A Systematic Literature Review on Mobile Learning for Nursing Education in Kingdom of Saudi Arabia

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***Abstract*—This systematic review collects, documents, examines and critically analyzes the current research literature on m-learning in higher education institutes in Saudi Arabia, published between 2010 and 2017. It explores the m-learning frameworks, the acceptance of m-learning and the factors that influence the deployment of m-learning. It also investigates the trends in m-learning by systematically analyzing the previous studies. This review explores new emerging practices relating to the use of mobile technologies in nursing education and aims to identify gaps in the research literature. The result shows reasonable evidence that the HEIs in Saudi Arabia face considerable challenges in implementing m-learning. It also presents a lack and existing studies with no theoretical framework, assessing the effectiveness of m-learning within Saudi Arabia HEIs. The absence of studies reporting existing m-learning study reflects the limited penetration of this technology and associated pedagogies and a need to strengthen research in this field.**

Keywords—mobile learning (m-learning); m-learning acceptance, factors influencing the mobile learning

I. INTRODUCTION

With the rapid transformation in mobile technologies, their implementation in teaching and learning process is gaining extensive acceptance at wide-ranging level. The support provided by the mobile technologies allows fast knowledge acquisition and information exchange. The efficiency of these innovations increases the level of independence for work and study, allowing anywhere anytime learning environment. Hence, this study presents a literature review on the m-learning domain particularly in KSA. Then, examines the trends in m-learning by systematically analyzing the previous studies. Furthermore, it explores the m-learning frameworks and factors relating to the use of mobile technologies. Finally, at the end is given a conclusion presenting the findings of this systematic review.

Only four previous review-based studies [1],[2],[3],[4] have provided important insights into m-learning, but have failed to examine or categorize research trends from other standpoint of research such as subject-domain, frameworks, methodologies, social learning environments, and outcomes.

The study conducted by [1], which was between 2003 and 2010 to study the importance of mobile education in various disciplines and courses. He presented that m-learning most frequently supports students in the professions and applied sciences (51%), followed by the humanities (36) and formal sciences (26) whereas (0%) for nursing students. Study [2] explored the m-learning field from the year 2003 to 2014 . Moreover, [3] has discussed the m-learning based on the African perspectives only. While the study conducted by [4] has covered the m-learning domain from the year 2005 to 2013 only for KSA as a developing country. Although the previous studies have presented significant data regarding the m-learning. The results of this study aim to provide a more comprehension data for researchers and educators into research trends in m-learning in KSA.

Therefore, the contribution would be to collect and analyze literature published between 2010 and 2017 since this is the period that marked the following trends:

Authors of [5] has started to measure students' attitudes and perceptions towards the effectiveness of m-learning. His study reports on the results of 186 students at King Saud University KSU in Saudi Arabia. He has attempted to determine how this technology can be used to improve student retention at the Bachelor of Art and Medicine program. The result indicated that offering m-learning could improve the retention of students, by enhancing their learning. We believe this aforementioned study provides an initial and respected analysis of m-learning issues in Saudi Arabia, but further investigation is warranted based on dis-similar research directions. It has revealed that the study of the m-learning in Saudi Arabia has started in the year 2009/2010.

The Internet World Stats, Internet Usage and Marketing Report, Saudi Arabia (2010) has announced that the total population of SA in the year 2000, only 0.09% user used the internet, whereas, in September 2010, Internet users have increased significantly to 38.10%. Likewise, the highest growth in the use of mobile technologies in developing countries such as Saudi Arabia. Authors of [6] stated that most Saudi universities were expected to switch to a system of e-learning by 2010.To achieve this, the Ministry of Higher Education has established the National Center for e-Learning and Distance Learning (NCeL) to organize the change and prepare e-learning materials. The universities have asked their academics who have agreed to adopt e-learning to be trained by the national center.

This study presents a systematic review of the published m-learning literature from the year 2010 to the year 2017. A huge number (800+) of peer reviewed papers are identified through journals, database searches, searching the Web, and chaining from known sources to form the basis for this review. The review categorizes the literature into different areas of interest, includes: M-learning theory; M-learning frameworks; Participant focused (Teachers /Students); Study focused; Country of the study focused; Study approach; Research methods; and Providing quantitative analysis of publications according to publication type (Journal /papers), year of publication between (2010-2017).

II. Systematic Literature Review on M-Learning in KSA

A systematic review starts with a precise question, clearly defined with the subject, intervention, and outcome elements, that is answerable in scientific terms [7]. The question is critical to the process because it generates the literature search terms and determines relevance criteria [8]. Finding the right question is a compromise between taking a holistic approach, and a reductionist approach [9] . Five questions drive this systematic review shown in Table.1.

TABLE 1 A SYSTEMATIC LITRETURE REVIEW FOR M-LEARNING IN KSA.

#	SLRs Research's Questions	Rationale
1	What m-learning frameworks exist and what do they claim about the design of m-learning?	To identify the key underpinning theories of m-learning, then to examine how these might be called into play in varying combinations, depending on the intent of m-learning. It is important since it underpins the expectations of meaningful learning outcomes that any given learning activity should have.
2	What are the most common factors influencing the m-learning in higher education?	To explore the most common factors, then contribute by adding other different factors that could influence the m-learning.
3	What is the researcher's development in the use of mobile learning in nursing education?	To identify how to develop a technology-enhanced learning system in the nursing institute.
4	Do Students /Teachers accept the m-learning in higher educations in Saudi Arabia?	To investigate and address participants' acceptance in order to promote m-learning initiatives and ensure the success of the new approach.
5	How are m-learning Frameworks validated?	To illustrate the appropriate methodology for validation to equip study.

The initial combined search of electronic and institutional databases produced 812 articles. Search terms include: Mobile learning; m-learning; Mobile learning frameworks; Mobile learning theory; Mobile learning in Saudi Arabia; Mobile learning in higher education; Mobile learning in/for nursing'; Acceptance of mobile learning and Factors influencing mobile learning. The examination of the articles was done based on titles, date, relevance, peer-review from which 152 articles were selected for further analysis. After removing the duplicates and studies that were outside the scope of the study, a total of 68 papers were selected that met the inclusion and exclusion criteria given in Table 2. These 68 papers form the basis of analysis to answer the research questions given in Table 1 above.

TABLE 2 INCLUSION AND EXCLUSION CRITERIA

Inclusion	Exclusion
• Directly related to the m-learning framework in higher education in SA. • Scholarly materials including Peer reviewed • Conference proceedings • Written in English • Open access items • Published between January 2010- June 2017	• M-learning not used for educational purposes. • Not peer-reviewed papers. • Book reviews • Dissertation • Journals not accessible online • Duplication Papers

Q1. What m-learning frameworks exist and what do they claim about the design of m-learning?

In total, 44 out of 68 studies were based on a framework development. Most of the reported frameworks relate directly to technology adoption and acceptance such as Technology Acceptance Model TAM [10], [11], while others are based on learning theories such as Activity Theory [12] ; Grounded Theory [13] ADDIE Model [14]. The distribution of framework-based literature, based on their underpinning theories is shown in Table 3. Table 4 describes the most used frameworks developed for M-learning. The unified theory of acceptance and use of technology UTAUT Model seems to be the most used being represented in at least 16 studies.

TABLE 3 DISTRIBUTION OF THEORETICAL BASIS IN M-LEARNING LITERATURE

The framework	Author and Year
A Framework of Analysis of Design Patterns	(Schmitz, et al., 2013)
TAM Model	(Chang, et al. ,2012; Park, et al., 2012; Seliaman, et al., 2012; Aljuaid, at el., 2014; Jung, H. J.,2015; Chang, et al., 2012; Almasri, A. K. M.,2014; Mac Callum, et al., 2014; Alzu'bi, et al., 2017; Tavallaee, et al., 2017).

A person-centred sustainable model	(Ng, et al., 2013)
Activity Theory	(Liaw, et al., 2010; Batista, et al., 2013)
ADDIE model	(Aliff, et al., 2015)
Pedagogical Framework	(Park, Y.,2011)
Cognitive framework	(Wu, et al., 2012)
Conceptual Framework	(First, M., & Ahmed, A. M., 2017)
Conceptual mobile learning model	(Lam, L., 2015)
Conceptual Model and Analytic Hierarchy Process	(Mejía-Trejo, J., et al., 2016)
Gilly Salmon's five-stage scaffolding model	(Abdullah, et al., 2013)
Grounded Theory	(Townsend, P., 2016)
Integrative Learning Design Framework	(Willemse, et al., 2016)
Mobile Learning Preferences model MLPs	(Yau, et al., 2010)
Repertory Grid approach	(Wu, et al., 2011)
UTAUT Model	(Isaias, et al., 2017; Nassuora, A. B.,2012; Alharbi, O., et al., 2017; Alshammari, et al., 2016; Mtebe, et al., 2014; Lu, et al., 2016; Abdulrahman, R., et al., 2017; Joo, et al., 2014; Ayoade, O. B.,2015; Ng, Kim Soon, et al., 2015; Nassuora, A. B., 2012; Bere, et al., 2013; Cruz, et al., 2014; Mutono, A., & Dagada, P.,2016; Abu-Al-Aish, A., et al., 2013; Uğur, et al., 2016)

Instructional designers and educators recognize the potential of mobile technologies as a learning tool for learners and have incorporated them into a various learning environment. However, little research has been done to classify the various examples of learning in the context of m-learning, and few instructional design guidelines based on a solid theoretical framework for m-learning exist [15] .

TABLE 4 CLASSIFICATION ON M-LEARNING FRAMEWROKS

Frameworks	Focus
A framework for Sustainable Mobile Learning in Schools. Primary school in Australia (Ng and Nicholas, 2012)	Dissects the findings of a longitudinal study of a secondary school adopting a personal digital assistant program and proposes a person-centred sustainable model for mobile learning.
A Pedagogical Framework for Mobile Learning: Categorizing Educational Applications of Mobile Technologies into Four Types. Park, Y. (2011).	Modify transactional distance (TD) theory and adopt it as a relevant theoretical framework for mobile learning in distance education.
Mlearning Scaffolding Five- stage Model. (Abdullah, et al.,2013)	Describe how learners could be assisted in language-learning via supportive scaffolding using mobile devices
A Mobile Learning Preferences Model. (Yau & Joy,2010)	To potentially increase the learning effectiveness of users by appropriately allocating mobile learning applications according to each learner' s type
An Extended Technology Acceptance Model (in the context of mobile learning; adding perceived convenience). (Chang, Yan, & Tseng,2012)	Analyzed and antecedent factors that affected students' acceptance of English mobile learning in Taiwan college.
A General Structural Model of Students' Acceptance of Mobile Learning. (Park, Nam, & Cha,2012)	Proposes and verifies the use of TAM to explain and predict students' acceptance of mobile learning at university in Taiwan.

Q2. What are the most common factors influencing the m-learning in Saudi Arabia in higher education?

From the reviewed studies, there is evidence that the higher education institutions in Saudi Arabia face significant challenges in implementing m-learning as shown in Table 5. The main constraints mentioned by relevant studies are centered around issues such as poor technological infrastructure leading to internet access problems [16],[17] ,lack of mobile learning pedagogical skills [18] and the poor attitude among some lecturers and institutional leaders towards m-learning [19]. M-learning presents unique challenges like slow download speed and limited internet access, small screen sizes with poor resolution, limited memory, small screen size of mobile devices, limited computational capabilities, limited battery life and the need for more time to find information [20].

With regard to students perceived 'mobile learning acceptance, findings seem to suggest eight key factors that influence the adoption of m-learning by higher education students in Saudi Arabia. These include performance expectancy, effort expectancy, facilitating conditions, social influence , environmental factors, nature of the institution's leadership, technological, access, organisational, and individual [21], [22]. While the other factors that influence the adoption

of m-learning by higher education students in developed countries such as Japan, Korea, Australia and UK include perceived convenience, perceived ease of use and perceived usefulness, instant connectivity, compatibility, interaction, content enrichment, and computer self-efficacy, influencing the perceived usefulness of Technology Acceptance Model (TAM) [23],[24],[25].

According to [26], he reported that it is a worse situations where the institutional leaders were hesitant to encourage and support the m-learning initiatives suggested by the lecturers or the institutions themselves. According to [18] the factors are 1) technological advances in digital and wireless solution and 2) technological improvements making mobile devices more user-friendly and cost effective. From user acceptance perspective, the two factors do not provide any concrete understanding, however, they do serve as an indicator that ease of use, technology considerations are other possible user focused factors that influence m-learning acceptance. Reference [27] makes the point that for the first time a major segment of users that include teachers and students both have extensive access to mobile communication technology and this is common observation for developing and developed countries both. Reference [27] cited considering teachers as essential factors or contributors in acceptance of m-learning practices among users, which would imply that teachers' effectiveness at mobile technology will also drive acceptance by students' groups. The educator's role in m-learning is further confirmed by studies conducted by [19] and [28] . Similarly, [29] put forward the role of educators in m-learning as most critical.

TABLE 5 A LIST OF FACTORS INFLUENCING THE M-LEARNING IN SAUDI ARABIA

Author and Year	Factors
(Chanchary, et al., 2011)	Wireless learning environment, Students' readiness
(Seliaman, et al., 2012)	Perceived innovativeness, Perceived ease of use, ICT anxiety, Perceived usefulness and BI
(Nassuora, 2013).	Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Condition
(Narayanasamy, et al. ,2013)	Usage of mobile applications, Awareness on mobile technologies
(Aljuaid, et al., 2014)	Perceived usefulness, Perceived ease of use
(Alshammari, et al., 2016)	Perceived skills in computer usage, Attitudes towards the use of computers.
(Alharthi, et al., 2016)	Teachers' perspective and readiness
(Alenezi, 2017)	Usage of mobile applications Adopted the learning management system.
(Alharbi, O., et al., 2017)	Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Condition

Q3. What is the research development in m-learning for nursing education?

From the reviewed studies shows in Table.6, there is reasonable evidence that the nursing course or clinical course face considerable studies and investigation.

TABLE 6 DISTRIBUTION OF STUDIES ON M-LEARNING BY EDUCATIONAL DISCIPLINES

Discipline	References
IT Program	(Townsend, P., 2016; Seliaman, 2012)
Nursing and Health Care	(Wu, et al., 2012; Wu, et al., 2011; Kenny et al., 2012; Lin & Yi-Chun, 2016; Hay, et al., 2017; Abdulrahman, et al., 2017; Joo, et al., 2014)
English Language	(Alharthi, K., 2016; Alshammari, ET AL., 2016)
Business and accounting School	(Cruz, et al., 2014)
Islamic Education	(Aliff, et al., 2015)
Educational Studies	(Mahat, et al., 2012)
Educational technology	(Aljuaid, at el., 2014)

Authors of [30]stated that studies on m-learning in educational contexts, most frequently, focus on supporting professional subjects and applied sciences (29%), followed by the humanities (20%), and formal sciences (16%). In terms of m-learning activity in various sub- disciplines, our findings partially support those of [31] For example, both studies [30],[31], showed mobile learning was often used language courses (5). More importantly, the present study found that m-learning is also widely used in courses related to the health program, but considerably less so in other general disciplines and courses (44). However, we suggest that mobile learning can be applied to any course or subject domain, and researchers from different disciplines can collaborate to develop suitable applications for under-represented courses.

Q4. To what extent that student's acceptance the m-learning in higher educations in Saudi Arabia?

There were 21 articles out of 68 studies which examined the users' acceptance of mobile learning, from both learners/students' perspective as well as the teachers'. Our analysis of these papers shows contrasting perceptions

between students and lecturers on the use of m-learning in university learning environments. Further finding shows that students are willing to use and adopt mobile devices and applications for learning purposes if they are made easy to use especially through providing more bigger screens, and high internet access [21],[22] For example, the study conducted by [32] to investigate students at Al-Jouf University in Saudi Arabia acceptance whether mobile technologies such as tablets, PDAs, iPads, and smartphones being used currently are useful and easy to use for instructional purposes. and to what extent the student's perceived mobile technologies as a self-independent learning tool and as an integration and interactive tool in classrooms. He found that students are willing to use m-learning as a tool to enhance their learning outcomes.

There have been studies that indicate that mere access to devices or technology does not reflect well on user acceptance of m-learning as a preferred medium [33]. This could be due to multiple factors that may range from technology to perceived value of learning. As indicated in studies conducted by [34] the success or failure of mobile learning could well be influenced by human interaction or in simple terms the relationship between student and teacher and the way m-learning influences this relationship. This makes it important to study the human relationship aspect of the m-learning experience.

Q5. How are m-learning Frameworks validated?

Our analysis of literature reveals that five main approaches have been used to validate m-learning frameworks. The result shows the distribution of literature based on validation techniques. Twenty-eight studies employed mixed research, which involves the combination of quantitative and qualitative research in order to facilitate a full understanding of a research problem [35]. The next most popular approach was quantitative research, which focuses on explaining and interpretation of a problem using numerical data [35]. This approach had 26 studies. This was followed by qualitative research emphasizing the use of words rather than figures in the collection and analysis of data [35] had 12 studies. Further, the case study research, which involves a detailed examination of a single case to gain greater insight of a given phenomenon [36] . This approach had a total number of 2 studies. Finally, one study employed descriptive research which studies groups of people without manipulation or looking for any specific relationships/correlations or change of environment [37].

In this review, mixed methods formed a large percentage followed by quantitative studies. The use of mixed methods in m-learning studies is possibly due to the desire by m-learning researchers to understand this phenomenon from multiple viewpoints and perspectives [35] .

With regard to the research data collection methods, six methods of data collection were informed in the reviewed studies with questionnaires (48), which involving a set of questions answered by respondents without the presence of the researcher [35] and Literature review (14), which involves the analysis of documents and contents following a predetermined category [38] being the most used.

The use of questionnaires is possibly due to its ability to gather data from a large population [35] compared to other methods such observation which is a tool used to systematically observe the behavior of study participants following a defined schedule of categories [39], given the large population that characterised most of the reviewed studies.

The popularity of questionnaires in the reviewed studies is justifiable. However, the absence of experimental research as a data collection instrument across all the studies can be regarded as a methodological weakness. This is because, tests are among the most useful tools in educational research and since some studies [40] aimed at assessing student achievement through the use of m-learning, achievement tests would have been used to ensure valid and reliable results.

The results indicated that 48 of the reviewed studies used the questionnaire as their research instrument, 5 used interviews, 1 employed focus groups that involve discussions, which is an interview with a number of people focusing on a specific area of study of interest to the researcher [36]. Observation which is a tool, used to systematically observe the behavior of study participants following a defined schedule of categories [39] was used in only one study. Additionally, a few studies that integrated interviews and questionnaires within the observation or focus group experiments.

III. GAPS ANALYSIS

The approach for this study entailed extensive searches of relevant m-learning, Information Technology IT databases base on meta-analysis review. The intention was to ensure that, as far as possible, most of the literature in the field of m-earning was identified – while keeping the focus on the literature of most relevance to the research questions. The research field of m-learning in a developing country such as Saudi Arabia in higher education is still at a relatively early stage with much research still needed to be carried out both from a problem identification and strategic perspective. Despite the tremendous growth and potential of the wireless devices and networks, m-learning is still in its infancy and in an embryonic stage [41]. Authors of [42] believed on the perception of mobile education is still a new issue and people still cannot get the picture of m-learning.

The Kingdom of Saudi Arabia has seen a considerable expansion in the utilization of mobile devices. The country's educational environment stands to be significantly improved through m-learning methods. In order for m-learning to be successfully developed and applied, it is crucial to consider various perspectives such as users' perspectives, learning environment, institutional perspectives on the concept of m-learning. Yet, there is still a lack of research on m-learning activities in Saudi Arabia in the field of nursing education.

Hence, there are several gaps to be considered by the researcher, practitioners, policy makers and educators when a study is to be conducted regarding m-learning applications. A substantial number of studies did not base their research on any theoretical framework, which puts the findings and assumptions into question. This is because, theory provides the basis for understanding complex problems, interpreting empirical data, and providing a basis for explaining and analyzing the way individuals and organizations work (Reeves, et al., 2008). Research on the use of mobile learning in KSA is still very limited more especially among the nursing education. Only a few studies have been found to focus on the University level for multi discipline but none on Nursing education.

This reveals a need for impending research on mobile learning projects to focus on Nursing education in KSA. Therefore, it is important to note that the gaps identified in the reviewed studies have strong implications for practice and research in mobile learning within KSA. For instance, the absence of empirical studies reporting on existing mobile learning projects in nursing education in KSA implies that mobile learning has not become popular in this context. Therefore, further research in this field is needed to explore its impact as the spread of mobile devices in KSA increases and the adoption of the mobile learning paradigm becomes rather a necessity with the ever changing requirements.

CONCLUSION

The research interest on m-learning in higher education is growing rapidly, even though there are still very few high-quality studies to provide evidence for its effectiveness. The study findings seem to suggest a growing interest in the integration and use of mobile learning in Saudi's higher education institutions. With the increasing spread of mobile devices, the future of m-learning in Saudi Arabia is encouraging. There has been an increasing trend in m-learning within developing countries. Moreover, studies should utilise the existing m-learning and other educational technology related frameworks to provide a lens through which study results can be analysed and interpreted. If these issues are addressed, the impact of m-learning in KSA can be evaluated and study results can be used to design appropriate policies to guide effective m-learning pedagogies for higher education institutions. This study is a systematic review of most relevant studies published between the years 2010 to 2017. The study highlights current trends in mobile learning and identifies the key research areas that need to be explored further. In summary, this study in mobile learning presents findings which can help supplement linkages with previous studies and forms an important reference base for the future research in m-learning, which is to be presented through the coming and future studies.

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