

Critical Review of the Prospects and Challenges of Mobile Learning

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Alshammari Bader Farhan

College of Educational Sciences
The Islamic University of Minnesota
E-mail: al-bader500-@yahoo.com



Abstract:

Since its establishment in the early 2000s, the concept of mobile learning or m-learning has become a significant subject of interest among academic researchers worldwide. In the quest to define the concept, m-learning has been subjected to significant scrutiny resulting from various perspectives. However, the lack of consensus on a universally acknowledged definition of m-learning has resulted in divergent theories as current definitions are limited to the hardware technologies rather than the learners' experiences. As such, further studies are required to redefine the concept according to current technological developments. Therefore, this paper presents a critical review of various definitions of m-learning along with its characteristic features and developments over time. Furthermore, it presents the various benefits and barriers to the adoption and implementation of m-learning. Based on the various definitions, theories, and ideas of m-learning, the paper surmised that the concept of m-learning is in its early stages of development. However, the rapid developments in mobile technologies and affordability mobile devices have promoted m-learning resulting in numerous benefits. The benefits of m-learning highlighted in the paper include time and cost savings, access to infrastructure, data management, and improved collaboration and cooperation between learners and teachers. Other benefits are the promotion of social inclusion, personalised or informal learning and elimination of learning restrictions. However, m-learning hindered by technological, social, economic and security challenges. In conclusion, the paper observed that



m-learning could significantly influence the education of future generations of learners provided the challenges plaguing the concept are timely and judiciously addressed.

Keywords: Prospects, Challenges, Technology Adoption, Mobile Learning

1. Introduction

The concept of mobile learning or m-learning has become a significant subject of interest since its inception in early 2000. Over the years, m-learning has gradually gained traction with several studies carried out to examine and understand its adoption and implementation.

Consequently, various researchers, academics, and practitioners around the globe have attempted to define the concept of m-learning from different perspectives [1]. Early technology-based definitions describe m-learning as “any educational provision where the sole or dominant technologies are handheld or palmtop devices” [2]. Other authors have focused on the mobility feature of related technologies. As a result, m-learning is defined as “e-learning through mobile computational devices such as palms, Windows CE machines, even your digital cell phone” [3]. Consequently, it is considered a growing development within the scope of distance education and e-learning [4].

Several researchers have defined m-learning as a process that combines the benefits of mobile devices and information and communications technology (ICT). For example, Geddes [5] defined m-learning as “the acquisition of any knowledge and

skill through the use of mobile technology, anywhere, anytime, which results in an alteration in behaviour.” However, other researchers have defined m-learning based on the applications of the technology [8-6]. Furthermore, some studies have examined contributory factors such as location and technology in describing m-learning [10 ,9]. According to Sharples and Spikol [11], the nature of mobile devices is critical to the process of m-learning. Similarly, other researchers have described m-learning as simply the act of receiving instruction through mobile computing devices [13 ,12]. Therefore, m-learning according to [14] is defined as “learning that is mediated through a mobile device.”

However, several other researchers argued that the focus on mobile devices ignores other important aspects of the m-learning process [16 ,15]. Hence, Sharples and Spikol [11] opined that the definition of m-learning needs to focus on the learner’s mobility instead of the mobile device. This demonstrates that the concept of learning “anywhere, anytime” is a critical feature of m-learning, as corroborated by El-Hussein and Cronje [17]. In general, many definitions presume innovative technologies are wide in scope without an in-depth examination of the terms of mobility and mobile devices for learning [17]. This has resulted in numerous efforts to critically describe and apply the fundamental concepts of m-learning to traditional learning experiences.

As a result, the definition of m-learning was deconstructed to build a comprehensive definition of the concept based on higher education. El-Hussein and Cronje [17], proposed separate theories to explain the process of m-learning based on three key components namely; the learner, learning process, and technology mobility. The mobility of the technology describes



the mobility of the software and flexibility of hardware which enables continuous wireless internet connectivity. However, the learner's mobility refers to the absence from physical learning sites.

Therefore, learners can simultaneously study with other students wherever mobile devices are accessible.

The study by El-Hussein and Cronje [17], posits the concept of mobility integrates "mobility of technology, the mobility of learner, and mobility of learning." Consequently, learning mobility is the direct consequence of both the mobility of the learner and transportability of the technology [17]. The study intrinsically defines m-learning as "any learning that takes place in environments and spaces that take account of the mobility of technology, learners, and learning" [17]. Based on the numerous descriptions of m-learning, the concept is essentially under development [18 ,9]. Although, the outlined definitions for m-learning are valid, future studies are required to redefine the concept based on present-day technological developments. This will effectively incorporate new devices such as tablet PCs which integrate features for communication and storage into one portable device. Therefore, various devices for m-learning can be conveniently conveyed from one place to another. As a result, m-learning through such devices has become popular among students in higher education due to its features perpetuity, ease, flexibility, nearness, variety, and interactivity [19 ,18].

However, Rossing et al., [1] posit that the various descriptions of m-learning in literature create ambiguity. Therefore, the notion of m-learning is not appropriately understood by academic researchers and theorists most of whom arrive at, although

unique but, different definitions of the holistic or some aspects of the learning process [17]. Furthermore, the lack of consensus on a universally accepted definition of mobile learning is that the various definitions and ideas regarding the concept are limited to the technologies and hardware used rather an emphasis on learners' experiences with mobile devices [2]. Hence, it is imperative to examine the various features and developments of m-learning that have occurred over the years. To the best of the authors knowledge studies on the barriers and benefits of m-learning in higher education are limited in the scientific literature. Therefore, it is envisaged that the findings will identify and highlight critical literatures and the prospects and challenges of m-learning in higher education.

2. Developments and Features of M-learning

2.1 Developments in M-learning

According to the studies [18 ,9], the concept of m-learning is in its early stages of development. Over time, the concept has evolved in three main phases namely; the focus on the devices in the mid1990-s, concentration on outside the classroom learning by 2002, and the present emphasis on the learner's mobility [,17 20]. According to Caudill [21], the outlined transformations of m-learning have been catalysed by two important factors. Firstly, the rapid improvements in mobile digital technology and wireless systems for the creation and dissemination of learning resources. Secondly, the availability and affordability of mobile devices to the low-middle class who comprise the largest demographics of m-learners around the globe [22]. This



demonstrates that developments of m-learning are based on the functionality and users (learners) of the mobile devices [23 ,20]. Therefore, the introduction and implementation of m-learning require adequate equipment and infrastructural support. As a result, the design and development of mobile devices needs to adequately address the factors of size, mobility, and availability. Other notable elements include accessibility and the convenience of conveying and utilising the devices. Therefore, strict standards are required to develop and deliver multimedia based m-learning resources such as mp3 taking into account copyright regulations for the production of playback content for selected mobile devices. Therefore, media content may not be easily accessible through different platforms, and the situation has gradually been transformed, and content is becoming access via different platforms [24].

One of the alternative platforms that has evolved over the years is ICT (information and communication technologies) such as mobile and wireless systems. The application of ICT spans various fields such as business, leisure, and work services. According to Motiwalla [9], enhanced wireless and mobile handhelds have evolved from “personalised, user-centred, mobile, networked, durable and ubiquitous” technologies. For example, mobile (or smart) phones with internet or other mobile-based devices or technologies such as Wi-Fi have improved connectivity between people. In addition, these modern mobile devices are designed with data storage and wireless-enabled internet capabilities [25]. The ease of internet access has changed the need for handy storage devices such as a portable (USB flash) drives or CDs. Additionally, the mobile devices can wirelessly connect to

a network through a network interface card (NIC) which enables voice communication and wireless data transfer [26]. Likewise in the educational field, the ample advantages derived by the users of mobile devices or other ICTs have resulted in improved access to mobile-based information, learning, and knowledge sharing conventionally housed by libraries [27]. Recent evidence in literature reveals the wide usage of m-learning is a slowly growing trend in educational development [29 ,28]. However, the scope of mobile devices and portable technologies for learning is heterogeneous. Therefore, it is vital to examine the characteristics of mobile devices along with the evolving phases of m-learning.

2.2 Characteristics of M-learning

According to Chen et al., [30], the main feature of the m-learning is the use of mobile devices or technologies. As such, the selected devices are required to provide incentives lacking in other distance learning technology systems. Furthermore, the findings emphasised that mobile academic and information content providers need to pay special attention to important characteristic features. Firstly, m-learning addresses the need for the individual attainment of information for various learning requirements. Secondly, the resources for the instantaneous attainment of knowledge or information is determined by the information pursuer's request. Thirdly, the scope of m-learning enables information searching and learning as required by the individual or learner. Fourth, the instructor-student interaction process of learning is based on the concept of wireless technology. Furthermore, information seekers and other learners have



wide contact with professionals and experts. These include professional librarians who can conveniently grant access to knowledge compared to other distance learning mediums. Fifth, instructional learning actions are considered extended learning and knowledge searches into natural, genuine, and other contingencies of personal life [31 ,23]. Lastly, the content of the instruction for learning is usually combined into the wireless mobile devices.

Studies by other researchers have revealed that the enumerated characteristics of mobile technology can positively affect knowledge acquisition through m-learning [29]. This can ultimately enhance students' feelings of online community through transmission of learning natural sets and mobile access to resources. In addition, studies by Alvestrand [32] reported that the tools or aids such as discussion board, wiki journals, and virtual chats for distance learning are lacking. Hence, the mobile texting could provide an avenue for online interaction. Generally, mobile texting is employed in web-based consultations, transmission of data files and academic library access. Other benefits include associated educational support for learning [33]. The findings demonstrated that mobile devices and technologies could potentially benefit the process of m-learning. Therefore, the prospects of m-learning will be identified and examined in detail.

3. Benefits of M-learning

The successful design, development, and implementation of m-learning requires a comprehensive understanding of the potential benefits to users and the society. In general, these prospects encompass cost and time savings, accessibility to infrastructure, improved data access and information management.

Other crucial benefits include improved collaboration, cooperation, in addition to social inclusion and recovery. Lastly, benefits such as convenience or personalised access, the simplicity of the process and enhancement of informal learning can also be accrued. The outlined benefits will be critically highlighted hereafter.

3.1 Cost and Time Savings

According to previous studies, one of the major benefits of m-learning is the cost of mobile technologies relative to desktop and laptop computers [26]. Over the years, the unit cost of smartphones has plummeted due to advancements in semiconductors and ancillary components used to manufacture mobile devices [34]. Furthermore, the use of mobile devices and like technologies for learning ensures time saves and better time management as mobile content and data are compressed and stored in devices that can be easily retrieved [24]. In addition to the low cost of mobile technology, access charges to internet network and data packages have become affordable over the years. As a result, low-income earners can have access to the wireless internet or numerous free Wi-Fi hotspots which have



become ubiquitous in many cities around the globe. The combined effects of cost and time afforded by mobile technologies have increased the prospects of m-learning.

3.2 Infrastructural Access and Data Management

The needed support for mobile-based learning and teaching relies on continuous connectivity, harmonised content, and the availability of reference materials and information. Others include organisational tools for grading assessments and process activities for learning. According to Kim et al., [35], there are three main benefits of using mobile technology in education. These include effective electronic information management, file sharing in real time, and the presence of wireless-based networks. The availability of mobile devices and infrastructure can therefore improve m-learning. For example, access to low-cost or unrestricted mobile applications and wireless infrastructure connectivity ensures the sharing of data or learning resources without the need for conventional desktop or laptop computers [24]. Furthermore, this can enable enhanced network processing power, synchronised access, and storage of data [26]. The study by Fozdar and Kumar [36] demonstrated that mobile devices or technologies provide infrastructure for student support services such as enrolment, guidance, and counselling. Wei et al., (2007) also highlighted the importance of mobile-based technologies and audio posts for discussion boards on the internet.

3.3 Enhances Collaboration and Cooperation

The harmonised data available as accessible content during m-learning eliminates the obstacles of learning. Furthermore,

it provides the necessary support for both independent and collaborative learning through the data stored on reference devices and information databases or repositories [37]. In addition, m-learning helps to develop and nurture a communal environment among students and eliminates the challenges encountered in distance learning programmes. This view is corroborated by Attewell and FutureLab [38] whose study stated that the mobile phone usage increases the prospects of students engaging in informal learning. As a result, learning is not restricted to the confines of a lecture hall, teaching venue, library, computer lab, or classroom. Lastly, m-learning and mobile technologies enhance communication between students and instructors ensuring convenient and timely scheduling of learning programmes. Similarly, DuVall et al., [39], advocated that m-learning could conceivably promote communication, collaboration and nurture communal belonging through instant messaging. This presents one of the most reliable techniques for combined and independent learning and teaching. In principle, m-learning fosters collaboration and cooperation amongst students and teachers which is an important aspect of the learning process in higher education worldwide [40 ,33].

3.4 Entrenches Social Inclusion

The use of mobile devices and portable technologies such as smartphones serve as a means of enhancing social recognition or inclusion. This is typically accomplished by providing information, knowledge and learning materials to people with limited access or the means to enrol in conventional classroom education. As a result, m-learning helps to foster social inclusion thereby



uniting disadvantaged individuals in various communities. This is particularly evident in modern day societies plagued by numerous socio-economic and environmental challenges. According to studies by [42-40 ,33], m-learning provides a conduit to bridge the digital gulf in such communities particularly learners with no means to acquire PCs. Consequently, the use of mobile devices fosters learning through unhindered access to learning materials in such communities. Therefore, the consensus is that, social inclusion strongly influences the satisfaction of learners.

Similarly, the increase in communication between individuals in the social strata can improve social presence otherwise termed social inclusion. Furthermore, the use of short messaging services (SMS) from mobile devices also supports social presence and peer interaction [39 ,33]. According to the findings of Kadirire [33], DuVall et al., [39], the use of SMS enhances the timely and convenient delivery of learning materials and resources. As a result, general course updates, grading information, schedules and deadline related information, periodic subject information are delivered to students through SMS [39]. Additionally, mobile technologies improve content engagement, feedback, and communal growth among students and teachers which ultimately improves social cohesion, understanding and conflict resolution.

3.5 Promotes Personalised Learning

The concept of m-learning helps to sustain personalised and enduring commitment to learning and teaching thereby promoting informal learning. This is particularly important because the concept of lifelong or enduring learning through

traditional methods rarely provides students with the requisite skills or capabilities for lifelong sustenance. However, it is recommended that the learning process is contextual in nature providing continuous self-development, skills acquisition and talent development through the learner's life [43 ,23]. This gap can be addressed by using mobile technologies for learning otherwise termed m-learning. The nature of information delivered through mobile devices or technologies is flexible and portable which ensures accurate, genuine, and contextual learning [31]. Similarly, m-learning simplifies the process of sharing knowledge and information as required for enduring lifelong learning [,42 ,30 44] along with adapted activities for teaching [45]. Additionally, mobile technologies promote lifelong learning and the search for contextual knowledge. This is achieved through convenient and flexible access to research tools and information through wireless networks [46].

3.6 Eliminates Learning Restrictions

The concept of m-learning eliminates the provisional and spatial restrictions typically associated with conventional classroom education [47]. M-learning enables students and instructors alike to conveniently organise and timely access related information on courses, communication, and learning schedules. Furthermore, the concept promotes networking and connection through Wi-Fi or wireless technologies. The use of mobile devices promotes interminable connectivity to information and knowledge and offers flexibility regarding access, interaction and engagement in learning and searching for knowledge [28 ,6]. Moreover, these benefits create appropriate conditions for students to learn,



gain skills and develop their talents [48 ,46 ,9]. The provision of instant access, information and communication in the form of text, email, video, discussion boards amongst others during m-learning provides opportunities for prompt satisfaction and fulfilment [9]. Furthermore, m-learning eliminates geographical boundaries thus enhancing social interaction among teachers and students and between teachers and students. This occurrence inspires students to achieve both personal and group tasks in environments for learning and training. Additional features of m-learning such as proximity ensure quicker and simpler method of learning compared to other modes of study. This ensures learners get instant and spontaneous replies, feedbacks and mentoring from teachers. Therefore, the use of mobile devices among students is a tool for communicating with instructors is critical to m-learning [49].

3.7 Promotes Informal Learning

Since access to public computers is habitually controlled, many users of computer labs in public spaces or at colleges cannot modify computer features such as bookmarks, installed programs or adapt email client to suit their personal preferences. However, the use of mobile devices can address these challenges vis-à-vis supporting flexible, suitable, adapted, safe, protected, and accessible interface content [51,50,36]. According to Caudill [21], m-learning ensures the convenient handling and management of resources. The guaranteed “ease of access” helps to streamline the process of learning for the learner. In addition, the direct engagement with technology through m-learning offers students the prospects of lifelong learning along with their everyday life

activities. Furthermore, m-learning and mobile technologies provide remarkable support for learning activities for students inside and outdoor classroom [48]. A study conducted in Japan examined the use of SMS to improve English vocabulary among students. The outcome revealed that students that were tested using SMS for vocabulary development significantly perform better compared to users of desktop computers [52]. Based on the preceding, the students stated that using mobile technology as a tool for communicating with instructors and one another is critical to m-learning [49].

4. Challenges of M-learning

Despite the various benefits of m-learning highlighted, the concept is currently hampered by various challenges. These drawbacks can be broadly categorised into four (4) namely; technical (or technological), social, economic, and security challenges.

4.1 Technological challenges

The technical challenges of m-learning are typically associated with mobile devices or technologies employed for the design, development and dissemination of learning materials. As a result, the technological challenges comprise the major impediments to the realisation of the concept. For example, these challenges are broadly categorised into software and hardware problems such as compatibility, battery size, flexible software, and sharing content. The study by Chanchary and Islam [53], observed that m-learning technologies are limited by memory size, processing



efficiency, battery lifespan, and graphical user interface (GUI) problems. Furthermore, the findings demonstrated that user-friendliness of mobile devices could result in the poor adoption of m-learning. Other technical factors highlighted were poor visibility, small sized screen and incompatibility of mobile operating systems (m-OS) on learning perceptions through mobile phones [53]. However, these challenges can be addressed by deploying strategic technology that caters to current developments in web technologies. Specifically, Al-Barhamtoshy and Himdi [54], states that deploying applications for the cloud, mobile m-learning, and associated tools that control other computing systems available can effectively address problems with web service and XML-based delivery.

4.2 Social challenges

The social challenges associated with m-learning are based on the acceptability, accessibility, attention span, social manners and distraction of users or learners. According to the study by Al-Barhamtoshy and Himdi [54], the use of mobile devices for learning distracts learners from the learning content. As a result, learners report incoherent experiences and inconsistent outcomes during m-learning. As a result, the perception and intention to use mobile devices for learning is negatively affected in the short and long term. Furthermore, social rules, norms and laws in various countries around the globe can limit the content of learning materials. This can result in probable restrictions of m-learning and or the imposition of penalties or fines for breach of regulations. In principle, social challenges can directly influence the acceptability and implementation

of m-learning. Furthermore, the lack of acceptability can affect accessibility as lack of understanding of the benefits of m-learning or technology acceptance is a crucial factor for implementation. Other social challenges of m-learning include the risk of mobile phone addiction otherwise termed excessive smartphone addiction. According to the report by Deloitte over %50 of school-age children between 16 to 24 years of age were addicted to smartphones [55]. Even without the risk of mentality, insomnia, and anxiety, such habits according to psychologists are reportedly responsible for the erosion of social manners and distraction of users in the society [56]. Furthermore, Leung and Liang [57], reported that the excessive use of mobile devices is an impulse control disorder that can ultimately result in negative social and psychological concerns. Hence, it stands to reason that, the proliferation or widespread adoption or utilisation of m-learning is potentially a social problem worth considering in the near and long-term. Given this scenario, future analysts, designers and educational policymakers must take into account the social challenges the use of mobile technologies in learning will present to the wider society.

4.3 Economic challenges

The economic challenges for m-learning are centred on the costs of phones, wireless internet, or infrastructural set up required to host, support and maintenance. Furthermore, this spans the human and material resources need to design, develop and implement m-learning course contents and materials. According to Al-Barhamtoshy and Himdi [54], the availability and accessibility of cheap mobile devices and reliable internet

is an economic challenge for the adoption and implementation of m-learning. Furthermore, convenient and timely access to wireless internet at home can be a challenge for m-learning [54]. Similarly, Yusuf and Al-Banawi [58] noted that access to the cheap, fast, and reliable internet in homes is an important factor for the realisation of m-learning. The study further demonstrated that access restrictions and regulated usage through IT-imposed regulations is a potential barrier to the use of m-learning by students [58]. Based on this, the cost of smartphones, access tools, and internet infrastructure can significantly influence the development, design and development of m-learning. To address this challenge, future analysts, designers and educational policymakers need to increase investments in education through scholarships, grants, or subsidies for m-learning. Lastly, programmes and strategies such as free hotspots, unrestricted and timely access to materials that support m-learning need to be established and supported. This view is corroborated by Nassuora [59], whose study suggested that the management of universities and colleges consider augmenting budget for m-learning. In addition, factors and variables that encourage the introduction, adoption, and effective operation of m-learning should be considered when determining future investments in education.

4.4 Security challenges

The security challenges that impede m-learning are mainly due to concerns about privacy, hacking, snooping or restrictions by organisations and governments around the globe. Given the importance of safe, secure, and unhindered access to

the concept, the challenges posed by breach of security can be a limiting factor for the adoption and implementation of m-learning. To address this challenge, Al-Barhamtoshy and Himdi [54] developed a secure m-system based on web service implementation conveyed through XML layer to mobile clients. The system comprised numerous constituents that permit only mobile clients to create content, knowledge base access, communicate and interact within the m-server. Furthermore, the system was incorporated with associated tools that not only control other computing systems but also applications for the cloud to safeguard mobile m-learning users [54]. Similarly, Razek and Bardesi [60] developed a robust m-learning framework that flexibly integrates various personalised learning techniques called the adaptive mobile learning system (AMLS). This was also considered as a talented development in the area of m-learning due to its capacity to support personalised delivery of educational course materials and learning resources. In additionally, the AMLS enhances the techniques, styles, and assigned interactions according to e-profile analyses of students which typically involves questionnaires or algorithms for machine learning [60].



5. Conclusions

The paper presented a comprehensive overview of the prospects and challenges of mobile learning otherwise termed m-learning. Firstly, the various definitions of the concept of m-learning were presented along with the characteristic features and developments in m-learning over the years. Next, the benefits of m-learning and barriers hindering its adoption and implementation were identified, and examined in detail. The analyses of the numerous definitions of m-learning demonstrate that there is a lack of consensus on a universally accepted definition of the concept. As a result, the various definitions, theories, and ideas of m-learning are limited to the technologies and hardware with emphasis on learners' experiences with mobile devices. Therefore, m-learning remains a concept in its early stages of development particularly within the context of the scope of e-learning and higher education.

In addition, the analyses of features and developments revealed that m-learning has evolved in three stages based on device developments, external classroom learning and focus on learner's mobility. Studies in the literature suggest that these developments were catalysed by rapid advances in mobile technologies and the availability of low-cost mobile devices. As a result, the developments have resulted in several benefits. The findings further revealed that the benefits of m-learning include cost and time savings, infrastructural access and data management, enhanced collaboration and cooperation. Others include the promotion of social inclusion, personalised learning, informal learning and the elimination of learning restrictions.



However, drawbacks and challenges exist in the realisation of m-learning. The study observed that the challenges currently encountered in m-learning could be broadly categorised in technological, social, economic and security challenges. In conclusion, the paper highlighted the significant potential of m-learning in the education of future generations of learners. However, the outlined challenges, limitations, and reservations need to be addressed to ensure the successful adoption and implementation of the concept.



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