driven; we know too little about what mobile devices are used for; we know too little about learning relationships/networks or the transactional analysis of mobile relationships; it will not change entrenched institutionalized education models; it relies on nascent consumer technology: mobile devices are inherently dissatisfying by never quite meeting every promised need for the consumer; there are no standards to overcome cultural differences; there is lack a bobigogy i.e. teaching and learning models.

As it was previously mentioned, mobile learning depends on quality information resources. Publishers and libraries should provide access to information and support all learners in use of educational and other types of information resources regardless of differences of mobile devices they own and differences in data formats or how much technical support students get in their use of such devices [2]. Part of the problems with content can be solved by libraries and their digital collections. Many libraries already have Web sites adapted for access by mobile devices so the digital content in library collections could be used in the learning process.

V. LIBRARIES AND MOBILE LEARNING

In the system of higher education, libraries have an important role of facilitator to printed and digital knowledge necessary for research and teaching. More frequently than ever, libraries are adopting mobile technologies to provide new and innovative services, as well as introducing ways for users to incorporate library services into their daily lives [21]. Today, libraries offer a variety of services. Some of them include: including mobile library websites and MOPACs (Mobile OPACs), mobile collections, mobile library instruction, mobile databases, mobile library tours, mobile learning, library SMS notifications, mobile library circulation, QR codes, access to services etc. [21]. Furthermore, mobile devices can be used in libraries for the following activities: voice and video calling, sending and receiving e-mail, SMS text messaging, searching the internet, searching databases of scholarly information, organizing citations, accessing a course management system, reading or listening to books and articles, taking photos, playing videos, making videos, setting an alarm clock, using a GPS navigation system and playing games, reading, watching, listening to, and producing digital content that will have the most impact on libraries [15]. Some of these activities are more related to the learning process than other. In libraries which are part of higher education institutions students can use rich digital resources in digital libraries for instruction, assessment, and professional development [22]. In combination with mobile technologies, students can study when they want to or need to and transport their learning materials [22] with them. Mobile technologies help students not only in using the already created digital content but as an instrument for creation of digital content [15].

With proliferation of use of mobile devices "(...) libraries must now decide how much time and funding they should devote to the development and support of academic library resources in formats that can be accessed on such devices” [2]. Once again, libraries can prove the values of their services because they have already traditionally served as a public good, providing resources and services to all, including those who could not afford to purchase some types of content or services on their own [15]. In case of mobile learning and other services related to use of mobile technologies, libraries are unable to equip every library user with and adequate device. It is therefore
highly unlikely that libraries would buy smartphones to its users, but many of them do offer tablets for use in library premises accompanied by the digital content. This is a major step forward towards popularization of use of mobile devices in libraries as well as use of digital content. Libraries would be hardly useful without librarians. The role of librarians can be very interesting and innovative. "Librarians might encourage, through contests or other means, student development of apps that make library content and services more useful for specific groups of users" [15]. They are not only knowledge managers. They are also promoters of new technologies that can be used in libraries and in academic institutions for research and teaching. As a result, many libraries in the world have embraced mobile technologies and support mobile learning.

VI. DEVELOPMENTS AND CHALLENGES OF MOBILE LEARNING

While there are many aspects of mobile learning that are already known to scientist and professional involved in research and implementation of mobile learning, there are still some issues that remain unresolved or unknown due to the novelty of technology used in this type of e-learning. Conole [23] wrote about organizational aspects of e-learning which can be applicable to mobile learning as well. Theses aspects should be taken into account for mobile learning to be successful: 1.) understanding of how stakeholders (academics, support staff, administrators, senior managers and students) currently work 2.) mechanism and procedures for developing shared knowledge banks of expertise and information 3.) outline of roles and responsibilities for mobile learning activities? management, technical, research, dissemination, evaluation, training 4.) What are the different views of e-learning and its role? academics vs support staff 5.) how are institutions dividing roles and responsibilities for mobile learning and how much training and support are staff getting.

Other problems related to mobile learning and libraries are: the growing quantity but not all content of library holdings is prepared and adapted for use on mobile devices. In addition to lack of digital content in libraries made for use on mobile devices, there is also a lack of digital repositories with educational materials. Furthermore, teaching staff is not equipped and trained for use of mobile devices in the teaching process, there is a lack of standards for evaluation of use of mobile devices in teaching etc.

Implementation of mobile learning is a complex endeavor and many factors must be taken into account if educators and technology developers want it to be successful [24]: context: gathering and utilizing contextual information may clash with the learner’s wish for anonymity and privacy; mobility: the ability to link to activities in the outside world also provides students with the capability to ‘escape’ the classroom and engage in activities that do not correspond with either the teacher’s agenda or the curriculum; learning over time: effective tools are needed for the recording, organization and retrieval of (mobile) learning experiences; informality: students may abandon their use of certain technologies if they perceive their social networks to be under attack; ownership: students want to own and control their personal technology, but this presents a challenge when they bring it in to the classroom.

When speaking about mobile learning, it is almost impossible not to mention social networks and learning management systems [25]. Students at the Faculty of humanities and social sciences (in Zagreb, Croatia) are using social networks in search of the learning material and for communication with other students and teachers while learning management system is used for access to the learning material created by teachers and students at this Faculty [25]. Since social networks are well adapted to access on mobile devices, everyday educational practice demonstrates that every communication between students and teachers on social networks is well accepted by students who use their mobile phones for communication related to the learning process as well for informal communication with family and friends [25]. The latest version of the learning management system Moodle which is called Omega at the Faculty of humanities and social sciences is also accessible on mobile phones and tablets and it is used in the learning process on daily basis. This helps students to stay in touch with the latest announcements or published content related to courses they enrolled in the academic year. The problem is the course related content which is not made to fit the small screens on smartphones or smaller tablets but is made for desktop PCs and laptops. This is one of the frequent problems related to mobile learning in an environment which is not fully adapted for implementation of mobile learning. Furthermore, the lesson plans must include students who own mobile devices as well as students who don’t own mobile devices or their mobile device is too old to access and display course content properly if at all. To enable use the course content more extensively on mobile devices in future, content creators will have to produce several versions of content which will be displayable on various devices.

VII. CONCLUSION

In the educational sector, mobile technologies are being introduced into the learning process more and more frequently and are becoming important for its development. More specifically, mobile phones can expand educational access and they can support instruction, administration and professional development [27]. The results of research conducted in 2012 [25] suggest that mobile devices are already present in the learning process in higher education in Croatia. Generally speaking, mobile technologies open the door for a new
kind of learning in which students can learn at any time and at any place. As technological devices become more present in education, more researchers are looking into different aspects of technology enhanced learning. Most recently, focus in technology enhanced learning is put on use of mobile devices i.e. mobile learning or m-learning. Current versatility of use of mobile devices in learning suggests that the possibilities of their future use will only increase as mobile devices become more feature rich and as new types of digital content becomes available and usable on mobile devices. Further implementation of mobile technologies in the learning process would probably result in better learning materials and systems [26] and this will in the focus of future research. Use of mobile devices in education represent a challenge because it is difficult to predict what the next generation of mobile devices will bring from the technological and pedagogical point of view. In addition to students who are keen on using mobile devices, libraries are also adopting mobile technologies more frequently than ever to provide new and innovative services, as well as to introduce new ways for users to incorporate library services into their daily lives. With proliferation of use of mobile devices, libraries must now decide how much time and funding they should devote to the development and support of academic library resources in formats that can be accessed on mobile devices. While there are many aspects of mobile learning that are already known to scientist and professional involved in research and implementation of mobile learning, there are still some issues that remain unresolved or unknown due to the novelty of technology used in this type of learning.

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