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# **Towards a Framework for Perceived Effectiveness of Mobile Learning**

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## **ABSTRACT**

Recent years have witnessed rapid advancement in mobile learning technology. A major issue is the identification of the factors that would relate to the diverse needs of users. If mobile learning is intended to enhance distance, interactive, and collaborative learning, then it is mission critical to understand the impact of individual, social, and technological factors that would play a role in the effectiveness of this learning model as perceived by its users. This paper addresses this need by proposing an integrated and a holistic model that depicts the factors that may have the potential to impact the perceived mobile learning effectiveness. To operationalize the model constructs, a survey-based instrument will be developed based on a review of frameworks pertinent to technology acceptance, diffusion of innovation, and media richness, and of literature related to e-learning. The conceptual model will be discussed, and the study conclusion, implications, and limitations will be presented.

## **Keywords**

Mobile Learning, Effectiveness, Diffusion of Innovation Theory, Technology Acceptance Model, Media Richness, Student Perception, Instructor Perception.

## **INTRODUCTION**

The impact of the internet technology has reached many industries and sectors, including the education industry, which represents a fertile area for wireless technologies nurtured by the high adoption rate of mobile devices by both faculty and students. Online courses as well as courses supported by online resources have become widely applied forms of e-learning or hybrid learning. Moving from immobile computers in university computer labs to mobile devices and wireless LANs could provide educational institutions with cost-effective and value added solution to reap the benefits of an educational network and could remove the restrictions of the on-campus lab computers. Mobile devices provide both faculty and students with the means to access and use computing power with no time or space constraints, whereas the Internet and wireless technologies provide the means for seamless interconnectedness with other online resources. Based on this, the instruction and learning processes will utilize laptop computers, mobile phones, PDAs, and wireless access points (Wong and Csete, 2004), which are connected to other networks and the Internet. This move was facilitated to a large extent by the affordability, increased computing power, and usability of laptop computers which started the wave of portable or mobile learning (M-Learning), and put a world of information at the immediate reach of users (Jacob and Isaac, 2007).

Establishing appropriate and useful interactive online learning communication environments facilitated by mobile learning technologies is key, yet a complex task. In fact, a recent report by Pew Internet and American Life Project shows that mobile technologies may contribute to reducing or eliminating the 'digital divide' (Smith, 2010), indicating that mobile learning can provide under-served communities with the opportunity of getting quality education. Nevertheless, designing a mobile learning environment that enhances the achievement of learning outcomes by supporting the users' learning process and empowering the pedagogical model followed by instructors is a complex process. The complexity stems from the fact that mobile learning encompasses technological, individual, and social aspects (Koole, 2009). This requires online workers to maintain and improve their sense of social responsibility in the information era (Dhillon, 2002) through proper identification of the main concerns and needs of mobile learners. Accordingly, a critical approach must be taken to handle the increased volume and frequency of use of distance learning, as well as to ensure a growth in the quality of online communications.

The need for the study stems from the fact that users' reliance on mobile learning technologies is increasing (Jacob and Issac, 2007), yet based on their socio-technical nature, these technologies can pose complex challenges. For example, in USA and UAE, one can find wide usage of mobile devices sometimes for learning purposes, yet in several other countries, the phenomenon is still a very modest one, and is subject to self initiative only. Symbolizing different cultures and different command of resources, it will be a major contribution to analyze the differences and similarities in mobile learning adoption and usage across various countries.

Previous research compared the situations of mobile market for mobile learning at universities in a certain context (Goda et al, 2008). Previous research also studied the impact of having a mobile learning culture in an institution on the higher education learning outcomes (Jacob and Isaac, 2007). Also, researchers discussed the importance of interactivity for having both efficient and effective learning and teaching in the mobile learning environment (Wang et al, 2009; Wessels et al, 2007). This efficiency in the learning process is manifested by the flexibility offered to students regarding the determination of the conditions and settings of their learning environments (Field, 2005), and the effectiveness is demonstrated by having students getting more deeply, actively, and personally engaged in the learning process (Looi et al, 2011; Wang et al, 2009).

Previous research also examined the teaching models which add mobility to the classroom setting and integrate online learning in a continuous stream framework (24\*7) (Simon, 2000). Field (2005) argued that these models can show significant efficiency benefits. Use of asynchronous discussion tools, where the format of interaction facilitates contributions at a student's own place and in their own time (Salmon, 2004) achieves efficiency and effectiveness in the learning process (Field, 2005). The portability of devices along with wireless connectivity is believed to benefit learners in terms of flexibility of access to learning materials (Barker et al, 2005), and is expected to provide instructors with opportunities for more interaction with students. Despite all the remarkable contribution of this research work, the mobile learning research stream still needs to look at the effectiveness aspect of mobile learning from the perspective of users themselves, namely students and instructors.

## **STATEMENT OF PROBLEM**

Mobile learning technologies have been the subject of serious academic research. Their use has been increasing enormously in various societies by various people groups, including students and instructors in universities. In USA, for example, the market for mobile learning products and services reached \$632.2 million in 2009 (Ambient Insight, 2010). Experts estimate that the demand is growing by a five-year compound annual growth rate of 18.3% and anticipate revenues to reach \$1.4 billion by 2014 (Ambient Insight, 2010). This attracted a lot of research work to be conducted in this respect. For example, previous research discussed the mobile learning culture and investigated the students' perceptions of its benefits (Jacob and Isaac, 2007). However, frequent adoption and use of mobile devices does not mean that instructors or students are ready for mobile teaching and learning (Corbeil and Valdes Corbeil, 2007).

In addition, the successful use of computers in classrooms depends on the teachers' attitudes towards computers (Uzunboylu and Ozdamli, 2011; Lawton & Gerschner, 1982). Prior studies have stated that teachers' attitudes as well as knowledge and skills in using computers are major factors affecting their early acceptance of computer technology as well as their future behavior a propos computer usage (Koohang, 1989). Kluever et al (1994) also found that teachers' attitudes towards computers might affect their instructional use of computers and the extent to which they benefit from training. However, recent studies have found that instructors and students are still reluctant to engage in an active or sustained manner in activities using information technology (Reffell and Whitworth, 2002). More recent studies suggest that further research design should extend beyond the technology-based tools, for example, to include a broader range of social factors (Selwyn, 2007). Thus, in order to understand and anticipate teachers' use and acceptance of mobile learning technologies, a well-defined framework is essential. Also, a well-put framework that assesses teachers' and students' perception of mobile-learning effectiveness will be a good contribution to the understanding of the factors that would pave the way to better implementation of mobile learning. This research is an attempt to fill this gap, as is elaborated in the next section.

## **STATEMENT OF PURPOSE**

Drawing on literature related to e-learning and mobile learning, and based on a theoretical framework encompassing three models, media richness theory (Daft et al, 1987), diffusion of innovation theory (Rogers, 1983), and technology acceptance model (Davis et al, 1989), this paper intends to: (1) identify the factors that are most likely to be associated to perceived effectiveness of M-Learning; (2) develop a conceptual model that depicts the relationships between these factors and the perceived effectiveness; and (3) operationalize the model constructs through scale construction phase ( that starts with

experts' consultation for content validity and domain coverage all the way through to instrument administration). These three stages pave the way for future research to empirically test the model through administering the questionnaire and testing its validity and reliability.

Based on this, the study is believed to be useful for many groups, namely scholars, e-learning designers, and IT system developers. Scholars can make use of the model to analyze the relationships, build on them, and empirically test them. E-learning designers may find the model useful for designing and developing e-learning systems and packages that take into consideration the very unique characteristics of users and their operating contexts to provide them with more effective learning and instruction processes. Finally, IT system developers may find the study useful for taking the technology aspects of the system into consideration, and in coordinating their efforts with e-learning designers to have a 'task-technology' fit.

In conformity with the above mentioned objectives, this study intends to address the following research questions:

1. What are the factors most likely to be associated to users' (students and instructors) perceptions about M-learning effectiveness?
2. How do perceived ease of use, usefulness, relative advantage, image, voluntariness, and social factors relate to users' (students and instructors) perception about M-Learning effectiveness?

In order to answer these questions, a model will be developed based on a theoretical framework and literature review. The model constructs will be operationalized in order to build a survey instrument needed for the data collection purposes. The remaining of the paper will proceed as follows. The next section will discuss the theoretical framework upon which the study relies. Following this will be a presentation of the literature review, a derivation of the study hypotheses, and a depiction of the conceptual model, which will be later validated and tested. Finally, the study conclusions, implications, limitations, and recommendations of the study will be presented.

### **Literature Review, Statement of Hypotheses and Conceptual Model**

This paper draws on three theoretical models; media richness theory (Daft et al, 1987), diffusion of innovation theory (Rogers, 1983), and technology acceptance model (Davis et al, 1989). To start with, the media richness theory points out that different media have different characteristics, and that these different characteristics affect the personal ability to communicate rich and complex information. Information richness can be defined as the ability of information to change understanding within an interval of time and the use of suitable media for equivocal information (Daft and Lengel, 1986). Ambiguity could be alleviated with a pedagogical approach that empowers, through the theory of media richness, the process of online communications (Kurubacak, 2006). So, using richer media through mobile learning technologies can have a remarkable impact on the learning and instruction processes.

As for the diffusion of innovation theory (Rogers, 1995), the characteristics of innovation have been reported to help explain the different rates of adoption regardless of the nature and characteristics of people. The five characteristics of innovation, as perceived by users, are (Rogers, 2003): (1) relative advantage (a better alternative of the currently applied system); (2) compatibility (degree of consistency with existing values and past experience); (3) complexity (degree of difficulty); (4) trialability (ability to experiment before adoption); and (5) observability (visibility of results). Of course, the applicability of these attributes to the adoption of mobile learning by instructors and students is clear. Also, emphasizing the effectiveness as perceived by the users of mobile learning, the relative advantage could possibly be of good use for explaining the variation in this construct along the two groups of users in a university setting: instructors and students.

Coming to the technology acceptance model (TAM), this theory was developed by Davis (1986) to model the factors that lead users to accept and use a technology. TAM suggests that when a new innovation is offered to potential users, some factors, especially perceived usefulness and perceived ease of use, influence their decision regarding how and when they will adopt it. The relevance of these two factors to the study of M-Learning perceived effectiveness is also clear. If M-Learning is perceived as easy to use and useful, then users would most probably perceive it as effective.

### **Benefits of M-Learning**

Being a subset of e-learning, m-learning benefits have some commonalities with e-learning benefits, including (Jacob and Isaac, 2007):

- 1) *Easy Access* of knowledge, with updated information done within the m-learning campus;

- 2) *Options for Self-study*; i.e. flexibility for participants to learn at their own time and pace which allows for increased information retention;
- 3) *Evaluation and Feedback* –assessment tools being parts of the m-learning or e-learning packages to monitor student's progress;
- 4) *Access of Online Repository* – the online materials accessed through m-learning system offers a place for the lecturers and students to interact frequently. Learners have access to digital course materials and a host of other online resources for assignments and exams; and
- 5) *Communities of Practice (COP)* – the three elements here are a domain, a community and a practice and the theory behind is that learning involves participation in a COP. Most COPs meet online and m-learning makes this quite feasible.

### **Students' Perception of M-Learning**

Exploring the factors that influence students' perception of M-Learning is pivotal for overcoming barriers to its adoption and proper implementation in universities or other contexts. Previous studies contended that student perceptions of M-learning could be influenced by certain individual variables; for example, Jacob and Isaac (2007) examined the effect of gender, course of study, and attitudes to new technologies on students' perception. Using the theories of technology acceptance and diffusion of innovation into consideration as a frame of reference, the authors reported that the student community widely embraced the idea of mobile learning as they had favorable attitudes regarding the fact that M-learning facilitates easy access to learning resources (74%); collaboration and chatting with online friends (43%); cost savings for university computer labs and library PCs (79%); less virus attack (30%); and communication is a lot easier with teachers and friends (33%). Of course, to achieve M-learning, the user must have access to a variety of mobile devices, including laptops, palmtops, mobile phones, and PDAs. Users must also have awareness about some technical aspects, such as bandwidth, speed, and security issues related to wireless networks (Jacob and Isaac, 2007).

### **Teachers' Perception of M-Learning**

The classroom is rapidly evolving. Nowadays, the teacher could be faced with the challenging task of effectively integrating the electronic device into the day's lecture. Hardwired desktop computers limit students to information access only inside wired classrooms and even there, the space requirements and fixed wiring prevent students from organizing into groups. Consequently, it would be difficult to make simultaneous interaction with other students and with information sources (Kabara et al, 2000). However, the decreasing price of handheld computers or laptops with wireless connectivity can reduce such problems, and can thus allow students' access to information within richer educational settings (Kabara et.al, 2000). Once again here, and as mentioned above, it is pivotal to focus in research on a broad range of factors that have the potential to influence teachers' perception about the effectiveness of M-Learning. These of course include human, technological, and institutional factors. The next section will elaborate on these factors that influence both teachers' and students' perceptions of M-Learning effectiveness, as derived from TAM, DOI, and media richness frameworks.

**Perceived ease of use:** Davis et al (1989) hypothesized perceived ease of use to be a fundamental determinant of intention to use. This, in turn, may influence the user acceptance to a certain information system. Ease of use was also reported to have a positive and significant effect on the behavioral intention to use ERP systems (Amoako-Gyampah, 2007). As validated from extensive previous studies, the following hypotheses could be stated:

*H1a: Perceived ease of use is positively related to students' and instructors' perceived effectiveness of mobile learning technology.*

*H1b: Perceived ease of use is positively related to students' and instructors' intention to accept M-learning technology as an effective learning media.*

**Perceived usefulness:** This was also hypothesized to be a fundamental determinant of intention (Davis et al, 1989) and, hence, behavior of user acceptance of a specific application system. Similarly, Amoako-Gyampah (2007) found a positive direct effect of perceived usefulness on the behavioral intention to use ERP systems. Thus, with perceived usefulness being the fundamental construct of TAM, it could be stated:

*H2a: Perceived usefulness is positively related to students' and instructors' perceived effectiveness of mobile learning technology.*

*H2b: Perceived usefulness is positively related to students' and instructors' intention to accept M-learning technology as an effective learning media.*

**Relative Advantage:** relative advantage was redefined by Moore and Benbasat (1991) as “the degree to which using the innovation is perceived as being better than using its precursor”. Relative advantage was contended by Rogers (1983) and reported by Moore and Benbasat (1991) as strong predictor for the adoption of internet by users. Based on this, and with M-learning advantages in mind, the following hypotheses could be posited:

*H3a: Perceived relative advantage is positively related to students' and instructors' perceived effectiveness of mobile learning technology.*

*H3b: Perceived relative advantage is positively related to students' and instructors' intention to accept M-learning technology as an effective learning media.*

**Image:** This refers to an individual's perception regarding the extent to which the use of a technology or an innovation would enhance one's image or status in one's social system (Moore and Benbasat, 1991). In their study, the image construct also had a positive impact on Internet adoption, explaining 8.9% of the variance in adoption. In fact, the concept of image encompasses the enhancement of the status that individuals gain in their social system (Moore & Benbasat, 1991). Rogers (2003) argued that the desire to gain social status was one of the most vital motivations for almost any individual to adopt an innovation. With this in mind, the following hypotheses could be set:

*H4a: Perceived image is positively related to students' and instructors' perceived effectiveness of mobile learning technology.*

*H4b: Perceived image is positively related to students' and instructors' intention to accept M-learning technology as an effective learning media.*

**Voluntariness:** this is defined as the degree to which use of innovation is perceived as imposed by an organization or perceived as being of free will (Moore and Benbasat, 1991). The results of multiple regression analysis conducted by the authors showed that voluntariness was significantly and positively related to internet adoption, explaining 3% of variance in predicting the adoption of Internet. Drawing on this, the following hypotheses could be stated:

*H5a: Perceived voluntariness is positively related to students' and instructors' perceived effectiveness of mobile learning technology.*

*H5b: Perceived voluntariness is positively related to students' and instructors' intention to accept M-learning technology as an effective learning media.*

**Subjective Norms:** This refers to a person's perception that most people who are important to him or her think he or she should or should not perform a certain behavior (Ajzen & Fishbein, 1980). In a university, the introduction of an M-learning platform is a combined effort of both the instructor and the organization. From the learner's view, in a learning community, the instructor and the institution are important others. Accordingly, the learner will naturally perceive that the instructor would think all individual learners should use the system. At the same time, because the instructor and the organization have spent so much effort in providing the M-learning materials on the platform, the individual will also view the system as useful – otherwise the instructor would not spend so much time and effort on it. Moreover, the learner would also have a general perception that, as the important others think that he or she should use it, it must be easy to use. Previous studies showed that instructors and mentors can contribute significantly to students' perceived usefulness, and that mentors can influence students' perceived ease of use (Shen et al, 2006). Based on this, the following three hypotheses could be stated:

*H6a: An individual's perception on subjective norm is positively related to his or her perceived usefulness about M-learning technology.*

*H6b: An individual's perception on subjective norm is positively related to his or her perceived ease of use about M-learning technology.*

*H6c: An individual's perception on subjective norm is positively related to his or her intention to accept M-learning technology as an effective media.*

**Computer self-efficacy:** This is defined as the judgment of one's capability to use computer technology. This is similar to the general self-efficacy derived from Bandura's social cognitive theory (Compeau & Higgin, 1995). The strength of a computer self-efficacy judgment refers to the level of confidence an individual has regarding his or her ability to perform various tasks in the system. Here, we argue that an individual will have a higher tendency to use the system if he or she perceives him or herself as capable or competent. On the other hand, if an individual views him or herself as less competent at using the system, there will be more hesitation to use the system. In general, if the individual seldom uses the e-learning platform, the individual will not be aware of the potentials and functionality of the M-learning platform, and will thus find it less useful.

Accordingly, a person with a high self-efficacy to computers in general will perceive a system more useful; a person with a low self-efficacy to computers in general will perceive a system less useful. Thus:

*H7a: An individual's computer self-efficacy is positively related to his or her perceived usefulness about M-learning technology.*

*H7b: An individual's computer self-efficacy is positively related to his or her perceived ease of use about M-learning technology.*

*H7c: An individual's computer self-efficacy is positively related to his or her intention to use M-learning technology.*

Finally, previous studies reported a significant and positive relationship between perceived effectiveness of a technology and its usage or the intention to use it. For example, Steyn et al (2010) found that bloggers' perceptions of social media release (SMR) effectiveness are positively and significantly related to SMR elements use. Accordingly,

*H8: Users' perceived effectiveness of mobile learning technology is positively and significantly related to their usage intention.*

Based on the above literature review and the derived hypotheses, the research constructs and their relationships could be depicted as shown in Figure 1.

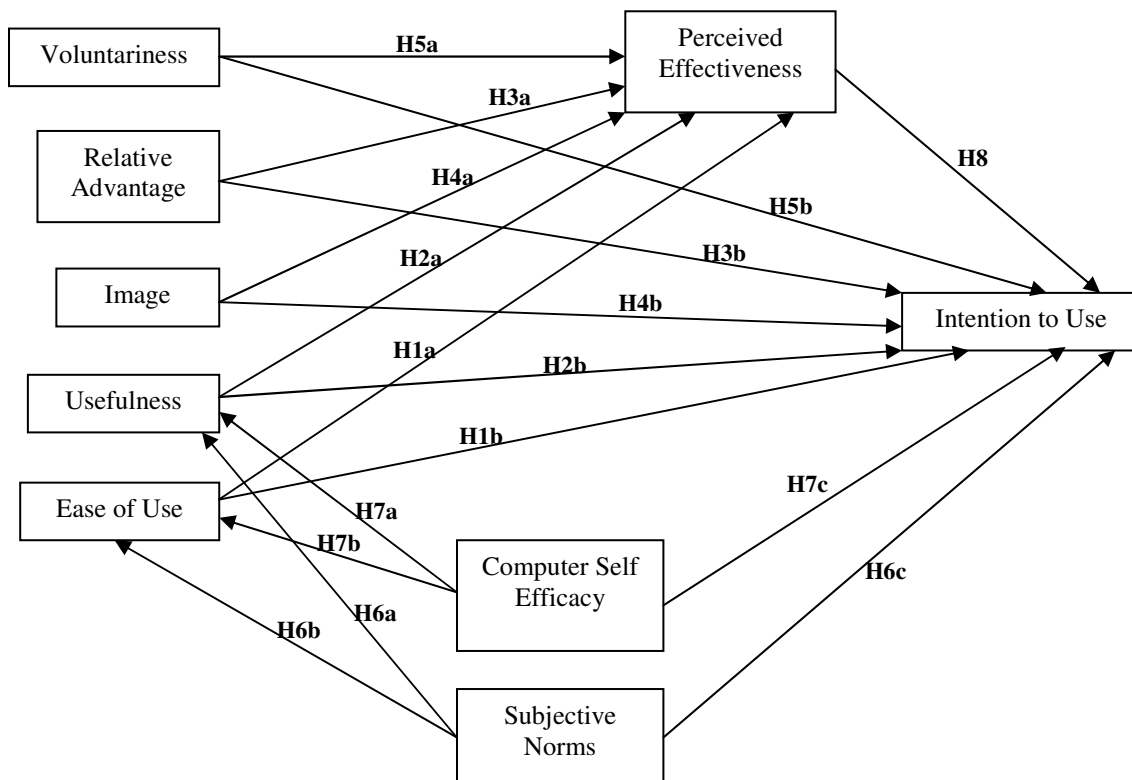


Figure 1. Research Model

**Instrument Development and Proposed Data Analysis**

The instrument used in this study was based on: (1) a general purpose instrument created by Moore and Benbasat (1991) who developed scales to measure individual's perceptions regarding the use of a technological innovation; (2) the TAM instrument as developed by Davis et al (1989); the social norms instrument as generated by Ajzen and Fishbein (1980), computer self efficacy, as developed by Compeau & Higgin (1995), and users' preference for mobile learning (Jacob and Isaac, 2007) The adopted measurements wordings were revised for study purpose, technology used, and target respondents (university faculty and students).

Specifically, the questionnaire is designed to include nine items for respondents' preference for mobile learning (e.g. easy access to information, flexibility, security, communication improvement); two items for intention to use; five items for perceived usefulness (e.g. performance improvement, productivity enhancement); four items for perceived ease of use (e.g. clarity, ease of learning); two items for subjective norms; and six items for computer self-efficacy (e.g. ability to learn and apply). All items are measured in a 5-point Likert scale, with 1 as "strongly disagree" and 5 as "strongly agree". The 5-item Likert type was applied throughout all these perception measures in order to be consistent with the original scale developed by the authors of the scales. Moreover, according to Goodwin (2010), a 5-item Likert scale should not be mixed with a 7-item scale in the same survey, as it is a general rule not to mix formats (Goodwin, 2010, p. 477). Questions pertinent to subjects' background information are asked in the last part of the questionnaire, including gender, age range, access to e-learning platform network outside lecture, and formal computer training experience.

### **Proposed Data Analysis**

The instrument developed will be subject to validation and reliability assessment. First of all, although it is based on a sound theoretical framework and literature review, the instrument will be checked for content validity using a group of experts in M-Learning and educational paradigms. After that, a pilot test will be conducted using a sample that would be very similar to the real sample of the study. The results of the pilot study will be used to refine the instrument, rewording certain items, or deleting others as deemed necessary. The refined scale will then be used in an administered survey that will be distributed (about three months from the date of this paper) to students and instructors in universities in USA, Lebanon, and UAE to collect data that will help in answering the above stated questions. The data collected will be used to conduct a validation and reliability assessment of the instrument using the construct validity assessment approach outlined by Cronbach and Meehl (1955). Finally, the data will be analyzed using descriptive as well as inferential statistics, including factor analysis, ANOVA, and SEM.

### **CONCLUSION**

It is a conspicuous truth that people in general are increasingly connected to the internet using it for various purposes, including communication, doing business, and learning. Of course, mobile computing, if well implemented and integrated into e-learning can make courses in the universities more accessible and portable. Drawing on TQM, DOI, and Media Richness theory, the paper discusses the factors that may affect university faculty and students' (1) perceptions about the effectiveness of mobile learning as well as (2) their intention to adopt it and implement it for instruction and learning purposes.

This paper is an attempt to construct a model that explores the factors that affect users' (teachers and students) perceptions of the effectiveness of mobile learning. Additionally, it examines the factors that are most likely to influence teachers' and students' perceptions about mobile learning and their adoption of the technology. This can be of vital importance to university executives for planning training and communications about M-Learning within their university. With the diffusion of the Internet and increase in mobile devices use around the globe, the results of the study could be of great value to educators and university administrators around the globe.

Based on this, all of those concerned with and involved in mobile learning technologies and distance education must consider the impact of the digital world not just at the domestic level, but at a global and international level (Kurubacak, 2007). This means that such study, when implemented and empirically tested in different cultures- thus allowing comparative analysis to take place- can be mission critical for the realization of a very important objective: enhancing the educational outreach to various society groups.

Besides its contributions, this study has few limitations. First, while all the adopted and adapted scales were previously tested and validated, the scale adopted from Jacob and Isaac (2007) was not validated by its authors. Also, while the study scope covers a comparative analysis in the perception of users in three different countries, the culture factor was not included. Future research can overcome these limitations by assessing the validity of the whole instrument. Future research can also include other variables, example culture, that may have an influence on users' perception of M-Learning effectiveness.

In conclusion, it is believed that mobile computing devices enable mobility and flexibility, and thus facilitate mobile learning. If properly facilitated, mobile learning can be of great benefit to learners by providing instructional materials and interaction through their mobile devices at all times and in all places. It can be beneficial to the instructors also since they can access services and interact with students outside physical boundaries. Planning for this wave should take into consideration all the factors contributing to this perception: the technological factors, the procedural factors, and most importantly, the human factor.



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