Mobile Learning

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Abstract: Mobile phones have become widespread in the modern era. One contemporary use of mobile phones is in the education field, commonly known as M-Learning. Subsequent to the growth of M-Learning, developers of educational mobile applications need to understand what the user requirements are, and how to satisfy them. In order to measure user satisfaction while engaging with mobiles aslearning tools, manymodelshavebeencreatedusingtheUnifiedTheoryofAcceptanceand Use of Technology, and other models such as the Technology Acceptance Model. However, none of these has focused on the technical factors affecting the users' intentions to use their mobile phones as learning tools. Due to technical limitations, as well as human psychology, mobile phone learning remains limited to an assistance-only function. This paper presents a review of studies that have been used to measure users' intentions of engaging with mobile phones as learning tools. One hundred and twenty-seven papers have been reviewed, dating from 2011 to 2020. These papers differ in terms of methodology and results collected. Results showed that many models had been extended by adding factors such as trust, pre-usage or attitude. Moreover, this review concludes that almost none of the above-mentioned studies had identified precisely the technical factors that may affect the intention of using this type of technology in education. However, when classifying the influential factors of M-Learning, almost none of the studies discussed the advantages of the technical aspect in imparting knowledge through mobile learning. This study is significant for the education industry in its identification of the relative importance of these factors where mobiles are involved in the learning process. In addition, it provides a brief history of the involvement of technology in education.

Mobile | Mobile learning | UTAUT

1. Introduction

Effective and influential learning can be approached as a process. This includes, first, creating the possibility of active learning by allowing students to learn at any time or location. Second, cooperation and teamwork among students should be facilitated by providing functions such as virtual collaboration. Third, learning develops through simplification of teamwork and joint ventures. Fourth, information and knowledge can be provided from realistic sources[1]. The development of mobile phone technology has led to greater versatility, ease of use and cost-effectiveness. Therefore, it can provide content for educational purposes and facilitate learning, in addition to providing personal contact with others, referred to as the World Social[2]. Research has found that the basis for the success of the educational process is placing the learning responsibility in the hands of the student[3]. Meanwhile, technology is developing and changing many aspects of human society[4].

2. Concept of Mobile Learning

With the inception of the M-Learning innovation and its presentation in the field of instruction, numerous components of this innovation within learning procedures have been recognized. The instructor has become no longer the main source of data for undergraduates. Among these components that have been utilised in current advances is the inclusion of cell phones into the instruction framework. Certain definitions that clarify this innovation have noted by numerous scientists. Portable realizing, popularly known as M-Learning, is the conveyance of any instructive substance to the beneficiary that is created and utilised by cell phones, regardless of whether it is explicit data or a full educational programme[5]. In a number of outcomes of recent studies, the basic positive features of the technology that undergraduates have reported were versatility and convenience, which is the principal foundation of this type of learning process[6]. With the advancements made in intelligent gadgets notwithstanding, versatile training is as yet considered an auxiliary strategy for discovery, which merely assists understudies to collect data. Meanwhile, the role of the human educator remains essential because of social and specialised competencies[7].

In spite of this reality, some previous studies found that numerous undergraduates want to utilise cell phones since this facilitates correspondence with their educators and associates more than any other conventional strategies now accessible[8]. Versatile learning also makes training procedures more satisfactory, particularly among youngsters who are bound to seek innovation and have an enthusiasm for it[9]. Furthermore, portable learning permits students to learn alone without the requirement for an educator, which simultaneously builds cooperation between classmates[10]. It is not necessary to do this activity in a similar spot[11]. Thus, it has been noticed that college undergraduates generally utilise their cell phones to speak with one another without having perceptible issues using phones in the learning procedure[12]. Besides, portable learning permits students to benefit as far as possible from contributing their time[13]. It is currently not mandatory to obtain data simply in lecture halls; however, there is a need to recognise cell phones as the means of exchanging information from anywhere on the planet at reasonable cost[14]. In recent years, some researchers and educational personnel have used games based on mobile technology in the educational process[15]. Some researchers have found that self-learning through mobile phones can be a major vehicle for student development[16].

Although certain aspects of education require the utilisation of portable learning, a key consideration remains that certain factors may influence this type of instructive procedure. The student, through cell phones, may confront a few issues while moving between one nation and the next, since the specialised standards may vary between the two nations[7]. Although many developments have been made in mobile learning, there remains a need to involve Mobile Learning Studies in Physical Education[17]. At the point when versatile learning is added to the training procedure in developing nations, clients may experience challenges in its application, one of these being specialised issues that may emerge for the student[18]. In addition, some instructive materials created for use with work area gadgets or workstations may not be suitable for smart gadgets or telephones utilised by students, except if they incorporate certain changes that make them usable in the two places[19]. This issue has recently been resolved with numerous instructive stages for supporting work area views and versatile views. Now it has become possible to use the mobile phone for learning at any time or location[20].

3. Previous Studies in M-Learning

Even though various studies have been conducted on the topic of mobile education, technical factors have not always been considered[21]. Several of these studies extensively utilised varied acceptance models, like applying original models, whereas others utilised altered models. One such study found that despite the enjoyment students might find in the relevance of the services provided through mobile education and also the importance of their acceptance of this type of education, this acceptance remains comparatively low in some Arab countries[22]. One incentive to use mobile education is the ease of accessing the material in spite of physical and time constraints, particularly if a high level of confidence exists among users that this type of education is compatible with students' devices[23]. Some researchers have planned the utilisation of the Mobile Learning Adoption Model (MLAM) and found that technological self-efficacy is a crucial element of encouraging students to accept M-Learning[23]. Furthermore, another study found that one key factor resulting in the success of mobile education among students is the corresponding support within universities for applying this type of education and taking advantage of its capabilities[24].

Though selection to find out whether victimisation of mobile devices is within the hands of scholars, a desire remains to research the factors that have an effect on student acceptance of mobile education[25]. The acceptance of mobile education among students continues to be comparatively poor in some Arab countries[26]. Therefore, considerable analysis is required to identify the factors behind, and causes of, these weaknesses. Researchers have developed a model that integrates the Technology Acceptance Model (TAM) with the updated DeLone and McLean's model (DL & ML), finding that among the factors connected to student intentions to explore such new technology is the quality of this type of M-Learning[27]. However, despite the emergence of mobile education or e-learning, determining the extent of learner acceptance of e-learning itself remains limited in Saudi Arabia and therefore needs more analysis[28]. Moreover, once scholars gain greater assurance of the victimisation of this sort of technology, their enjoyment and use of it in educational life would increase[29]. Some studies have suggested that upon embarking on the inclusion of mobile education, it is necessary to address problems technically, educationally, socially and in combination[30]. There is little question that technology is vital to modern life; however, learners' knowledge and use of this technology is additionally necessary, a factor which has hitherto been unnoticed and unexplored[31].

Improvements to M-technology extend the ways of learning far from the traditional classroom by providing opportunities to obtain knowledge more easily. Using mobiles for education can also be a key element of formal education[32]. Students have experienced difficulty in cooperating with each other in group activities when they depend on mobile computers[33]. Tablets are not that difficult to use for entertainment, but this may not be replicated when they are used in education[34]. Nowadays, educators are surrounded by devices that they use for many purposes, and that changes the way the environment is managed and understood[35]. Learning systems often fail to hold students' attention for the full duration of a class[35].

People intend to use applications depending on how far they enable better performance[36]. Mobile learning offers a vital opportunity to learn as it is a method that may be fixed in mind, particularly among youths who take a huge

interest in mobile technology[9]. Students believe that mobile devices allow them to obtain knowledge faster while allowing them to contact and help each other, and to learn through different methods[37].

The use of games consoles as mobile learning tools will offer a more effective route if shared web-space can be found[38]. It is important to illuminate the perceptions of learning languages using mobiles[39]. To raise the effectiveness of M-Learning, teachers should focus on the extent of students' desire for participation in this method of learning[40]. Prior research provides positive feedback about implementing mobile technology in education to help students. As a result, usability should be further emphasised while developments are introduced for different devices in order to use programmes on different platforms[41]. Student performance in the learning process can be raised by merging the system based on user preference and on learning that does not depend on the time or place due to the availability of mobile devices[42]. Recently, the way of teaching and learning is not necessarily confined to a traditional classroom. Therefore, mobile technology is needed to spread knowledge around the world at an affordable price[14].

Several factors have a considerable positive influence on student acceptance of learning via mobile devices. These are satisfaction, autonomy, system functions and interaction, and communication activities[43]. In reality, combining the real objects and M-technology together offers a bright future for the education sector[44][. Students can make the best use of their time to learn if they are equipped with M-Learning materials with proven usefulness[13]. It is possible for the same levels of students to learn any subject via mobiles in any part of the world[45]. It is noticeable that university learners usually use their mobile devices for peer communication instead of learning. However, they encounter no problems in using mobiles as learning tools[12].

Mobile devices can help parents to monitor how their children perform in a learning environment[3]. The use of technology may differ depending on the user's environment[46]. The use of mobile learning encourages students to learn alone without an instructor's help but meanwhile enhancing the interaction between them[10]. Mobile technologies provide students with a learning environment without the need to face the teacher or be in the same place[11]. Both learners and instructors intend to involve learning via mobiles, and they have a positive attitude towards it. However, they do not have the same level of efficiency[47]. The student's role has been transformed from simply listening and passively receiving information into a knowledge seeker to whom the teacher only needs to provide instructions when necessary[48].

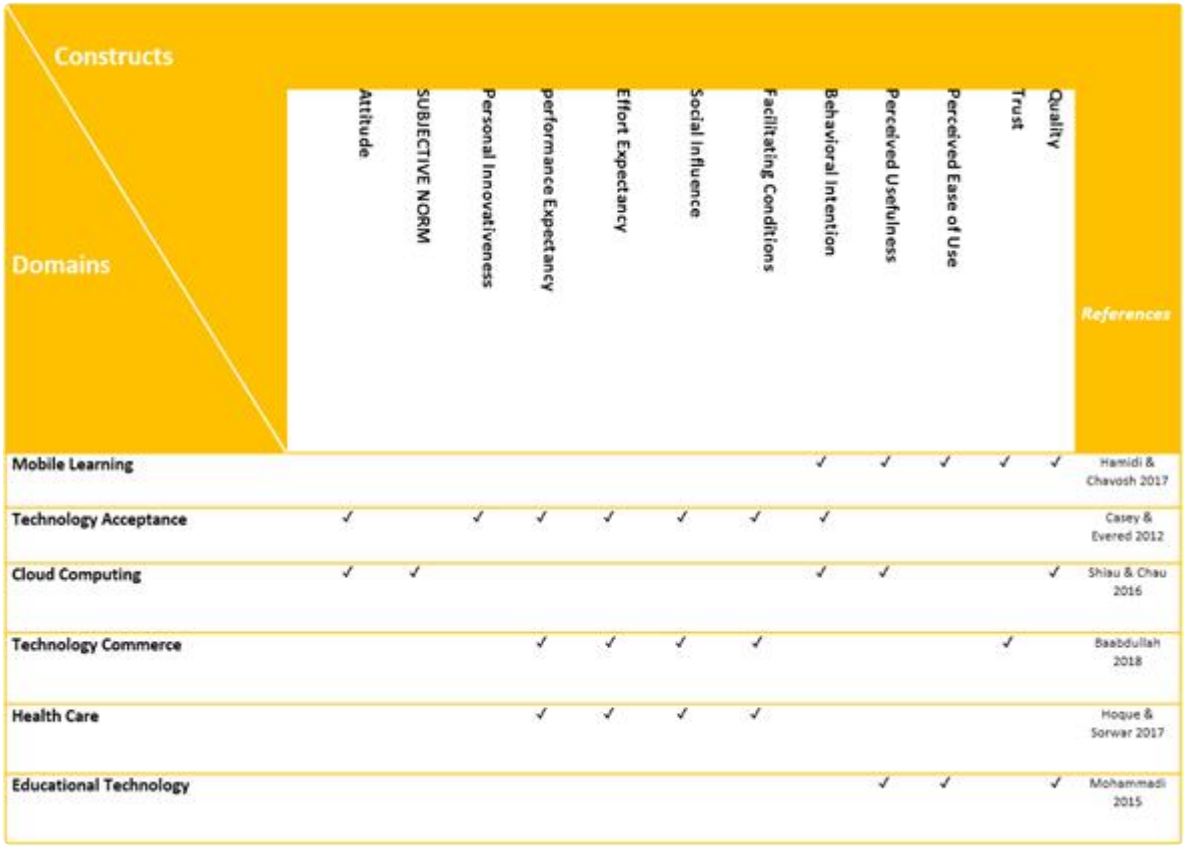
Mobile devices or the Internet can be a more effective way to coordinate both schools and parents[49]. One study of a group of participants showed that the use of laptops was preferred in the learning process[50]. Mobile technology offers huge support to develop education and to help learners achieve success[1]. M-Learning is not restricted to a specific area of learning, but rather provides learners with continuous help and cooperation from their colleagues[51]. People are encouraged to learn continuously through mobile devices unofficially instead of using computers officially[52]. Mobile devices that incorporate technology can be used inside or outside any schools and institutes effectively, depending on how learners obtain the greatest benefit[53]. Learning through mobile devices can improve education simply by connecting it to the Internet[54].

A group of researchers has introduced an extension for TAM, named TAM2, by adding more constructs[55]. Technology has a more significant influence on modifying culture than real life and the influence of age[56]. Within one to two decades, learning through mobile devices and wireless technology will be integrated and make the world resemble a village covered and connected by mobile devices[57]. Learners and teachers depend on Internet-related tools, which are believed to increase productivity[2]. Knowledge in the present time can be obtained from many resources rather than in traditional ways[58]. The need remains for more nuanced definitions of mobile learning and how this relates to other definitions, such as ubiquitous learning[59].

4. Factors that Influence Students' Acceptance of Mobile Learning

The most frequently studied general constructs were social, educational and behavioural. A few studies refer to technical factors but as tangential topics rather than the focus. University students' intentions to use M-Learning is affected by attitudes, subjective norms and behavioural control[32]. The theory of planned behaviour offers a useful description of behaviour and intention[60]. A high percentage of intention to use mobile learning in an American higher education context was measured by TPB, and it was found that the most important concepts are attitudes, subjective norms and behavioural control[32]. In the most frequently used constructs in the selected papers, it is clear that the Trust construct was most often used in the Commerce and Learning field, whereas the Quality construct was most often used in M-Learning, cloud computing and educational technology. Constructs of the TAM model were used in mobile learning, contrary to the UTAUT, which was almost never used in this area. Facilitating Conditions were most often used in commerce, healthcare and technology acceptance, whereas they were almost never used to measure acceptance in mobile learning. With the rapid improvements in technology, it is important to accommodate both student needs and organisational needs when implementing mobiles as learning tools[61].

Learning materials created for desktop or laptop use may not suit mobile devices unless altered to do so relating to screen size[19]. One issue that most affects mobile usage is everyday human behaviour, such as reducing internet bills, lending mobile phones to others without due care, and services that need payment[62]. Few studies have compared learning processes that depend on computers and students' usage of mobiles[63]. There were no noticeable differences in how undergraduates perceive the involvement of mobile technology in learning within gender-segregated classrooms[64]. It is recommended that studies are conducted to determine whether differences exist between users who can use mobiles and users who cannot, via the TAM[65]. The UTAUT developer recommended that further studies examined extra constructs to ascertain how intention and behaviour can be predicted, in addition to facts already established[66]. The following Figure 10 shows the most frequently studied factors in a selection of reviewed articles.



Domains \ Constructs	Attitude	SUBJECTIVE NORM	Personal Innovativeness	performance Expectancy	Effort Expectancy	Social Influence	Facilitating Conditions	Behavioral Intention	Perceived Usefulness	Perceived Ease of Use	Trust	Quality	References
Mobile Learning								✓	✓	✓	✓	✓	Hamidi & Chavosh 2017
Technology Acceptance	✓		✓	✓	✓	✓	✓	✓					Casey & Evered 2012
Cloud Computing	✓	✓						✓	✓			✓	Shiau & Chau 2016
Technology Commerce				✓	✓	✓	✓				✓		Baabdullah 2018
Health Care				✓	✓	✓	✓						Hoque & Sorwar 2017
Educational Technology									✓	✓		✓	Mohammadi 2015

Figure 1. Constructs Table.

It is clear that the Trust construct was most often used in the Commerce and Learning field, whereas the Quality construct was most often used in M-Learning, cloud computing and educational technology. Constructs of the TAM model were used in mobile learning, contrary to the UTAUT, which was almost never used in this area. Facilitating Conditions were most often used in commerce, healthcare and technology acceptance, whereas they were almost never used to measure acceptance in mobile learning. Figure 10 shows the frequencies of constructs through different domains. Self-efficacy has an important effect on the benefits users expect from using computers and their feelings towards this. Moreover, results have shown that self-efficacy produces expectations that also have a favourable influence on others' attitudes[67]. It has been confirmed that self-efficacy and outcome expectations influence user's effective and behavioural reaction towards IT[68]. Figure 2 shows the frequency of constructs associated with domains.

Constructs	Domain	Frequencies of Constructs in Some Selected papers
Attitude	cloud learning, M-learning, E-learning	13 Times
Subjective Norm	M-learning	4 Times
Personal Innovativeness	M-learning	4 Times
Performance Expectancy	M-learning, E-learning	14 Times
Effort Expectancy	M-learning, E-learning	13 Times
Social Influence	M-learning, E-learning	14 Times
Facilitating Conditions	M-learning, E-learning	14 Times
Behavioral Intention	M-learning, E-learning	22 Times
Perceived Usefulness	M-learning, E-learning	13 Times
Perceived Ease of Use	M-learning, E-learning	13 Times
Trust	M-learning, E-learning	4 Times
Quality	M-learning, E-learning	5 Times

Figure 2. Frequencies of Constructs.

Concerning the final question of this study, it is clear that some technical problems need to be resolved. Devices may not support the same type of file formats, which forces students to use file transformers[69]. The mobile model used and the characteristics of the content delivery platform were technical challenges for developers[9]. Although tablets have developed, users who have weak technological skills would not easily find resources that help them[70].

With the massive developments in the use of the mobile phone and its applications in the field of educational processes, many studies have measured students' acceptance of M-Learning and the factors that influence this acceptance. Many studies were based on models designed in the past to measure the acceptance of students, and other factors were generally added to or modified from the existing models. The significant increase in the use of mobile phone devices has led to the need for a particular model to measure the extent to which students or learners accept this technology in the learning process. Moreover, some researchers have evaluated and reviewed previous studies, concluding that a very limited number of studies focus on the technical factors that affect the intention of learners to use M-Learning[21].

The section above provides answers to the four study questions of this paper. It is clear from the review that in terms of question one, many studies have investigated mobile technology. Almost a third of these studies were on mobile learning. As for the most frequently used models, the answer to question two suggests that these were the UTAUT and the TAM, in that the UTAUT has been used in 62 papers and TAM in 28. The remainder of the papers used other models. As for the last question of this study, it is clear that some technical problems need to be resolved in connection with the use of mobile devices as learning tools. Therefore, it is necessary to develop a model oriented to measure student acceptance of learning processes provided through the use of mobile phones

from technical aspects. This would, in turn, lead to research by educational institutes or other organisations that wish to take advantage of the opportunity to use M-Learning.

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