

Challenges of Applying Mobile Learning in Teaching Mathematical Courses in Saudi Arabian Universities

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Abstract- This paper is based towards the adoption of mobile learning in teaching mathematical courses and its basic risks that the region should be aware of in the context of Saudi Arabian Universities. The current era of the web application experienced vulnerabilities, manipulation by hackers and other people possessing negative vibes and emotions. The study included elements of evidence and the major findings of relevant studies while concluded the security risks that come along with mobile learning. The study exhibits the need for the security check and surety of the data security before implying mobile learning on the education system. The major risks are the primary cyber-threats like malware and third-party involvement; however, there is an essential need to deal with these risks to avoid major loss.

Keywords – E-learning, Mathematical Courses, M-Learning, Saudi Arabia, Security Risks.

I. INTRODUCTION

Mobile learning or M-learning refers to the learning or education through portable electronic devices. The concept of M-learning is spreading around the world rapidly while the globe has become more dependent on these electronic devices (Chanchary and Islam, 2011). Although, there is still a difference in developing nations and the developed ones (Seliaman and Al-Turki, 2012), the world is slowly and gradually adapting the same trends of education (Sarrab, Elgamel, and Aldabbas, 2012). It is a matter of fact that the government of Saudi Arabia is exclusively concerned about the education sector of the nation while putting a significant amount of attention on the budget of education for years (Traxler, 2005; Seliaman and Al-Turki, 2012). The initiative of the e-government includes a number of new ideas and techniques for the betterment of the education and there is a great budget, which is allotted to the IT expenditures in Saudi Arabia (Chanchary and Islam, 2011).

The country is focused on new trends and ideas of learning and has been successful in many cases whereas M-learning is still in progress (Nassuora, 2012). The advantages of this approach towards learning while there are significant challenges as well. These challenges majorly include the security risks and cyber threats since whenever there is an involvement of electronic devices risk comes along. These days' online frauds are most common and are on the rise than ever before (Sreedhar, 2018).

Majority of the countries have strongly preferred to enhance learning and teaching skills in mathematical courses for reinforcing innovation that lead to economic development as well as to develop the maximum likelihood of future employees for potential job opportunities. Currently, Saudi Arabian universities are experiencing issues related to lack of policies that can guide in making effective decisions regarding the adoption of online learning and teaching platform. It becomes vital to execute and adopt learning and teaching skills in this area as existing empirical proof

can help educators and policymakers in order to make effective decisions. This study has responded to this requirement by providing an investigation of the empirical evidence that has been carried-out on M-learning, specifically in mathematical courses. Therefore, a case study has been adopted by undertaking Saudi Arabian universities, which intend to enhance the use of M-learning in higher educational institutes for mathematical learning courses.

Case studies are a rigorous, transparent, and methodological approach to inquire, choose, extract, and develop the information on a subject of interest in order to address research questions from published empirical evidence. This paper provides high-quality scientific information on a particular topic. The objective of this case study is to be auditable, repeatable, and unbiased for other researchers. The prime aim of this case study is to find and elaborate on the security risks in the approach of M-learning. Following questions have been adopted to fulfill the use of case study regarding studies on the adoption of M-learning in mathematical courses in Saudi Arabian universities.

RQ 1: What are the educational policies related to E-learning and M-learning in Saudi Arabian Universities?

RQ 2: What is the current state of M-learning in Saudi universities?

RQ 3: What are the effects or security risks of M-learning in learning mathematical courses in Saudi universities?

II. METHODOLOGY

The core focus of studies in this paper is toward mathematical courses with mobile technologies. In this regard, this paper has followed the Evidence-Based Paradigm guidelines (Budgen & Brereton, 2006; Dwan et al., 2013) to carry-out this case study. It is essential for providing sufficient details of the selected studies for making the case study repeatable and transparent.

This paper is based on the case study of Saudi Arabia universities while the data and theories were collected from different relevant reports and journal articles. It is a descriptive case study, which tends to explain the security risks that can be faced while adapting the new techniques of learning mathematical courses. The results of these searches were shortlisted as per the year of publication. For the purpose of this paper, only studies and reports published after 2000 were used to examine the phenomenon of M-learning in Saudi Arabia as well as its risks.

The case study had four major search terms: M-learning, mathematics, higher education institutions, and universities, based on the major research questions. The paper has identified the alternative terms and synonyms from the major search terms (Table 1).

Table 1: Alternative Terms and Synonyms for Major Search Terms

Mobile Learning	Mathematics
Mobile learning	Math
M-learning	Maths
Mobile pedagogy	Mathematics
Wireless learning	Mathematical courses
Seamless learning	Mathematics education

This case study has got the following search string for searching on abstracts of the appropriate papers based on the terms: (“Mobile learning” OR “M-learning” OR “Mobile pedagogy” OR “Wireless learning” OR “Seamless learning”) AND (“Math” OR “Mathematics” OR “Mathematical courses” OR “Mathematics education”) AND (“Higher education institutions” OR “HEIs” OR “universities”). Different online databases have changed the string on the basis of the requirement in order to maintain the sequential approach. The search string has been applied in this paper on a series of databases for assuring that none of the relevant studies are missed. Conference publications are present within the online databases that can be of significant importance in providing evidence related to emerging and dynamic discipline of M-learning.

The selection criteria were based on the approach that exclude the inappropriate studies once all the findings were extracted from the online sources. In the initial phase, the search outcomes have excluded inappropriate papers by reading their titles as well as abstracts that were extracted because of possible search engines. Secondly, duplicate

citations or papers were excluded before applying the filter. Lastly, the remaining papers were filtered with the inclusion and exclusion criteria presented in Table 2.

Table 2: Study Selection Criteria

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> Published in English 	<ul style="list-style-type: none"> The study does not provide sufficient details of empirical research design and data analysis
<ul style="list-style-type: none"> Follows empirical research methods 	<ul style="list-style-type: none"> The paper is focused on special needs education or special cases
<ul style="list-style-type: none"> Investigates mathematics learning/teaching with mobile apps/technologies 	<ul style="list-style-type: none"> The paper is conceptual or discursive in nature e.g. focusing on personal opinions, theory or conceptual work
<ul style="list-style-type: none"> Published from 2000 to 2020 	

III. RESULTS & DISCUSSION

What is Mobile Learning (M-Learning)?

M-learning is “the stipulation of training, learning and education on personal digital assistants (PDAs), mobile phones, palmtops, and smartphones” (Hashemi. et al 2011) while it is also defined as “mobile computational devices carrying out e-learning across education landscape” (El-Hussein & Cronje, 2010), majorly to digital cell phones as well as personal digital assistants (Parsons, Ryu, and Cranshaw, 2006). Some authors defined M-learning as “eLearning that uses mobile devices” (Parsons, Ryu, and Cranshaw, 2006). M-learning is viewed by majority of academicians as a learning platform, which is associated to a mobile device and evolved within this platform (Sharples. et al, 2009). One of the primary mediums for such execution is the mobile phone, which allow individuals to carry-out their banking, bookings, and purchasing in order to make it as a single unique instrument in order to mediate communication between educational institutions and individuals (Crompton, 2013).

Studies have presented a general classification of existing mobile learning systems along with a framework for mobile learning systems based on the education landscape (Traxler, 2005). One of the authors emphasized that mobile learning is essentially the evolution of e-learning that completes the missing components of an e-learning solution (Sharples. et al, 2009). Other authors have defined m-learning as e-learning through mobile devices or “an extension of e-learning” (Laurillard, 2007). Palmtop devices or handheld are the technologies used to provide M-learning in an interactive medium (Parsons, Ryu, and Cranshaw, 2006).

Researches have discussed how M-learning is defined not just from a technological viewpoint (Hashemi. et al 2011). The occurrence of M-learning becomes observable and possible when benefits are taken by a learner from the learning opportunities provided by mobile technologies in the absence of a predetermined or a fixed location (Parsons, Ryu, and Cranshaw, 2006). All of these studies have defined differently the presence and use of M-learning and asserted that the major role of M-learning is to offer learning resources through technology.

The Educational Policies related to M-learning in Saudi Arabia

The training arrangements in the Kingdom of Saudi Arabia (KSA) are chosen by the Saudi government and principally dependent on Islamic social principals and guidelines (Al-Khalifa and Garcia, 2013). As expressed, beforehand, the Saudi government exerts extraordinary efforts in training (Oyaid, 2009). This has additionally implied developing force to portable learning in higher learning organizations in the Kingdom (Prokop, 2003). Government offices are accountable for realizing the improvement of portable learning (Prokop, 2003). In the region, improvements in M-learning and E-learning are made by both the National Center for Distance Education and Saudi Government by adopting a multi-purpose approach (Prokop, 2003; Rugh, 2002).

Several instruments are involved in this approach; for example (Al-Khalifa and Garcia, 2013):

- The Qualification and Training Project
- The Educational Portal
- The Jusur System for the Administration of Electronic learning
- The Saudi Repository for Learning Objects
- The Tajsir e-Learning Initiative

The Saudi Ministry of Education has propelled a national venture, “AAFAQ (Arabic for ‘Horizon’)", for building up a far-reaching, long-lasting plan for college training, and for addressing the difficulties confronting colleges. AAFAQ has energized the usage of e-learning and separation instruction by setting up eight framework ventures (Figure 1):

Logo	Service Name	Description
	Saudi Digital Library	<ul style="list-style-type: none"> • A pioneer project that aims to: <ul style="list-style-type: none"> ○ Cover the requirements of scientific research ○ Empower competency and build a knowledge-based society ○ Support the digital curricula with sources and resources important to both learner and teacher. ○ Improve and expand awareness levels and facilitate sharing of information. ○ Provide digital books and resources from leading publishing houses
	Jusur	<ul style="list-style-type: none"> • A Learning Management System (LMS) that helps to: <ul style="list-style-type: none"> ○ Register students in the portal ○ Plan and schedule courses ○ Deliver courses ○ Track students' progress and issue reports for their performance ○ Evaluate and test student's through quizzes and examinations
	SANEED	<ul style="list-style-type: none"> • A Centre for support and counselling that provides: <ul style="list-style-type: none"> ○ Educational, academic and advisory support and guidance to all beneficiaries of e-learning ○ Solutions and services to its customers through: <ul style="list-style-type: none"> ▪ live voice connection, email and SMS
	MAKNAZ	<ul style="list-style-type: none"> • an electronic national repository that helps to: <ul style="list-style-type: none"> ○ develop digital content ○ enrich the curricula ○ retrieve, reuse and share learning objects
	Training Programs	<ul style="list-style-type: none"> • A project that aims to: <ul style="list-style-type: none"> ○ Provide training to faculty members and administrators as well as technical staff. ○ Collaborate with local and international experts to present basic programs to more advanced and professional programs for trainers.

Figure 1: E-learning Ventures in Saudi Arabia (Alharbi, 2013)

The variety of administrative foundation showed that the legislature is going towards guaranteeing the ideal usage of interchanges and data innovation in training (Oyaid, 2009). There has been a generous increment in the quantity of web access suppliers in Saudi Arabia, which are compared with the expansion in the quantity of imported portable innovative gadgets obtained (Al-Khalifa and Garcia, 2013). Likewise, the Saudi government has proclaimed that all advanced education organizations, regardless of whether open or private, need to build up a deanship of eLearning and separation learning. The Saudi Ministry of Education has likewise made the NCeDL so as to help to progressions around there. The Saudi government additionally settled the Saudi Digital library (SDL), which is another means to modernize data frameworks in Saudi Arabia (Oyaid, 2009).

Both the National Transformation Program 2020 and Saudi Arabia's Vision 2030 similarly emphasized significance on national intentions to give a variety of learning strategies in the advanced education segment, including e-Learning (Al-Khalifa and Garcia, 2013; Oyaid, 2009). Currently, the KSA hopes to transform resources and monetary investment into the Saudi economy to generate more information and knowledge-based industry rather than one that relies on oil and oil-derived products, according to Saudi Vision 2030 (KSA, 2017). In spite of the fact that e-learning is not equivalent to M-learning, the improvement of one shows the advancement of the other (Sarrab, Elgamel, and Aldabbas, 2012).

The Current State of M-learning in Universities of Saudi Arabia

The KSA has reported that the nation will utilize separate learning and it has propelled activities to set up six frameworks for advanced education and separate training activities (Prokop, 2003; Wiseman, 2010). These activities incorporate frameworks that extend the e-learning instructive entrance framework. For example, the board in e-learning dispatches an honor in college for e-learning greatness, a national storehouse for learning items administration for e-learning, the foundation of the Saudi National Center for e-learning, and separate training for college training (Al, 2010). Other frameworks include and the executive's framework in agreement with the necessities of college training in the KSA, building up the scholastic and managerial aptitudes and administration framework, e-learning and separate instruction, building electronic educational program substance and types of computerized, and print for various college courses. These activities assist in fabricating the instructive entry for e-learning and separate learning and mindfulness program for electronic instruction and separate training (Drosten et al. 2014).

Saudi Arabian colleges have made some noteworthy headways in incorporating versatile learning into their educational programs (Al-Khalidi and Wallace, 1999). Consequently, the higher learning foundations in Saudi Arabia are endeavoring to incorporate M-learning into their projects (Drosten et al. 2014). However, the pace of innovative advancement is excessively fast and subsequently, there are various difficulties that still remain (Al, 2010). Since 2003, E-learning advancements have been executed by King Fahd University for Petroleum and Minerals (KFUPM) (Drosten et al. 2014). Also, King Khalid University (KKU) was established by The Deanship of e-learning in 2005 as part of the continuous efforts of the University in adopting the latest scientific methods to improve the educational process. Numerous Saudi colleges are using separation learning innovations via Short Message Service (SMS) for educating and learning (Wiseman, 2010).

A couple of years back, King Saud University had started assistance that offers clients (understudies, staff, and representatives) with the capacity to send instant messages legitimately from a PC to a cell phone (Wiseman, 2010). The administration was presented as a greater part of college students using cell phones, and these devices were used to give different tasks. SMS or 'messaging' has turned out to be ubiquitous and adaptable as the messages can be sent either to a single student or to groups (Al, 2010). This direction given by King Saud University (KSU), is not quite the same as the mass promoting approach of a university (Drosten et al. 2014). It permits the administration of resources, schools or authoritative divisions to give auspicious, significant and focused data to their students. Furthermore, universities in Saudi Arabia are using many mobile learning programs for the purpose of teaching, such as Prince Sattam bin Abdulaziz University uses a *blackboard* program, which can be easily installed and used in student and staff phones.

The Effect of M-learning on Learning Mathematics in Saudi Universities

Learning resources are enhanced and accessed anywhere and anytime by mobile devices, even outside HEIs. In this regard, the importance of mobile learning has been elevated quickly in the realm of future of learning (Trifonova, 2003). This flexibility makes it interactive for adult learners for reducing their unproductive time, which may improve their work-education adjustment (Motiwalla, 2007). In recent times, mobile applications have been developed by researchers in order to carry-out teaching in Statistics, Mathematical Analysis, Algebra, and other mathematical areas. Functions are explored by users through mobile math applications in order to offer particular

calculators and graphical abilities (Athanasios & Marios, 2015). In recent years, mathematics has been followed with the advancement in the technologies, such as M-learning platform.

Saudi students can be assisted through mobile educational tools for solving their issues, offering dynamic representations of their ideas, and escalate understanding of mobile concepts. In the course of mathematics, the rapid use of mobile technologies can assist students for enhancing their abilities as well as support the enhancement of mobile learning applications. Although, mobile math apps are increasingly in demand and used by many students for the purpose of online learning there are numerous complex code vulnerabilities, malware, unsafe app capabilities, and hidden processes included in it. The conditions continue to worsen in case of regular updates. The best way to deal with such issues is to penetrate real-time mobile applications, test for malware detection, and log analysis as well as many others.

There is a number of security risks that are faced by electronic data and devices globally. Though developed countries have strengthened their security management quite a lot, there is still a space for security risks while the countries that are adopting these technical approaches are still at great risks. Along with technical development, threats are also being smarter. There are several connections, devices, and other things involved when some regions have started adopting M-learning. The major security risks include the applications that are owned by the third party. Since the application that is providing data are neither verified by device developers nor the user, there are significant numbers of chances that the data stored in that device or provided to the particular application is in a vulnerable position. Several cyber-attacks and malware can attack the device if one is dealing with any kind of sensitive information. Usually, the applications that provide guaranteed security exclude the third-party involvement to make sure that the user data is safe. However, since M-learning in teaching mathematical courses is in a progressive mode in Saudi Arabia, there is a number of points where devices cannot defend themselves.

Another security risk that M-learning in teaching mathematical courses may face is that various security software is not compatible with the operating system of mobile devices. This eventually makes it critical to make sure that the device and data are secure. Moreover, there are some of the privacy hazards that users may come across while using M-learning techniques. If there are links and sites that may help the student to learn in a better manner, there are spams as well and in that case scenario, the data might go into wrong hands through different viruses and malware.

IV. CONCLUSION

The use of mobile devices has been raised on a moderate level, while everything is becoming convenient. Higher education institutes are also adapting the technical approach and making learning more portable. The benefits are affirmative and mobile learning can be an opportunity for a number of Saudi students. Students are motivated through M-learning applications and thus created mathematics syllabus interactive and beneficial. However, along with all these feasibilities, there come the major security risks especially in the region that are in the adopting mode. This study was aimed to find the security risks of mobile learning in teaching mathematical courses in Saudi Arabian universities, whereas, it was concluded that the particular region still requires a better cybersecurity level to make mobile learning common. The government of Saudi Arabia should actively work on improvements in the education system, while there was still a significant amount of effort required to make the e-learning and M-learning completely secure in the region.

Despite the number of studies discussed in this research on mobile learning, the remarkable progress in the universities of Saudi Arabia towards the use of M-learning could increase students' motivation and participation in mathematics learning and provide the opportunity of teaching methods of Mathematics. However, such education faces a lot of security risks including exploiting vulnerabilities in systems for sabotage or phishing. Therefore, the government of Saudi Arabia should emphasize on how to protect the Saudi universities' Systems from hacking.

V. ACKNOWLEDGEMENTS

The authors thank Prince Sattam bin Abdulaziz University for the encouragement they found from that institution.

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