The Critical Success Factors Influencing the Use of Mobile Learning and its Perceived Impacts in Students' Education: A Systematic Literature Review

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Abstract

Mobile Learning (M-learning) adoption and success in supporting students' learning engagement mainly depend on many factors. Therefore, this study systematically reviews the literature, synthesizes and analyzes the predictors of M-learning adoption, and uses success for students' learning engagement. Literature from 2016 to 2023 in various databases is covered in this study. Based on the review's findings, the factors that influence students' learning engagement when it comes to M-learning usage and adoption, can be divided into technical, pedagogical, and social factors. More specifically, technical factors include mobile devices availability and quality, connectivity to the internet, and user-friendly interfaces, pedagogical factors include effective instructional design, teaching methods, and assessment strategies, and social factors include motivation of students, social interaction and perceived enjoyment – all these factors have a significant impact on the M-learning adoption and use success. The findings of the review also indicated that M-learning has a key role in enhancing the learning engagement of students through different ways, like increasing their motivation, attention, and participation in their process of learning, paving the way for interaction and building relationships opportunities with peers and instructors, which in turn, can lead to strengthening the learning environment. The implications of these findings extend beyond immediate educational contexts, offering vital insights for future educational technology strategies and policy decisions, particularly in addressing global educational challenges and embracing technological advancements in learning.

Keywords: Mobile Learning, Students' Engagement, Technology Adoption and Use, Technology and Education

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1. Introduction

Technology advancements throughout the past several years have been the impetus behind the availability and integration of extensive mobile devices in daily life. This has led to new educational pathways, allowing for further mobile learning development. Essentially, M-learning is described as using mobile devices, like tablets and smartphones, to access and consume educational content and interact in learning activities and processes. Through access to educational resources and interaction in learning activities at any time and place, mobile learning has made it possible to move past traditional educational models and adopt new and innovative learning methods [1-3].

Moreover, mobile learning (ML), driven by technological advancements, has become essential in online education, offering flexibility and convenience in accessing learning materials. The COVID-19 pandemic highlighted its significance as n-Learning rapidly replaced traditional classroom settings, demonstrating its ability to sustain education in challenging times and hinting at its potential to reshape future educational models [4-6].

Based on research, M-learning has a positive influence on the learning engagement, learning motivation, and learning outcomes of students [6-8]. This stems from the ability to access educational resources and interact with learning activities via a personal device, enabling students' learning autonomy and increasing their learning engagement and motivation. In addition, using m-technology in the educational field can support students' interaction and communication and bring about the completion of assignments, thereby enhancing the learning environment [9-11].

In the past few years, educational institutions have begun adopting M-learning and integrating it into their curricula to leverage its potential advantages, and through such leverage, educators can ensure enhanced engagement, interaction, and personalized learning experiences among students. This is why M-learning usage in education is expected to transform education, particularly regarding students' learning quality [1, 12-14].

The burgeoning field of mobile learning has seen extensive research; however, a notable gap exists in understanding its multifaceted impacts within educational settings [7, 15, 16]. The review identifies a lack of comprehensive analysis integrating technological and pedagogical perspectives, particularly in how mobile learning influences student engagement and educational outcomes across diverse demographics [1, 7].

Indubitably, the advantages that can be reaped from using M-learning are clear. Thus, it is crucial to highlight the factors influencing its adoption and use success to enhance students' learning engagement from higher education institutions [1, 17]. Hence, this paper conducts a systematic literature review (SLR) on the factors influencing M-learning adoption and uses success to enhance students' learning engagement. The research focuses on four significant impacts dedicated to examining the effect of M-learning on students' engagement, motivation, and learning outcomes. This research is crucial in an era where digital learning tools rapidly evolve and become integral to education. Addressing these gaps is academically significant and essential for practical applications [15, 18]. Our findings offer insights that can guide educators in optimizing mobile learning strategies and assist policymakers in formulating effective digital education policies.

In this regard, the factors influencing the M-learning adoption and use success towards enhancing students' learning engagement can be further understood through a thorough SLR. In other words, this SLR mainly aims to present the different factors that determine M-learning success [1, 19, 20].

The paper's organization is as follows: the second section provides an overview of the adoption and use of M-learning in higher education institutions, while the third section describes the SLR methodology. This is followed by the fourth section, which provides the review findings and follows up with a discussion. In the fifth section, the SLR enumerates the findings' implications while the sixth and final section concludes the review through the presentation of the key findings and suggestions for future studies.

2. Mobile-Learning Adoption and Use in Higher Education

This section delves into four key aspects of ML in higher education identified in current literature. These include an overview of M-learning, models developed within M-learning literature, factors influencing M-learning adoption in higher education institutions, and the impact of M-learning on student engagement. Understanding these dimensions is vital to grasping the global research direction and intention toward M-learning adoption.

In the realm of higher education, especially in developing countries, the implementation of M-learning poses significant challenges. A primary concern is the absence of comprehensive models to guide successful integration and engagement in M-learning initiatives [5]. For instance, [21] conducted a study at Zayed University, Abu Dhabi, involving 280 students, examining the drivers of M-learning adoption. The research tested a model through a questionnaire survey, revealing that perceived ease of use, utility, satisfaction, and attitude significantly influenced ongoing M-learning usage. In contrast, fear and confirmation of expectations were pivotal in determining the intention to adopt M-learning.

In another study, [22] focused on the effects of intention to use M-learning technology among students based on an integrated model built upon the theory of planned behavior (TPB) and technology acceptance model (TAM). The author gathered data from 487 university students to test the model and used SEM for data analysis. Based on the findings, behavioral intention is significantly influenced by attitude, while attitude is influenced by perceived usefulness, perceived ease of use, subjective norm, and self-efficacy. While self-efficacy had the lowest effect on the intention to use technology, attitude had the highest effect level.

Despite the numerous studies dedicated to the factors influencing M-learning adoption, the topic has been largely untouched in the Middle Eastern region [14], and thus, it is crucial to examine the factors influencing the intention of students toward M-learning adoption in higher education institutions in this context. This is possible by focusing on the factors that influence higher education students' inclinations towards M-learning system use in their learning process in Saudi Arabia.

In [23]'s study, M-learning in Palestinian higher education institutions was examined using TAM with additional elements (mobility, self-efficacy, and enjoyment), with data gathered from 388 learners. The two significant predictors of ease of use of M-learning were enjoyment and perceived self-efficacy, and the predictors of perceived usefulness were perceived ease of use and mobility.

There is an increasing general trend in awareness of investing in technological innovation worldwide to enhance the educational system [24]. M-learning adoption in education has been happening worldwide to mitigate the gap between education supply and demand. Moreover, using M-learning forms the provision of education in the education sector comprising of implemented processes for enhancing higher education institutions' effectiveness in light of their performance and objectives achievement. Studies of this caliber have presented different barriers to M-learning use in developing nations. However, more studies are needed to

highlight the role of M-learning in enhancing students' learning engagement [25].

The above highlights the urgent need to determine the factors that affect M-learning innovation/technology use in higher education institutions for their transformation into global educational leaders. This holds true for the role of M-learning in students' learning engagement, as this can lead to the diffusion and integration of different innovative tools for learning enhancement learning [7, 26-30].

3. Systematic Literature Review (SLR) Methodology

This study adopted the SLR based on a comprehensive and systematic method for identifying and analyzing the studies [31-33] in M-learning adoption among students of higher education institutions. The steps taken towards carrying out the SLR are presented in the following **Fig. 1**.

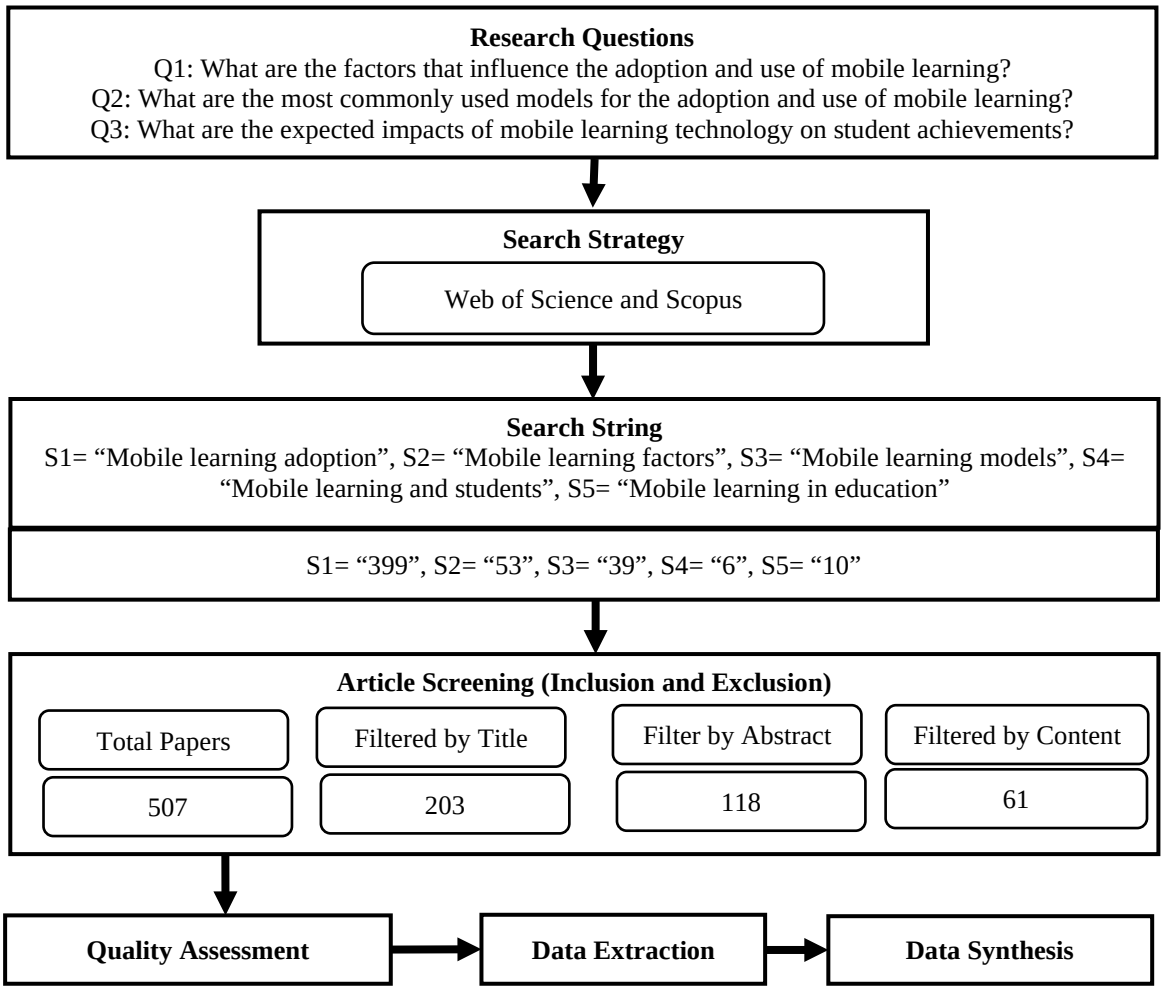

Fig. 1. SLR Stages

The detailed methodology of this study is not just a procedural backbone but a critical element that directly shapes the credibility, specificity, and applicability of our findings and conclusions. This kind of study allows us to confidently assert that the identified critical success factors are key influencers in the effective implementation and perceived impacts [32] of mobile learning in students' education. The following sub-sections explain the SLR steps in detail.

3.1 Defining the Research Question

This step entails establishing clear and concise statements to identify the research topic and set down the study's parameters [33]. Several conditions exist for defining a research question: clarity, relevance, specificity, importance, feasibility, testability, and novelty [34]. In other words, the question needs to be developed to allow the determination of its answer within the study scope, and it needs to explain the knowledge gap and contribute to the phenomenon being examined [32, 34]. The question must also be feasible and achievable within available resources and be innovative, original, and present viewpoints to the study field [35]. The above conditions ensure that the research has a definitive direction, is relevant, and leads to meaningful and enriching outcomes.

In this SLR, the research questions are as follows;

Q1: What factors influence the adoption and use of mobile learning?
Q2: What are the most commonly used models for adopting and using mobile learning?
Q3: What are the expected impacts of mobile learning technology on students' achievements?

3.2 Search Strategy

In the case of a well-thought-out search procedure, the execution of the resources at hand is required to determine the relevant studies that meet the research conditions [32, 35]. This determination using SLR is core to searching the relevant sources and maintaining SLR standards. This study searched to identify the materials available in reputable library databases [16, 35]. The study used five primary keywords to search the library databases: Scopus, Web of Science, ProQuest, and Google Scholar. The keywords are S1: mobile learning adoption, S2: mobile learning factors, S3: mobile learning models, S4: mobile learning and students, and S5: mobile learning in education.

3.3 Inclusion and Exclusion Criteria

The study manually searched books, conference proceedings, journal publications, and other online materials in the libraries using the above keywords. Using Endnote reference manager software, the author managed the references [36] and bibliographic information, including the author's name, the title of the article, the name of the conference/journal, the year of publication, and page numbering. The library search process and detailed keyword presentation were included in the findings and discussion section, and the initial search, inclusion, and exclusion criteria are presented in **Table 1**.

Table 1. Inclusion Criteria

1	The journals published from 2016 to 2023
2	English language as a medium of writing
3	The content is available
4	The paper includes information to answer research questions
5	The articles in the selected databases

Table 2 tabulates the exclusion criteria for article selection

Table 2. Exclusion criteria

1	The journals published before 2013
2	Journal written not in English
3	The content is not available
4	The paper does not include information to answer research questions
5	The articles from the selected databases

The study selection process was categorized into different phases in the initial review – this entailed reviewing the titles of the articles based on the inclusion and exclusion criteria [16, 32]. The papers that were not cut were dropped, while the remaining ones were filtered by reviewing their abstracts and findings.

The top major papers were included and assessed to ensure they met the established criteria.

3.4 Quality Assessment

The included studies were assessed for their quality according to established criteria (i.e., research design, sample size, and the results' validity [37, 38]. The quality assessment (QA) process plays a significant role in the SLR-established protocol [38]. Therefore, the QA of the selected papers was ensured after they were selected and reviewed, during which the QA was established using each defined research question. In addition, the quality criteria (QR) of each research question were also defined in the following way;

- QR1: The paper describes the information regarding the defined research questions.
- QR2: The paper is dated within the specific period defined, from January 2016 to April 2023, in mobile Learning.
- QR3: The paper enumerates details regarding Mobile Learning methods.
- QR4: The paper describes the benefits of mobile learning in student engagement.
- QR5: The paper is carried out in the education field.

The final selected papers were then reviewed and analyzed by the authors, following which they have appropriated weights according to the review and quality assessment criteria. The appropriated weights are as follows: 1 denotes a thoroughly explained question, 0.5 denotes an incomplete explanation, and 0 denotes a lack of details regarding the defined question.

Quantifying the evaluation was done by assigning each paper a total score in relevance to the examined topic, with the assigned values of the research questions totaled in each paper. In **Fig. 2**, the x-axis shows the articles' numbers, and the y-axis shows the average value of the quality assessment of the paper's quality evaluation.

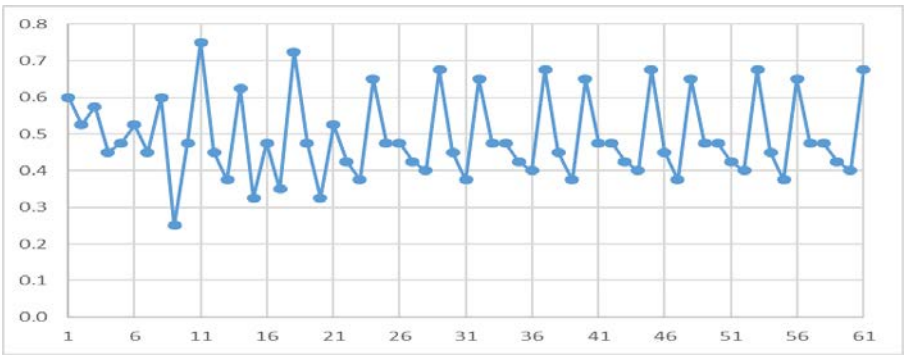

Fig. 2. Quality Assessment of the SLR articles

3.5 Data Extraction and Analysis

The authors reviewed the articles and extracted the relevant data, after which they were analyzed. Data consisted of information regarding the author's names, publication year, research design, size of the sample, findings concerning the factors that influence mobile learning adoption and usage, the study's country context, and the number of citations. Data was extracted to determine the literature patterns and trends and to synthesize the findings of each study so that the research questions could be answered [32, 38].

3.6 Synthesis and Conclusion

The obtained data from the studies were analyzed and synthesized to determine the major factors influencing mobile learning adoption and use success for students' learning engagement in higher education institutions.

The conducted SLR primarily aimed to present an overview of the factors that influence the adoption and use of mobile learning in higher education institutions and highlight the adopted best practices to enhance engagement in mobile learning among university students.

3.6.1 Studies per Journal

The number of articles covered in the SLR from the two targeted scientific databases, namely Scopus and Web of Science (WoS), is presented in the following table. Based on the results, 33 articles were obtained from WoS and 24 from Scopus. **Table 3** and **Fig. 3** show the distributions of articles based on the journal indexes.

Table 3. Distributions of articles based on indexes (WoS and Scopus)

Index	Number of Articles
Scopus	24
WoS	33
Other	4
Total	**61**

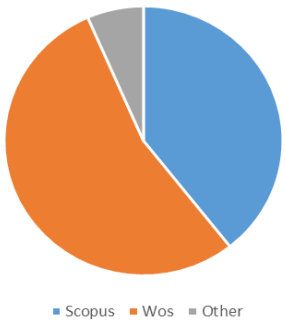

Fig. 3. Distributions of articles based on indexes

A detailed indexing of the journal in the past databases is shown in **Table 4** and **Fig. 4** below.

Based on the following table and figure, the most published articles were from MDPI with 15, Springer with 11, and Elsevier with 10. The other remaining articles were published by other publishers (i.e., Taylor & Francis, Sage, IEEExplore, IGI-Global, FRONTIERS, and Wiley). There were six articles under the "other" category, which means they were published by publishers that were not in the mentioned categories.

The above findings indicate that most of the studies concerning the factors influencing mobile learning adoption and use were published in the following journals – MDPI, Springer, and Elsevier. Researchers who focus their work in the same area may find this valuable information regarding the source of the relevant articles. Added to this, researchers may also publish with the same publishers to maintain consolidation of the topic. Notably, the research quality is not determined by the publisher as articles published by others may also be of high quality and, thus, contribute significantly to extending literature.

Table 4. Distributions of articles based on Publishers

Publisher	Number of Articles
Elsevier	10
Springer	11
MDPI	15
IEEExpolore	2
Taylor & Francis	4
Sage	1
IGI-Global	1
FRONTIERS	2
Wiley	1
Other	14
Total	**61**

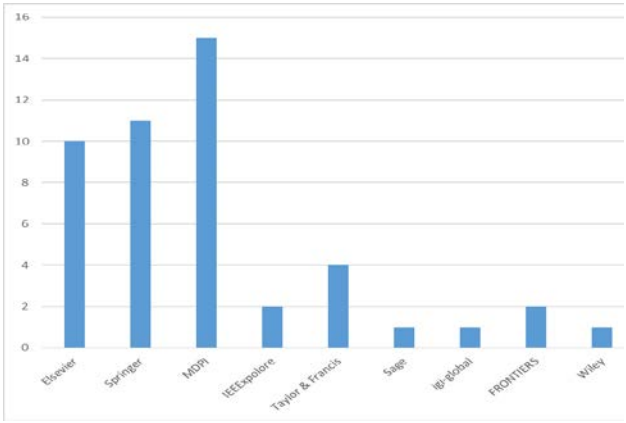

Fig. 4. Distributions of articles based on Publishers

3.6.2 Studies per Year

The following table tabulates the number of publications concerning the factors influencing mobile learning adoption and use based on year (2016-2023). Based on the obtained findings, there is a noticeable increase in the number of studies since 2019, with the highest number of publications in 2021, with 19, followed by 2020, with 11. Notably, no studies were recorded in 2017 and 2018, which could be attributed to stringent Systematic Literature Review (SLR) criteria that may have excluded publications from these years for not meeting the required relevance, methodology, or quality standards (Refer to **Table 5** and **Fig. 5**).

Table 5. Distributions of articles per Year

Year	No of Publications	Authors
2016	1	[39]
2017	0	
2018	0	
2019	8	[40-47]
2020	11	[48-58]
2021	19	[21, 59-76]
2022	16	[3, 5, 77-90]
2023	6	[1, 91-95]

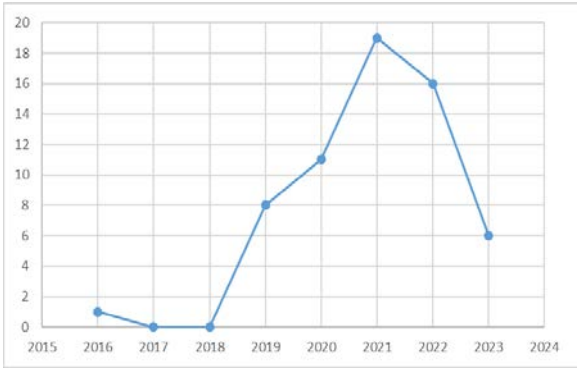

Fig. 5. Distributions of articles per Year

The number of publications has increased throughout the years and shows that interest in the topic is also growing, which may be attributed to the increasing use of mobile devices in education and the benefits reaped in the sector for students' learning engagement and achievement. Also, the ongoing interest (as observed from the three publications in 2023), indicates that the topic concerning the factors that affect mobile learning adoption and use remains expansive for exploration.

3.6.3 Studies per Model

The number of articles included in the SLR based on the theoretical models adopted to study the factors influencing mobile learning adoption and use are categorized in the table. The UTAUT was the top model adopted, with 15 articles, followed by TAM, with 13 articles. **Table 6** and **Fig. 6** elaborate on the details.

Table 6. Distribution of Studies per Model

Theory Model	No. of Studies
UTAUT	15
TAM	13
D&M	2
Technostress	2
TPB	2
Proposed model	5
Combinations	19
Other Models	3

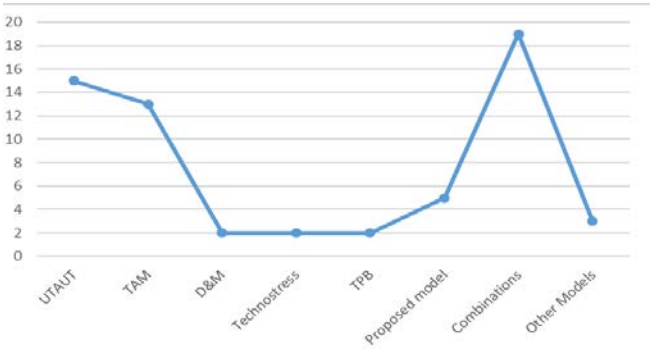

Fig. 6. Distribution of Studies per Model

Added to the top models adopted in most articles, two articles adopted the D&M model and Technostress model; another two adopted the TPB, five proposed developed models, and 19 combined between different models. Lastly, three articles did not use any model categories mentioned in the table.

In the above table, information concerning the adopted theoretical models used to examine the factors influencing mobile learning adoption and use is contained, and the notable lead by UTAUT and TAM among the other models indicates their extensive acceptance as frameworks for the phenomenon. Some of the articles used a combination of different models, which indicates that more researchers' search for a more extensive and accurate model combination

is still ongoing in the quest to identify the factors influencing mobile learning adoption and use accurately.

Notably, using a particular model does not ensure the findings' reliability and validity; instead, the research quality and analysis rigor require independent evaluation. However, the table still offers insights into the theoretical framework used by the studies to explore the adoption and use of mobile learning, which may be used as a guide for further studies.

3.6.4 Studies per Country

Based on the obtained findings, most of the articles reviewed in the SLR were carried out in Saudi Arabia (18 articles), indicating the high level of interest in mobile learning investment in the country, followed by China (12 articles) and Malaysia (5 articles). The remaining studies, singly or by 2s were carried out in the remaining countries. Based on this finding, mobile learning adoption is still confined to a few countries, calling for more studies in other countries to contribute to the literature concerning the factors influencing mobile learning adoption and use success. **Table 7** and **Fig. 7** show the distribution of articles based on countries.

Table 7. Distributions of Studies Per Country

Country	Count	Country	Count
Australia	1	Oman	1
Bulgaria	1	Palestine	1
China	12	Philippine	2
Greece	1	Romania	1
Hong Kong	1	Saudi Arabia	18
Indonesia	2	Spain	2
Iran	1	Taiwan	2
Iraq	1	Turkey	1
Jordan	2	UAE	2
Kyrgyzstan	1	US	1
Malaysia	5	Vietnam	1
Nigeria	1		

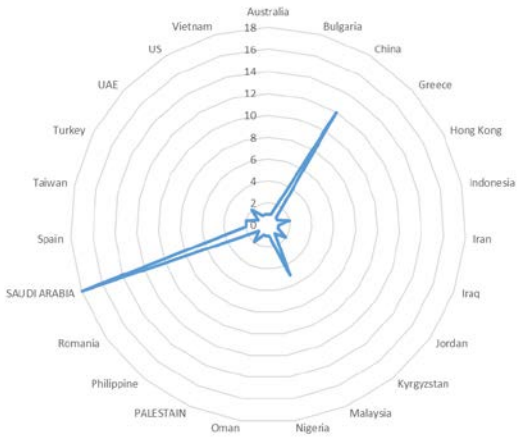

Fig. 7. Distributions of Studies Per Country

4. Findings and Discussion

In the next section, the SLR findings are further presented and discussed in light of the factors impacting the use and adoption of mobile learning among students. The SLR-selected studies used various models, including UTAUT, TAM, and D&M to examine the above factors. In this section, the impact of mobile learning on students and its potential to improve learning outcomes, learning engagement, and motivation while providing convenience and flexibility are also discussed. The findings and discussions about them further highlight the need to provide insight into the factors that promote mobile learning adoption and use success and the need to develop models and strategies to ensure that mobile learning is successfully integrated into the education system.

4.1 Factors influencing the mobile Learning use

Technology incorporation into higher education curricula and institutions has garnered increasing attention in recent years [12, 96-101]. Using mobile devices in the learning environment can contribute to successful student learning engagement and outcomes [1, 7, 18, 102]. Studies investigating the use and adoption of mobile learning in higher education institutions pinpointed several factors based on their effects on implementation success.

Based on the following frequency table, 63 factors mentioned in the literature are significant to implementing mobile learning in education, as seen in **Table 8**.

Table 8. The factors extracted from the SLR

No.	Factor	Occurrences	No.	Factor	Occurrences	No.	Factor	Occurrences
1	Behavioral intention	12	22	Academic relevance	1	43	Academic experience	1
2	Performance expectancy	10	23	Lecturer influence	1	44	Mobility	1
3	Effort expectancy	9	24	Personal innovativeness	1	45	Enjoyment	1
4	Perceived usefulness	8	25	Perceived enjoyment	1	46	Enhances communication between participants	1
5	Facilitating conditions	7	26	Social influence	1	47	Provides authentic and situated learning	1
6	Perceived ease of use	5	27	Price value device connectivity	1	48	Challenges	1
7	Actual use	4	28	Device compatibility	1	49	Culture	1
8	Task-technology-fit	3	29	Device security and reliability	1	50	Trust	1
9	Hedonic motivation	3	30	Power, memory, device performance, network coverage, network speed	1	51	Fear of contracting covid-19	1
10	University management support	2	31	Mobile learning self-efficacy	1	52	Computer self-efficacy	1
11	Students' satisfaction	2	32	Psychological factors	1	53	Motivation	1
12	Attitude towards use	2	33	Teacher attitudes	1	54	Students' burnout	1
13	Information quality	2	34	Teacher technostress	1	55	Person organization misfit of technostress	1

14	System quality	2	35	Service quality	1	56	Personal misfit of technostress	1
15	Learning value	2	36	Innovativeness	1	57	Person-people misfit of technostress	1
16	Habit	2	37	Human attitude	1	58	Perceived performance	1
17	Gender	2	38	Attitude toward higher education	1	59	Administration support	1
18	Age	2	39	Academic engagement	1	60	Peer support	1
19	Country	2	40	Level of study	1	61	ICT competence	1
20	Smartphone ownership	2	41	Major in terms of students	1	62	Learning burnout	1
21	Perceived mobile value	1	42	Academic rank	1	63	Teaching-related aspects	1

Most of the top cited factors or their equivalent constructs are encapsulated by the UTAUT or TAM, justifying their use in examining behavioral intention towards adopting and using M-learning in higher learning institutions.

This SLR meticulously delineates the critical success factors influencing mobile learning and their perceived impacts on students' education. While the initial list of factors provides a comprehensive overview, it is imperative to delve deeper into the interrelationships and contrasts among these factors to enrich our understanding. For instance, 'Behavioral intention', the most frequently occurring factor, is often closely linked with 'Performance expectancy' and 'Perceived usefulness'. This suggests that students' intentions to engage in mobile learning are significantly shaped by their expectations of performance enhancement and the utility they perceive in this mode of learning. On the other hand, factors like 'Facilitating conditions' and 'Perceived ease of use' highlight the role of external and technical aspects in shaping learning experiences.

Moreover, demographic factors such as 'Gender', 'Age', and 'Country' offer a lens to understand the diversity in mobile learning adoption and its varied impacts. By juxtaposing these factors, we can discern patterns and contradictions, such as how 'Perceived ease of use' might not uniformly translate into 'Behavioral intention' across different demographic groups. Such an analysis not only aids in a more nuanced understanding of mobile learning's success factors but also paves the way for tailoring educational strategies to diverse learner needs, ultimately enhancing the effectiveness and inclusivity of mobile learning in educational contexts.

4.2 Models Used in the Past Researches

The synthesized findings showed that UTAUT and TAM are the top models used in studies to examine mobile learning implementation in HLIs.

More specifically, UTAUT was the top model with 15 articles, followed by TAM with 13 articles. Other models (D&M, Technostress, and TPB) had two articles each, while the proposed models had five articles, combinations of models had 19 articles, and others had three articles. This finding indicates that both UTAUT and TAM are the most extensively used models in studies dedicated to mobile learning implementation among university students. The models' effectiveness and reliability are strong enough to explain the factors influencing mobile learning use and adoption in this context.

Nevertheless, the use of combinations of various models also shows that a universally accepted model/theory for mobile learning implementation is non-existent. Instead, combining the theories may be more effective in presenting a complete picture of the factors influencing mobile learning adoption and use. Researchers and educators may use this finding to design and implement their mobile learning initiative in HLIs.

Analyzing the TAM and the UTAUT within mobile learning reveals critical strengths and limitations. TAM's simplicity effectively highlights usability and utility in technology adoption but lacks breadth in addressing mobile learning's diverse factors, such as social and pedagogical influences. UTAUT offers a broader perspective, considering social influence and institutional support. Yet, its complexity can hinder practical application, primarily since it focuses on voluntary technology use, which may not align with the compulsory nature of some educational technologies. Both models, while providing foundational insights, require careful adaptation to fully encapsulate the unique aspects of mobile learning, such as its context-specific and mobile-centric nature.

4.3 Impacts on Students Education

In this section, the impacts of mobile learning on students are further explained.

4.3.1 Convenience of Students

With mobile devices, students are offered the convenience they require by mobile learning as to the time and place to access educational content and resources [103, 104]. This can benefit the students who find attending traditional classroom settings inconvenient and impossible, as M-learning enables them still to fulfill their study requirements at their convenience. This may be exemplified by the use of mobile devices for accessing online lecturers, reading course content, and submitting course work without being confined to the classroom settings-enabling a high level of flexibility and accessibility to those with packed schedules, commitments to other work, and family and other issues that may prevent them from attending traditional classroom settings [15, 18, 30, 104, 105].

Moreover, mobile learning enables students to learn at their own pace of accessing and reviewing course content. This can help those who need additional time to comprehend a concept or to understand an unfamiliar topic [2].

Previous research highlighted students' convenience and ability to learn whenever and wherever they are, as stated by [3] and [106]. This anytime, anywhere access to educational content enhances students' autonomy and empowers them to take ownership of their learning process. Additionally, learning on the go provides continuous learning opportunities and allows students to integrate their educational pursuits seamlessly into their daily lives. Most of the researchers in this SLR agree with the ability of mobile learning.

4.3.2 Personalized Learning of Students

Students are offered a personalized learning experience through mobile learning as they can select the resources and educational content that meet their needs and interests, leading to higher engagement and effectiveness of the learning experience [13].

Students may use their mobile devices to access extensive educational resources (e.g., videos, simulations, and quizzes) to assist them in comprehending the content. They may also use the same to access learning management systems, allowing them to receive personalized feedback and suggestions for their strengths and weaknesses [3, 90]. Additionally, mobile learning will enable students to access resources that suit their learning style – students who learn using visual aids can access videos and simulations. In contrast, those who learn through

hands-on learning can do so through virtual labs and simulations [3, 107].

Findings of SLR showed that M-learning also enables students to learn at their own pace, accessing and reviewing course content at their convenience. As such, they can have extra time to understand the concepts and subject [71, 77, 105, 108].

Generally, SLR findings confirmed that mobile learning has a crucial role in improving personalized learning as it allows access to an extensive array of resources, customized learning experiences, and learning based on one's own pace. Despite the benefits, it is noteworthy that mobile devices used in learning should support students' learning instead of deterring it.

4.3.3 Increased Engagement

Mobile learning can improve student engagement by incorporating interactive elements and multimedia into the learning process [7, 109]. For instance, mobile devices can be used to access educational games, simulations, and virtual reality experiences for a higher level of engagement and enjoyment in learning [104].

Some SLR findings as [110] asserted that mobile devices might also bring about collaboration and communication among the students, allowing group work and sharing of resources to complete projects in real-time. This can lead to an interactive and dynamic learning environment, enabling the students to engage and interact with their group members in hands-on coursework [47, 57].

The findings identified some essential issues and confirmed students' ability to receive immediate feedback and support through their mobile devices, which can heighten their motivation and engagement while learning. Students can answer quizzes and assessments through mobile devices, after which feedback on their performance can be forwarded. This can build student confidence and provide a sense of accomplishment as he is aware of his performance at every step [111].

SLR findings concluded that mobile learning can lead to a higher level of engagement through the availability of interactive elements, promotion of communication and collaboration, and provision of immediate feedback on performance. Mobile devices, however, need to support rather than detract from students' learning engagement.

4.3.4 Improved Collaboration

Mobile learning can improve students' collaboration through the different online tools and platforms that bring about easy communication and collaboration. This is clear through the use of group chat apps, online forums, and other collaboration platforms that enable the students to work together on completing projects [112-116]. They may also use the same for sharing ideas and providing suggestions and feedback to each other – such tools are useful for online and remote learning environments, not requiring any face-to-face interactions [117].

Moreover, collaboration is also facilitated through mobile learning by enabling students to access and share learning materials among themselves – for instance, they can make use of cloud storage services for uploading and sharing presentations, documents etc., which can assist in understanding the course content and bring about a collaboration among themselves for coursework completion [5, 59].

All SLR findings confirmed that mobile learning enhances collaboration by allowing students to access and explore online learning communities that they can use for networking with other learners, participating in forums and discussions, and collaborating with assignments and other projects.

5. Implications

This SLR has several implications for practicing, particularly for educators, policymakers, and technology developers focused on bringing about successful M-learning to enhance learning engagement among university students.

First, educators can use the findings to remind them and keep them aware of the technological, pedagogical and social factors influencing M-learning adoption success. These must be considered when designing and implementing M-learning activities and programs to enhance student motivation and engagement.

Second, policymakers may use the findings to invest in the required resources and infrastructure to ensure that mobile devices and internet connectivity will remain accessible and available to students. This covers providing subsidies/grants to purchase such devices, provision of Wi-Fi areas, and ensuring that the proper infrastructure is available to facilitate M-learning.

Third, the findings also have implications for technology developers in their quest to design the most effective mobile applications and interfaces that are easy to use and with intuitive functions. This involves ensuring always accessible and easy-to-use applications, even with individuals suffering from disabilities or low-level technology efficacy.

This SLR also has several implications for the theory of M-learning. First and foremost, the technical, pedagogical, and social factors influencing M-learning adoption and use success have been highlighted and are a significant contribution to M-learning adoption in education.

Second, this SLR emphasizes the potential of M-learning to improve students' learning engagement and collaboration through increased motivation, attention, and participation in their learning process. Future studies may use this as a theoretical basis to further explore M-learning capabilities and mechanisms to improve students' engagement.

Third, the review findings also present the need for more studies to be dedicated to examining the effect of M-learning on education, considering its potential to enhance students' engagement. Studies of this caliber may explore its long-term impact on learning outcomes and student achievements.

Finally, the findings highlight the immense value of global collaboration in developing and disseminating M-learning resources. Engaging in international partnerships can lead to a richer understanding of diverse educational needs and preferences, contributing significantly to global educational advancements. This review, therefore, recommends that future development in M-learning should emphasize inclusivity and cross-cultural cooperation, ensuring that the benefits of technological advancements in education are universally accessible and culturally relevant.

6. Conclusion

Mobile learning has enhanced students' collaboration by enabling access to various learning tools and resources online, furthering effective collaboration, sharing of materials, and communication. Such resources have developed an environment that caters to enhanced engagement and interaction of students as well as their collaboration towards achieving their education objectives. Moreover, M-learning can enhance students' engagement by increasing their attention, focus, motivation, and participation in their learning process. It paves the way for students to develop connections and relationships with their peers and instructors, which can support their learning. It also offers flexibility and convenience in accessing learning

resources and activities at any time and place. This review has considerable practical implications for policymakers, educators, and technology developers. From the above, educators can take the technical, pedagogical, and social factors influencing M-learning adoption and use success into consideration for enhanced engagement and collaboration of students, while policymakers can direct their investments towards the required resources and infrastructure to ensure that students always have easy access to mobile devices and internet connectivity. Moreover, technology developers can work towards developing user-friendly applications and interfaces. SLR findings present higher education institutions with information on the way the major factors and sub-factors can play a key role in ensuring sustainable and successful ML. It also has implications for decision-makers, educators, and developers regarding the design and implementation of M-learning strategies and systems to meet the student's needs and requirements. Additionally, emerging trends such as integrating artificial intelligence in M-learning and exploring augmented and virtual reality for educational purposes warrant further investigation. These areas offer promising avenues for enhancing the interactivity and personalization of M-learning experiences. In sum, this SLR provided considerable information on how M-learning can be successfully implemented in HLIs to enhance students' engagement, thereby increasing their quality of education. M-learning adoption and use success depends on several factors that educators, policymakers, and technology developers can consider. With the advancements and evolvement of technology, ongoing research and analysis of the M-learning effect on education are called for to determine novel methods to enhance the engagement and collaboration of students for better education quality.

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