Review

Towards Sustainable Mobile Learning: A Brief Review of the Factors Influencing Acceptance of the Use of Mobile Phones as Learning Tools

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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 as learning tools, many models have been created using the Unified Theory of Acceptance and 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.

Keywords: mobile learning; technical factors; acceptance models; UTAUT; TAM

1. Introduction

The improvements relating to communication technology that relies on mobile networks are among the key developments in modern society. Evidence of this transition is clear: by 2014, the number of mobile phone users had reached almost 7 billion subscriptions [1]. In the past, using mobile phones was a luxury, but it is now considered the main feature of general life. Nowadays, reliance on using

mobile phones as learning tools has increased, which suggests there are influential educational factors linking mobile use to educational achievement.

In the last decade, mobile phone technology has progressed at a significant rate, with numerous achievements and by providing a range of services in this brief period. The growth was about 5% in 1998, and the number then soared to 8.9 billion beneficiaries of this service. Examining the use of the Internet, this increased by approximately 362.3% from 2000 to 2009 [2]. A study published in 2019 claimed that smartphones exist everywhere and are used in many different situations [3]. This increase matched the rise in the number of mobile phone users. The use of the Internet is virtually a global commonplace now since it has become a necessity of life and distributed throughout different cultures. In evaluating the technological advances of this era, the increased use of the Internet is aligned with the rising number of mobile devices, as well as the use of mobile applications.

Mobile phone technology can provide the user with complete sets of video or audio tools, which are available for general consumption. In addition, a 3G service enables the user to access several features, such as the Internet and the capacity to download audio and video files. Mobile technology is not currently limited to education but extends to many fields such as tourism and hospitality [4]. Mobile devices allow the user to link to Wi-Fi networks, but in this case, the speed and the number of users associated with the same network may be affected, which clearly shows that a greater number of network users may lead to reductions in speed [5].

4G is the fourth generation of communication technology that increases the effectiveness of special services and multiple videos through wireless networks and media. Joint international action on 4G technology has resulted in many developments in terms of speed, performance, reliability, fault tolerance, portability, interoperability and latency in real-time applications. 4G also provides safe and easy access at the same time [6]. Service contributions by fourth-generation multi-technology [4] include higher connection speeds, a wider network spectrum, more flexibility in communications and better viewing of visual channels [4]. These improvements in the service have certainly led to more effective applications for M-Learning.

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 [7]. 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 [8]. Research has found that the basis for the success of the educational process is placing the learning responsibility in the hands of the student [9]. Meanwhile, technology is developing and changing many aspects of human society [10].

Despite the various studies that have been conducted on mobile learning, scholarly analysis largely continues to be directed towards the angle of mobile learning (M-Learning) [11]. Illuminating this finding can provide a greater understanding of this type of technology and its applications [12]. Similarly, despite all the advantages provided by mobile devices, a limitation, if not a weakness, remains in the lack of acceptance of this technology in some areas [13]. This reality has motivated and attracted the interests of many researchers to explore the explanations behind this situation. For example, applying this type of technology within education can facilitate learners' realisation of the optimum use of such devices in reinforcing their data mentality [14]. Some instructional authorities have adopted and employed M-Learning in universities, although obstacles have prevented students from using mobile devices in certain applications and activities [15]. These obstacles could be associated with technical and non-technical aspects like device capabilities, network coverage, facilitating conditions or social influence [16]. Additionally, student acceptance of the current new form of instructional learning technology is vital in realising future success in certain aspects of their learning in instructional establishments, such as tutorials [13].

A previous study claimed that mobile learning is still considered a supplementary method that can help students to learn but not operate as a full learning process, nor can it assume the role of the teacher due to its technical limitations and its inability to replicate human nature [17]. Moreover, another study found that about 95% of students support the use of mobile phones to communicate with classmates and teachers as this is faster than traditional methods [18]. In addition, many scientific voices urge further studies on student attitudes to learning while using the phone [19]. Involving mobile technology in the learning process in developing countries might confront many difficulties resulting in problems of using the technology, one of these being technical challenges [20]. Mobile learning users may encounter difficulties in using this technology when they travel abroad if their destination countries do not follow the same technical standards [17]. Due to the weaknesses of the technology substructure in Africa, inserting M-Learning among postgraduates may face challenges [21]. Therefore, this paper aims to investigate the state of contemporary acceptance models in mobile learning. With the rapid advancement of mobile learning technology, the factors affecting this technology need to be illuminated. This paper addresses this by evaluating many papers presented between 2010 and 2020, and its main goal is to provide educational institutions and universities with a clear vision of the factors that may affect the extent to which students and learners accept this type of technology. A further objective is to determine circumstances that provide sustainable mobile learning, which led to the formulation of the following questions for this paper:

1. What is the state of art in the mobile technology field?
2. Which models have been used in previous studies?
3. What factors that influence students' acceptance of mobile learning have been the focus of previous studies?
4. What are the limitations and gaps in the current status of research into M-Learning?

2. Background

2.1. 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 [22]. 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 [23]. 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 [24].

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 [17]. Versatile learning also makes training procedures more satisfactory, particularly among youngsters who are bound to seek innovation and have an enthusiasm for it [25]. Furthermore, portable learning permits students to learn alone without the requirement for an educator, which simultaneously builds cooperation between classmates [26]. It is not necessary to do this activity in a similar spot [27]. 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 [28]. Besides, portable learning permits students to benefit as far as possible from contributing their time [29]. 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 [30]. In recent years, some researchers and educational personnel have used games based on mobile technology in the educational process [31]. Some researchers have found that self-learning through mobile phones can be a major vehicle for student development [32].

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 [24]. Although many developments have been made in mobile learning, there remains a need to involve Mobile Learning Studies in Physical Education [33]. 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 [19]. 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 [34]. 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 [35].

2.2. 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 [36]. 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 [37]. 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 [38]. 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 [38]. 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 [39].

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 [40]. The acceptance of mobile education among students continues to be comparatively poor in some Arab countries [41]. 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 [42]. 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 [43]. 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 [44]. 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 [45]. 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 [46].

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 [47]. Students have experienced difficulty in cooperating with each

other in group activities when they depend on mobile computers [48]. Tablets are not that difficult to use for entertainment, but this may not be replicated when they are used in education [49]. Nowadays, educators are surrounded by devices that they use for many purposes, and that changes the way the environment is managed and understood [50]. Learning systems often fail to hold students' attention for the full duration of a class [50].

People intend to use applications depending on how far they enable better performance [51]. 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 [25]. 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 [52].

The use of games consoles as mobile learning tools will offer a more effective route if shared web-space can be found [53]. It is important to illuminate the perceptions of learning languages using mobiles [54]. To raise the effectiveness of M-Learning, teachers should focus on the extent of students' desire for participation in this method of learning [55]. 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 [56]. 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 [57]. 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 [30].

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 [58]. In reality, combining the real objects and M-technology together offers a bright future for the education sector [59]. Students can make the best use of their time to learn if they are equipped with M-Learning materials with proven usefulness [29]. It is possible for the same levels of students to learn any subject via mobiles in any part of the world [60]. 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 [28].

Mobile devices can help parents to monitor how their children perform in a learning environment [9]. The use of technology may differ depending on the user's environment [61]. The use of mobile learning encourages students to learn alone without an instructor's help but meanwhile enhancing the interaction between them [26]. Mobile technologies provide students with a learning environment without the need to face the teacher or be in the same place [27]. 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 [62]. 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 [63].

Mobile devices or the Internet can be a more effective way to coordinate both schools and parents [2]. One study of a group of participants showed that the use of laptops was preferred in the learning process [64]. Mobile technology offers huge support to develop education and to help learners achieve success [7]. M-Learning is not restricted to a specific area of learning, but rather provides learners with continuous help and cooperation from their colleagues [65]. People are encouraged to learn continuously through mobile devices unofficially instead of using computers officially [66]. Mobile devices that incorporate technology can be used inside or outside any schools and institutes effectively, depending on how learners obtain the greatest benefit [67]. Learning through mobile devices can improve education simply by connecting it to the Internet [68].

A group of researchers has introduced an extension for TAM, named TAM2, by adding more constructs [69]. Technology has a more significant influence on modifying culture than real life and the influence of age [70]. 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 [5]. Learners and teachers depend on Internet-related tools, which are believed to increase productivity [8]. Knowledge in the present time can be obtained from many resources rather than in traditional ways [71]. The need remains for more nuanced definitions of mobile learning and how this relates to other definitions, such as ubiquitous learning [72].

2.3. Acceptance Models

Numerous models have recently been developed that measure innovation acknowledgment by clients. These models have been examined and evaluated during recent years. Among the most famous and generally utilised models are the Technology Acceptance Model (TAM), which was conceived in 1989, and the Unified Theory of Acceptance and Use of Technology (UTAUT), which was presented by Venkatesh et al. in 2003 [73]. That model was created to quantify the social aspect of a client's demeanour toward personal computers [74]. It indicated several uses that were modified based on perspectives of the analysts who examined it. In addition, TAM has been remembered for various examinations and explorations to gauge clients' acknowledgement of the consideration of innovation within the instructive procedure; however, a large number of these investigations revolved around the instructor [49].

Many studies in recent years have focused on measuring the acceptance of technology among learners. Moreover, Magsamen-Conrad, Upadhyaya, Joa and Dowd showed in their paper, published in 2015, that one of the most widely known models is the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh and Morris in 2000. In addition, the 2003 paper by Venkatesh et al., as shown in Figure 1, was developed on the basis of eight theories: the Theory of Reasoned Action (TRA) outlined by Davis, Bagozzi and Warshaw in 1989; the Technology Acceptance Model (TAM) published by Davis in 1989, Davis et al. in 1989 and Venkatesh and Davis in 2000; the Motivation Model (MM) by Davis, Bagozzi and Warshaw, presented in 1992; the Theory of Planned Behaviour (TPB) by Taylor and Todd, which was published in 1995; the Combined TAM and TPB (C-TAM-TPB) by Taylor and Todd, produced in 1995; the Model of PC Utilisation (MPCU) by Thompson, Higgins and Howell in 1991; the Innovation Diffusion Theory (IDT) by Moore and Benbasat developed in 1991; and the Social Cognitive Theory (SCT) by Compeau and Higgins, presented in 1995 (see Figure 2), and by Compeau, Higgins and Huff in 1999 [75].
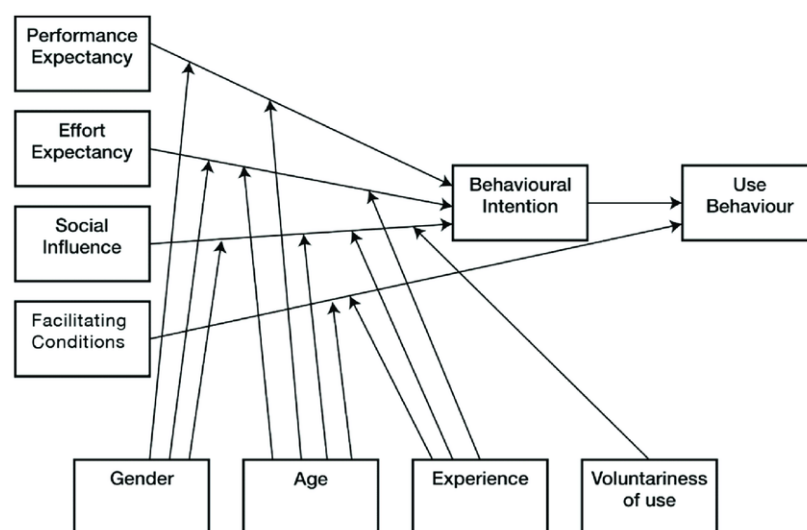

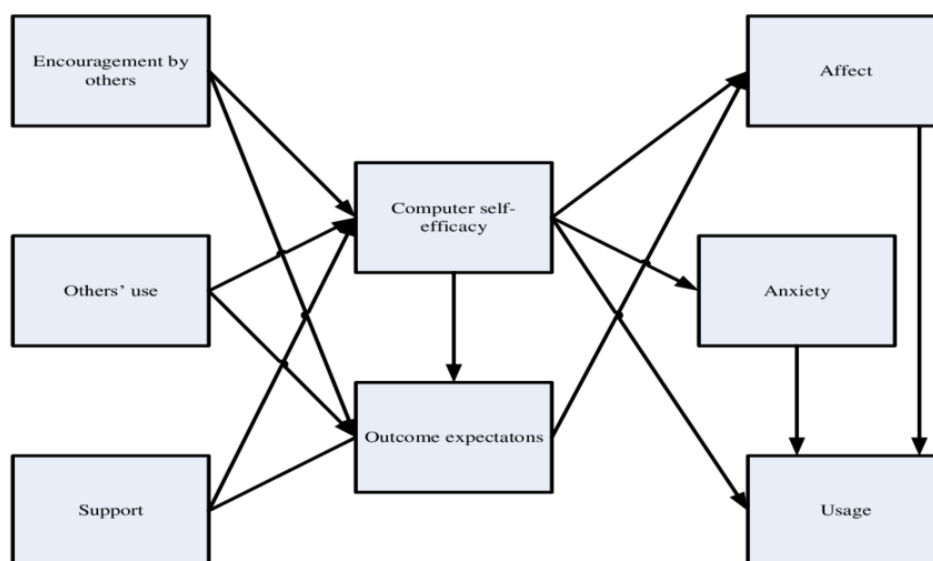**Figure 1.** Unified Theory Acceptance Model by Venkatesh et al. [76].

Figure 2. Compeau & Higgins Model 1995 [77].

The TRA, TAM and TPB have been involved in many studies that measure the acceptance of technology in learning but most of these revolve around the teacher [49]. The TAM has adopted the TRA relating to IS [78]. The TAM was developed only to measure behaviour in regard to computer use [74]. User intentions to use computers in their jobs is affected by the extent to which it can benefit their work performance [79]. Certain factors affect a student's intention to use the mobile phone as a learning tool, which are cognitive, affective and social needs by means of attitude [80]. The TAM is a useful measurement tool, but it needs to be adapted to contemporary changes [81].

The investigation into how the perceived features of innovations react with each other can assist in building a general theory [82]. One study used a modified model of the TAM and found that attitude was the key construct to interpret the cause [83]. Information system adoption is influenced by "trust" that raises the willingness to use it [84]. Prediction of learners' online learning satisfaction is generated by online learning self-efficacy [85].

Many studies have measured user perceptions of technology. The Technology Acceptance Model (TAM) and Unified theory of acceptance and use of technology (UTAUT) represent the most recognised and frequently used models. The TAM was developed to measure only behaviour in regard to computer use [14]. The UTAUT was developed based on eight theories to measure acceptance of the technology. However, when classifying the influential factors of M-Learning, almost none of the studies discussed the technical aspect as a vehicle for imparting knowledge through mobile learning [36].

3. Research Methodology

Based on the research objective and research questions, this paper relied on collecting published papers from several different sources in order to broaden the scope of the research and benefit from the greatest possible diversity of knowledge of the sources. The use of inclusion and exclusion norms is to help the reviewers of published papers to specify which papers they should include in their review, and whether or not a paper is related to the area of the topic being researched [86].

3.1. Data Collection

The data was collected from various locations and libraries and mostly listed in Institute for Scientific Information (ISI) and Scopus such as the Association for Computing Machinery (ACM), the Institute of Electrical and Electronics Engineers (IEEE), Springer, Science Direct, Sustainability and the publisher John Wiley & Sons. The material included journals such as the British Journal of Educational Technology, the Journal of the Association for Information Science and Technology,

ProQuest and International Publisher of Information Science and Technology Research IGI, as shown in Figure 3. Several of these libraries were listed by Levy and Ellis in their paper published in 2006, in which they claimed that reliable literature should be collected from peer-reviewed journals [87]. Moreover, pairs of keywords were used to specify papers related to these reviews, namely "*Mobile Learning, Technical Factors, Mobile learning Acceptance Model, UTAUT, TAM, and UTAUT2*". The figure below shows the names of libraries and the numbers of articles selected.
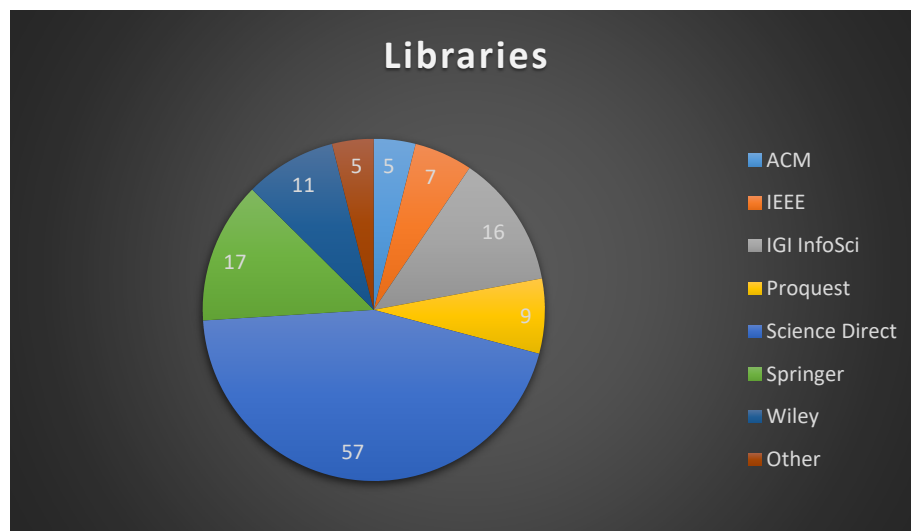

Figure 3. Resources Libraries.

The dates of articles ranged mainly between 2011 and 2020 due to the enormous increase in smartphone sales since 2018, which is predicted to continue [88]. A number of articles are dated earlier due to the need to include some historical data and older theories, such as the TAM, which dates back to the late 1980s. Figure 4 below shows the numbers of articles specified in the order of their year of publication.
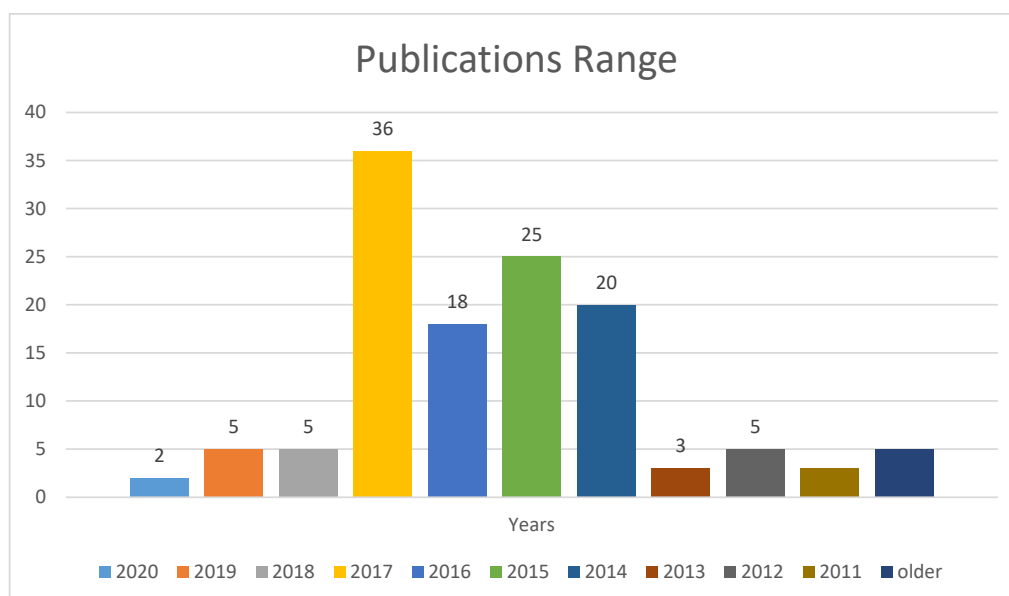

Figure 4. Date range of publications used.

3.2. Search Protocol

The use of inclusion and exclusion norms is to help the reviewers of published papers categorise which papers they can involve in their review and whether papers are related to the area of the topic being researched [86]. Figure 5 shows the procedure followed to determine suitable papers. One hundred and twenty-seven papers were selected from different libraries, while five papers were excluded as being irrelevant or unsuitable to the area of this review paper. In addition, some were not in English.
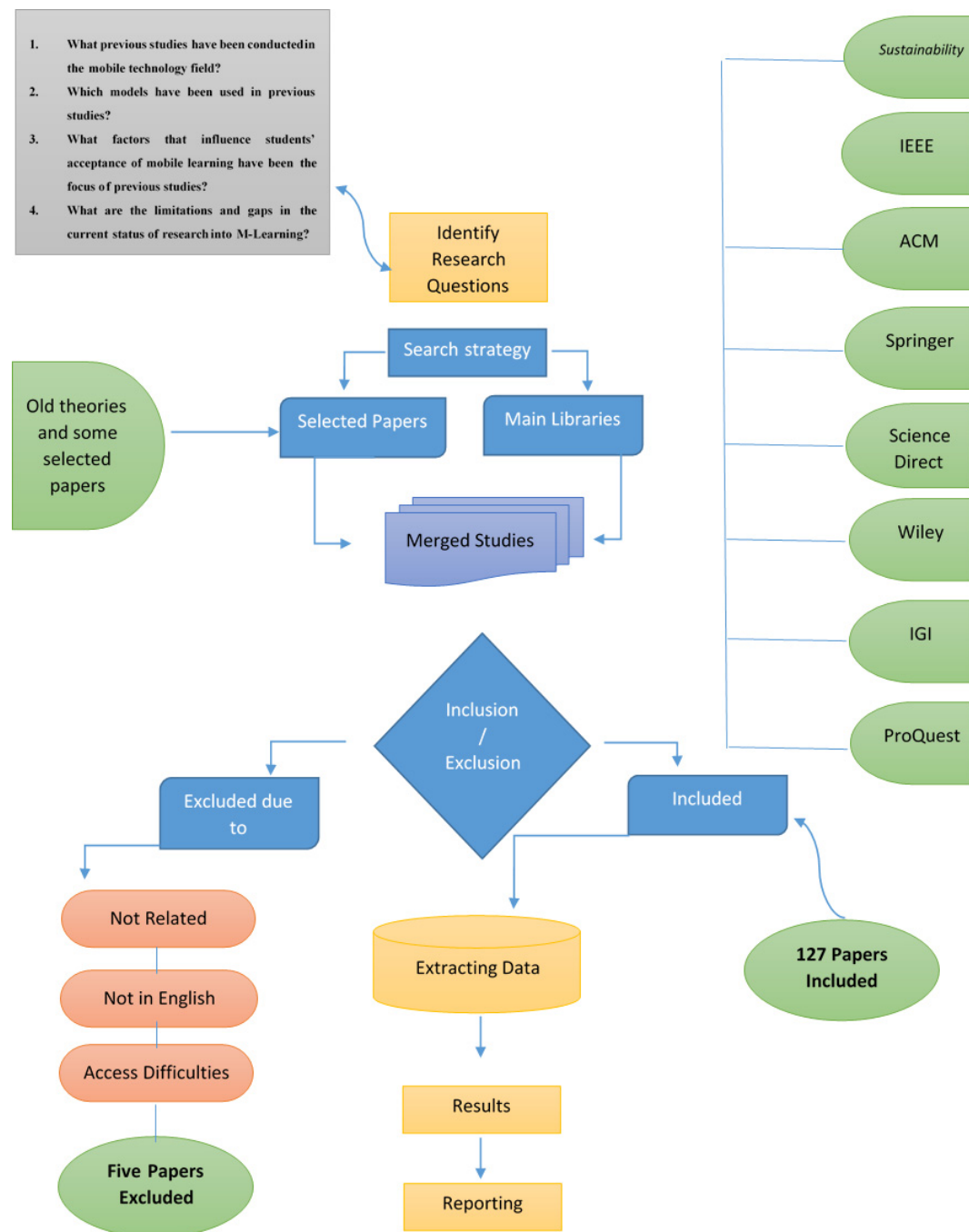
Figure 5. Search Protocol.

4. Findings and Discussion

This section provides answers to the questions at the beginning of this paper and is divided into three sub-sections. The first section discusses the inclusion of technology in education and other areas, and the importance of such inclusion. The second section discusses the most frequently used models of acceptance in previous studies. Section three discusses the most frequently used factors and whether technical factors were included or not.

4.1. Involving Mobile Technology

To answer the first research question, many studies have been conducted on mobile technology. Almost one-third of these studies were on mobile learning, as shown in Figure 6.
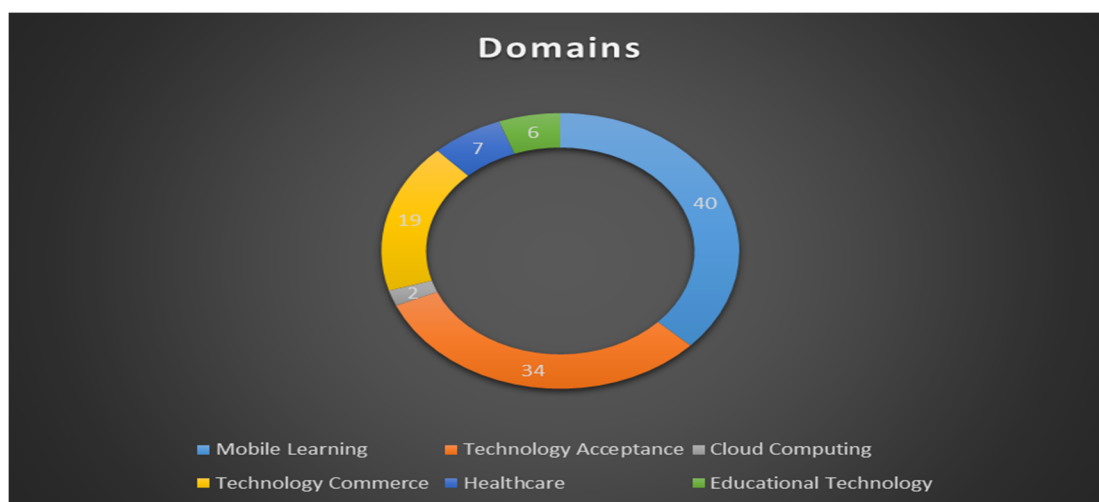

Figure 6. Domains.

Mobile technology allows anyone to access media files that are usually found on websites. A 3G service offers individuals the chance to use the Internet in many locations. It can be connected to Wi-Fi networks, and the speed may vary based on the number of network users [29]. Students like to use mobile technology as a learning tool, but this is combined with their scepticism toward security and coverage issues [89]. Mobile learning is not bound by any specific location but can be followed anywhere [2].

Half the world's population can access the 4G network, and 84% can use 3G. The number of mobile users has reached 5 billion and about three-quarters of them can use the Internet. These huge numbers have been achieved by the continuous advancement in mobile infrastructure that is conducted by mobile companies [90]. China Internet Network Information Centre issued a report stating that, as of June 2010, the number of people who used the Internet amounted to 420 million [4]. Education authorities must change their approach to the education process to keep it efficient and create a space for competition [36].

Providing coverage of mobile and Wi-Fi services on trains is not easy [90]. Therefore, it is necessary to consider this while evaluating the use of mobile devices as learning tools while the learner is moving. Although the screen size of mobile devices has developed, people may find it annoying to use a device for learning, especially in noisy environments. Mobile device designs normally concentrate on providing a few learning services [4]. Many difficulties may arise from applying M-Learning, most of which is related to the characteristics of the mobile device, while the remainder are generally linked to user expectations of this technology [36]. In almost no cases have studies illuminated technical factors that affect mobile learning [36].

4.2. Acceptance Models Used

Regarding research question two, the UTAUT and the TAM were the most frequently used models, in that the UTAUT has been used in 62 papers and the TAM in 28 papers. The remaining papers used other models, as illustrated in Figure 7 below. In this review paper, the most frequently used model was the UTAUT, followed by other models. The TAM was used least as it has been studied considerably. Figure 7 shows the frequency of acceptance models in the reviewed articles.
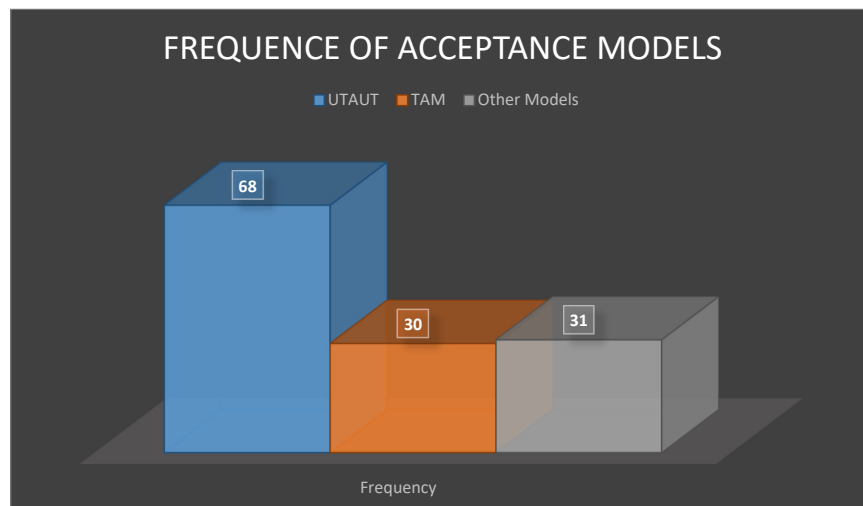
Figure 7. Frequencies of Acceptance Models.

The most popular model is the Unified Theory of Acceptance and Use of Technology (UTAUT), which was developed based on eight previous theories, including the TAM. These theories are the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivation Model (MM), the Theory of Planned Behaviour (TPB), the Combined TAM and TPB (C-TAM-TPB), the Model of PC Utilisation (MPCU), the Innovation Diffusion Theory (IDT) and the Social Cognitive Theory (SCT) [19]. The UTAUT was found to outperform previous theories when they were compared and tested by developers [76].

The majority of studies have concentrated on the effectiveness and development of mobile learning systems. These studies have utilised surveys and experiments [91]. Through articles reviewed in this paper, the most frequently used methodology to confirm results was surveys, as shown in Figure 8.
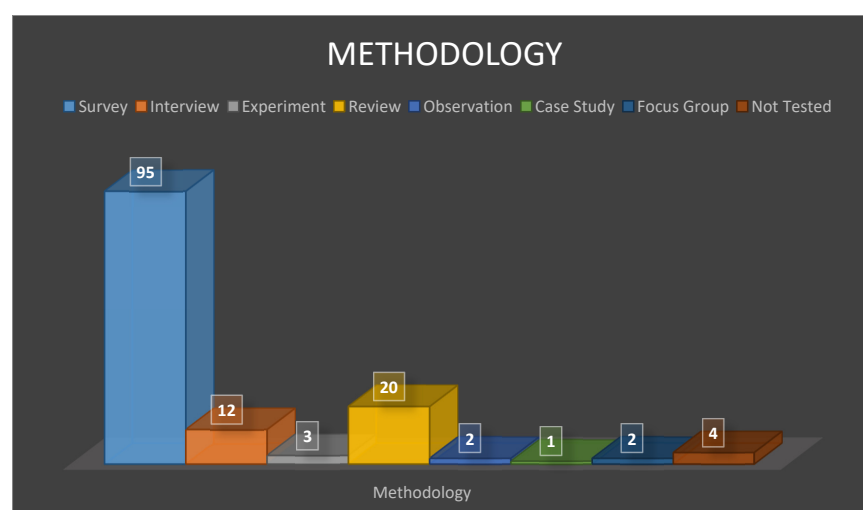
Figure 8. Methodology Used.

Samples collected by previous studies differed. Thirty-seven percent of samples were collected from students and 33% from the public. The academic staff sample comprised 19%, followed by 11% that sampled professionals. In addition, most studies were applied in Asia (56 papers), Europe (30 papers), America (23 papers), Africa (10 papers) and Australia (2 papers) as shown in Figure 9. Very few studies have been conducted in Arab countries compared to other Asian regions. For example, only four studies occurred in Saudi Arabia, and none concentrated on the technical factors of mobile learning. Despite developments in e-learning, mobile learning in some Arab countries and some Gulf Arab countries is still seen as a not-so-essential method of education and one of the modern methods prevalent today [37].

Place of Study	Frequency
Asia	56 Times
Africa	10 Times
Europe	30 Times
America	23 Times
Australia	2 Times
Worldwide	1 Times

Figure 9. Number of Papers per Affiliation Location.

4.3. Influencing Factors

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 [47]. The theory of planned behaviour offers a useful description of behaviour and intention [92]. 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 [47]. 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 [93].

Learning materials created for desktop or laptop use may not suit mobile devices unless altered to do so relating to screen size [34]. 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 [94]. Few studies have compared learning processes that depend on computers and students' usage of mobiles [95]. There were no noticeable differences in how undergraduates perceive the involvement of mobile technology in learning within gender-segregated classrooms [96]. 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 [83]. 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 [76]. 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 10. 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 [77]. It has been confirmed that self-efficacy and outcome expectations influence user's effective and behavioural reaction towards IT [97]. Figure 11 shows the frequency of constructs associated with domains.

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 [98]. The mobile model used and the characteristics of the content delivery platform were technical challenges for developers [25]. Although tablets have developed, users who have weak technological skills would not easily find resources that help them [75].

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 [36].

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 11. Frequencies of Constructs.

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.

5. Conclusions

This study provides an overview of the inclusion of mobile technology in various fields, especially education. A review approach has been used to answer four questions about mobile technology and acceptance models. This paper included a review of papers published from 2010 to 2020. After scrutinising these papers, 127 related to mobile technology were selected and the rest excluded as they were not relevant. It is clear from reviewing the above studies that the majority revolved around the importance of mobile learning and the factors that may affect the intention behind its use or implementation for education. Most studies concentrate on general factors, while surveys were the most commonly used methodology for measuring acceptance.

Nevertheless, involving new technology like M-Learning ought to be supported by society acceptance before applying such technology [12]. However, whereas the facility related to technology acceptance models have been examined in several countries worldwide, studies and researches are still limited within the context of developing countries, particularly in Arab country settings, to measure factors affecting the adoption and use of technology [73]. Also, there are limited studies that specialise in the technical aspects that have an effect on M-Learning, such as performance, compatibility, connectivity, security and reliability, process power, memory and different factors [73]. Therefore, there is an exigency to develop a model that measures the acceptance of M-Learning amongst students supported the technical aspects, particularly within the context of Arabic countries.

Although research has stated that nearly no studies discuss technical factors, some papers did discuss these matters. However, it is important to perform more research to clarify this point in order to help decision-makers who want to implement M-Learning in education, especially in Arab countries where just a few studies have been conducted. It is highly recommended to conduct new models or extend existing models to include technical factors, as almost no studies concentrate on this area.

This study is significant for the education industry in illuminating, whether these are important factors for involving mobiles in the learning process. In addition, it gives a brief history of the involvement of technology in education. Some limitations can be discerned in this review. Firstly, the number of papers covered in this review is limited, so future studies could include more papers for greater accuracy. Secondly, the smartphone industry is a rapidly developing sector. As a result, more studies need to be conducted in this field. This review paper benefits developers by enriching their knowledge of the factors that affect the acceptance of students or learners of this technique, in order to take this into account when developing M-Learning application.

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