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Technical and Infrastructural Aspects of Mobile Learning Adoption in Iran Higher Education

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Abstract

Nowadays learning has developed to a new way of anywhere and anytime by using mobile devices called m-learning which can provide flexibility, independency and creativity in academic environment. Most studies about m-learning are for higher education and the most users of m-learning are higher education students. Although developed countries are using m-learning in educational sectors, most of the Middle East countries are far from m-learning, and facing number of challenges. In Iran m-learning is still in early stage of implementation in higher education and in terms of technical and infrastructural aspects there is a vast gap in compare with developed countries. Although technical and infrastructural difficulties are one of the significant aspects in implementation and integration of m-learning technologies in education, the technology will not be successful if could not adopt with users. Due to the importance of user adoption with m-learning, there are limited studies about m-learning adoption in higher education of Iran. This paper attempts to review on technical and infrastructural aspects that facilitate m-learning which have effect on adoption of Iran higher education system. The review of the trend in the literature provides a reference for higher education institutes for decision making in developing m-learning for their students.

Keywords*: Mobile learning, M-learning, Iran, Higher education, Technology adoption, Mobile adoption, Technical and infrastructural factors*

1. Introduction

The education system has had major reforms in the developed countries that have brought independency, interactivity, creativity and flexibility in the academic environment through the last fifteen years. The context of mobile-learning is not equal to the traditional e-learning. In fact, mobile learning is usually targeted to the user's learning needs and highly dynamic. The terms fast learning or just in time learning have been used to mention the user's current context. Otherwise, mobile learning can be regarded as a 'down time' activity. Mobile learning (m-learning) has become not only possibly nowadays but also practical due to new and advance mobile device features such as color display, browsers and video streaming. Facilitation of student–

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teacher communication and interaction, freedom and self-study, and information sharing have been identified by many studies as the benefits of m-learning. Based on Chee and his colleagues' study, most of the research on m-leaning have focused mainly on higher education with most users of mobile learning been students of higher learning [1].

Although educationally developed countries such as United State of America, Singapore, Japan, Australia and European Union are utilizing mobile devices in the learning sectors and they have accommodated m-learning in their traditional educational system, most of the Middle East countries are quiet out of race, and facing with a numerous challenges in m-learning system and learning the advantages of mobile devices remained unexplored especially in countries with less advanced education system in the Middle East. In Iran also m-learning faces problems, for example: m-learning is still in early stage of implementation in higher education of Iran, and in terms of technical and infrastructural aspects, there is a vast gap in compare with developed countries [2] [1] [3]. Moreover, it is true that technical difficulties are one of the significant aspects in the implementation and integration of m-learning technologies in education but the technology will not be successful if could not adopt with users and there are limited studies about m-learning system adoption in higher education of Iran [1][3]. In fact, the first step in implementing successful m-learning in higher education environments is an examining the factors which have effect on students' adoption to use m-learning [4] [5]. The momentous goal of this research is to investigate the technical and infrastructural factors which facilitate on m-learning system by explore on m-learning technology in educational setting.

To successfully implement m-learning, universities must understand what best ways to apply m-learning and the nature of services the m-learning system should offer to students. In addition, designers can make better decisions for implementation of mobile learning systems if they investigate about students' perspectives and understanding of quality factors for m-learning systems [6]. This paper attempts to review on technical and infrastructural aspects that facilitate m-learning which have effect on adoption of Iran higher education system.

2. Literature Review

M-learning is not location-dependent, meaning m-learning can take place almost anywhere, for example, at a restaurant, in a taxi, on the street. M-learning has become more attractive compared to electronic learning (e-learning) as data plans for mobile devices decrease and become more affordable. This is coupled with the flexibility of m-learning as e-learning also requires a fixed location and at best very little mobility. However, due to m-learning is still new technology, there are still some existing challenges associated with, including technical and infrastructural aspects [2]. With the great learning opportunities that m-learning provides, it is beneficial to consider it more seriously in education and take advantage of what it has to offer. Although the social and educational challenges on the way of implementing mobile learning are not always a major concern and most of these challenges apply only to specific aspects of m-learning and under certain circumstances, technical difficulties which are Factors Related to Devices [7] [8] and Factors Related to Infrastructure are the main aspects in integration and implementation of m-learning technologies in education [9].

2.1 Factors Related to Technical Aspects

Mobile devices are usually equipped with small screen size and Typing difficulty due to small keyboards or virtual keyboards [7]. Mobile devices are also limit the type and amount of information being displayed, and this triggers the redesign of old text presentation. According to [10], another issue is cost, that data service plans may still be costly for some students. There are other limitations of using mobile device in

teaching, including connectivity, short battery life [7], unsuitability and Lack of Rich Graphical and Interactive Features [7], Meeting required bandwidth for nonstop or fast streaming, the possibility of transaction errors, limited input capabilities, Limited memory size for downloading learning materials from designated websites [8], Processing Power for responding to educational functions of instructors such as: participating quizzes and video conferencing. In addition to above, there are more technical aspects that facilitate m-learning in Iran higher education system. For example: processing speed of mobile devices play a vital role in m-learning. It is clear that students who have latest version of mobile devices with enhanced processing speed and memory are more flexible regarding with learning via mobile devices. Moreover, slow load time, difficulty with reading content format (e.g., PDF not sized correctly), file format limits that means some file formats are supported only by specific mobile devices and not by others , lack of specialized mobile applications, Content security, copyright issue from authoring group , Multiple standards/multiple screen sizes, multiple operating systems, reworking existing e-Learning materials for mobile platforms [8] [11], hardware issues, mobile software [12] and operation issues such as: software portability, software agent support, scalability are other difficulties of m-learning. In addition, sometimes programming and designing learning material for mobile devices is difficult and costly [11]. Also, different and incompatible processing platforms, different file formats and risk of sudden obsolescence [13] are the other issues of m-learning. When rolling out m-learning services, academic institutions must understand the academic backgrounds of the learners as this can affect the nature of applications the need to use m-learning [14] [15].

2.2 Factors Related to Infrastructural Aspects.

Mobile devices should have mechanisms that enable them to connect to a variety of systems through various means. Wi-Fi, GSM, Bluetooth, infrared, and CDMA are common existing wireless technology standards that are crucial for m-learning. The Internet and the World Wide Web have been a source of unparalleled access to scientific, procedural, and cultural information. The quality of data and speed of data transfer can be compromised if there are no adequate standards. In Table 1 m-learning infrastructural aspects are shown [16].

Table 1. Infrastructural Aspects of M-learning

Criteria /Aspects	Examples & Concepts	Comments
Device Networking	Personal area networks (PANs), wide area networks (WANs), wireless local area networks(WLAN), synchronization software, wireless fidelity (Wi-Fi), cellular connectivity.	The various connectivity standards allow users to connect to other users, systems, and information. Networking in mobile systems are often hindered by low bandwidth on wireless networks.
System Connectivity	Internet access and document transfer protocols.	Users must be able to exchange documents and information within and across systems. This affects the organization of individuals and systems that are attempting to interact.

Some problems with infrastructural aspects of m-learning in universities include: i) Login, password and authentication problems as it took too long to authenticate and short inactivity windows meant only a short period of inactivity required re-authentication.; ii) Short life spans of mobile devices; iii) Unstable Wi-Fi connectivity; iv) slow access to webservers which affect time-constrained educational applications and tasks; v) provide stable Wi-Fi infrastructure for mobile applications; vi) provide simple and stable educational applications in large classes [17].

2.3 M-learning Adoption

There are other challenges to m-learning implementation in higher education institutions besides technological aspects of mobile devices as the implementation of mobile learning does not necessarily result in effective learning and teaching performance cannot be enhanced by technology alone. In other words, knowledge in technical and infrastructural aspects of m-learning does not help to technology adoption [18]. Sabah (2016) also believes that the foremost step towards implementation of m-learning in higher institutions of learning is by examining factors that influence the acceptance and adoption of m-learning by students. Therefore, there is a need to understand and investigate the factors that influence students' adoption to use m-learning regarding to existing technical and infrastructural aspects of m-learning in Iran. This will help Iranian universities to make m-learning systems that are acceptable and relevant. Moreover, attempts to apply technology adoption models to explain students' intentions to adopt m-learning in an education context have also been limited and require further investigation to determine whether these models need modification to address m-learning technology adoption [19]. In information systems, many competing theories and studies have researched, designed and implemented to accessing IT user acceptance and adoption. These models can guide researchers for study about the factors that influence the acceptance and use of technology such as m-learning. From the viewpoint of the task-technology fit (TTF), people will accept a technology just when the characteristics of technology is fitted with their task features [20]. Although people may observe a technology is valuable, they will not accept the technology if it is not match with the task at hand properly when they cannot increase their performance[21][22]. The technologies of mobile learning are usually designed for people to conduct various learning-related tasks for effective purposes. Therefore, it is significant to explore m-learning acceptance from combine of different views to the technology and the fit based on TTF. Unified theory of acceptance and use of technology (UTAUT) is also one of the popular theories in information technology acceptance. According to [23], Unified Theory of Acceptance and Usage of Technology Mode (UTAUT) explained about 70% of the variance in behavioral intention. It has been reported that UTAUT outperforms the earlier models. In addition, it is a useful tool for assessing whether new technology can be successful [24]. UTAUT includes eight other models that are significant to user adoption information system models. Venkatesh noted that researchers usually choose constructs from other models for their studies. In the technology of acceptance model (TAM), two principles are relevant to UTAUT: Perceived Usefulness and Perceived Ease of Use. TAM theorizes has effects on external variables such as System Characteristics and Developmental Process and Training and so on. Intention to Use is mediated by Perceived Usefulness and Perceived Ease of Use. Moreover, TAM theorizes that Perceived Usefulness is also influenced by Perceived Ease of Use because other things being equal, "the easier the system is to use the more useful it can be."

In addition, researchers have developed m-learning adoption models to assist formal learning in higher education which are from combination of IS models for achieving user adoption with technology and they are relative with this research. Sabah, 2016 considers students' perceptions and awareness of mobile learning and inquires the parameters affecting students' behavioral intention into adopt mobile learning, using a

modified research model that integrate TAM and UTAUT alongside with other parameters such as: m-learning services and mobile limitations. Moreover, moderator variables (frequent use of m-services, level of mobile usage and mobile capabilities,) and control (gender, study level, field of study) were used to confirm whether there were individual differences among respondents on the main factors that affect adoption and utilization of m-learning. The theory attempted to explain computer usage behavior and explore whether external factors associated with the acceptance of technology had influence on the internal beliefs of users (Perceived usefulness and Perceived ease of use), attitudes, intentions, and technology use. Sabah believes students' acceptance must be the foremost consideration in the designing and implementation of a successful m-learning system [4]. The research aim of Oliveira and his colleagues (2014) is m-adoption by proposing a model for understanding the significance of relationship between the user perception of m-Banking, initial trust in m-Banking services and the fit between the m-Banking technology characteristics and task characteristics with combining task technology fit model TTF, UTAUT and ITM [26]. In [3] the goal was to investigate the effects of social and individual factors on m-learning adoption in Iran, i.e., effects of perceived ease of use, perceived usefulness, perceived image, subjective norm, personal innovativeness, absorptive capacity, individual mobility and self-efficacy on user intention and satisfaction in m-learning system. Moreover, the study searched about student's satisfaction for actual use of m-learning. in the research author combined two models of TAM and ECT with together in order to m-learning antecedents, satisfaction and intention as well [3]. In addition, The purpose of Rehman and colleagues was to identify factors influencing the adoption of mobile learning from learners' perspective and behavioral intention. The conceptual model is proposed in order to measure students' intention towards mobile learning. in addition, the model has been made base of integrating two models of TAM and UTAUT [27] . In Gan and his colleagues research, the study investigated the factors that drive an individual's behavioral intention to adopt m-learning in the context of a mobile library and found that in comparison with traditional library services, the mobile library offered more benefits [28]. The study proposed a model based on the integration of attitude and TTF. According to [22], focus is on the explanation of the user's adoption from technology perceptions such as, interactivity, perceived ease of use, perceived usefulness, and relative advantage. However, technology fit to user tasks can also determine a user's adoption of m-learning. That is to say, advanced technology might not be adopted by users if it is not suitable or does not fulfil their task requirements. The study proposed a mobile banking user adoption model by incorporating the task technology fit (TTF) model with the unified theory of acceptance and usage of technology [22].

3. Methods

In particular, the review have addressed the following research question: "How can m-learning be adopted in Iran higher education system based on existing technical and infrastructural issues"? The online databases that have been used to collect the related articles are: Science Direct, Emerald, Scopus, Elsevier, Web of Science, Springer and IEE. These online databases are widely accessed with top publication reports released by the Google Scholar metrics. In this review all of the papers published in these databases about technical and infrastructural aspects of m-learning and especially technical and infrastructural aspects of m-learning in Iran without utilizing other filtering criteria were selected. A total of 98 studies concerning to m-learning from 2007 to 2017 were selected and among these studies 22 papers were selected and referenced in this review paper. In addition, the key words which are used for these research are: Mobile learning, M-learning, Iran, Higher education, Technology adoption, Mobile adoption, Technical and infrastructural factors.

4. Results and Discussion

Today, mobile devices have a significant role in people`s lives whole the world especially young people as a tool in communications and data transfer. In fact, at the first glance m-learning is like using personal computers but in a smaller in size; however, findings show that the technical and infrastructural limitations can have negative impacts on educational system such as students' adoption in terms of m-learning. It is also clear Iran has a number of technological and infrastructural issues that can have effect on students' adoption with the system. Slow load time, difficulty with reading content format (e.g., PDF not sized correctly), file format limits that means some file formats are supported only by specific mobile devices and not by others, lack of specialized mobile applications, content security, multiple screen sizes, multiple operating systems, multiple standards, reworking existing e-Learning materials for mobile platforms [8] [11], hardware issues, mobile software [12] and operation issues such as: software portability, software agent support, scalability, Difficult programming that Programming and designing learning material for mobile devices is difficult and costly [11], interfaces of mobile phones, Processing platform issue that learners may use different devices with different processing platforms, various file formats of learning, risk of sudden obsolescence [13], and the academic background of learners would determine the types of applications needed to use m-learning, and academic institutions must understand and take these factors into consideration before rolling out m-learning services [14][15]. Login, password and authentication problems, device power issues since mobile devices have short device life spans, unstable Wi-Fi connectivity, and slow web servers are further issues that affect m-learning from an infrastructural perspective.[17] [12].

5. Conclusion

The high amount of mobile phones and the fast mobile technology growth let to new opportunities in learning environment through mobile devices. It is clear that mobile technologies have many advantages for higher education such as interaction and cooperation or connection and communication among students out of classroom. In fact, m-learning able students study anywhere without time limitation. The paper reviewed the technical and infrastructural aspects of Iran higher education m-learning system. According to previous researches there is no doubt that m-learning would be one of the most popular technologies of learning and teaching in the near future. In future the research will investigate factors influencing the adoption of mobile learning from Iranian students' perspective and examines the factors affecting students' behavioural intention to adopt m-learning, by using a modified research model that integrate task technology fit model and unified theory of acceptance and use of technology according to existing technical and infrastructural limitations in universities in Iran.

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