

Towards the Acceptance of Functional Requirements in M-Learning Application for KSA University Students

Alaa Badwelan

Information & Communication Technology School,
Griffith University, Brisbane, Australia

Adel A. Bahaddad

Faculty of Computing and IT
King Abdulaziz University Jeddah,
Kingdom of Saudi Arabia

Abstract

M-learning is one of the most important modern learning environments in developed countries, especially in the context of the COVID-19 pandemic. According to the Ministry of Education policies in Saudi Arabia, gender segregation in education reflects the country's religious values, which are a part of the national policy. Thus, it will help many in the target audience to accept online learning more easily in Saudi society. The literature review indicates the importance to use the UTAUT conceptual framework to study the level of acceptance through adding a new construct to the model which is Mobile Application Quality. The study focuses on the end user's requirements to use M-learning applications. It is conducted with a qualitative method to find out the students' and companies' opinions who working in the M-learning field to determine the requirements for the development of M-learning applications that are compatible with the aspirations of conservative societies.

Keywords:

M-learning, Mobile Learning, UTAUT, KSA, MOE, Application Quality, Qualitative study

1. Introduction

M-learning represents a new style of terminology, especially in the second half of the current decade. It is used in various ways relating to modern teaching techniques and in meeting the changing needs of educational institutions and communities after the spread of the Corona pandemic. It considerably reflects the increasing role of smart device use and significant play in the educational process throughout daily life. This change represents a defining trend in modern education, as the Internet in particular has extended education beyond the physical confines of schools or other educational institutions, providing many opportunities for technical and educational experiences outside the classroom. Many researchers and authors have defined M-learning from different aspects. Most of them believe that M-learning includes four fundamental aspects: mobility, wireless connectivity, ability to share knowledge

resources, and providing communication channels between parties in the educational process (Al-Fahad, 2009; Jaradat, 2014; Behera, 2013). These pillars represent the main factors in any definition of mobile learning through smart devices. From previous pillars, the definition of M-learning extends to include M-learning materials using a range of media, such as text, images, animation, videos, and audio. The term is also applied to the development, distribution, and promotion of E-learning resources, which now extends to networks and cloud storage technologies as well as smartphones and PDAs (Kukulska-Hulme & Traxler, 2005). These innovations have contributed significantly to the development of E-learning and its acceptance by educational institutions at all levels (Clark & Mayer, 2011). Furthermore, the devices that can be included in the M-learning environment are smart devices, tablets, and laptops. Thus, M-learning can be summarized to provide learning opportunities through mobile devices by using learning applications compatible with smart device OSs. In this sense, M-learning is an experience that encompasses a variety of learning factors to include participation, simulation, and practice within an Individual online learning context in time and space to facilitate mobile learning (Melhuish & Falloon, 2010).

2. Literature review

Many studies have examined acceptance models and how these models determine the target audience requirements and can be used to increase level of acceptance in the E-learning and M-learning fields. The main models that have been applied in E-learning and M-learning are the Technology Acceptance Model (TAM), the E-learning Acceptance Model (ELAM), and the UTAUT model, which consider user and behaviour attention.

2.1. Technology Acceptance Model (TAM)

The TAM is an extension of the Theory of Reasoned Action (TRA). The TAM includes two main factors that determine the extent to which a new technology is considered acceptable. These are the perceived ease of use (PEOU) and the perceived usefulness (PU) (Davis et al., 1989). In brief, intention is influenced by attitude, and this impacts the behaviour of actual system usage (Davis et al., 1989).

According to Abu-Al-Aish and Love (2013), the TAM addresses some impact of external variables, such as the design characteristics of the systems, training, and perceived self-efficacy with the learning system and internal beliefs (Abu-Al-Aish & Love, 2013). Furthermore, Seliaman and others (2012) investigated the influence of using smart devices for student learning at universities and academic institutions. Other main constructs not mentioned above that influence M-learning acceptance are perceived innovativeness, perceived ICT anxiety, and external cultural factors. The main finding in the Seliaman study is the relationship between the practical requirements that influence the student's M-learning use such as how to share knowledge, what appropriate online resources can be used by university students, the steps that help students work through online course materials, and the requirements that help the student interact when working in online group assignments rather than individual or physical assignments (Seliaman et al., 2012). Furthermore, Alharbi and Drew (2014) indicated some different external variables when they applied the TAM with LMS in terms of PEOU, PU, and attitude towards usage. The external variables identified were the lack of LMS availability, the extent of prior experience, and job relevance. These factors present a significant impact on online learning in Saudi universities and are applicable to measuring behavioural intention to use the LMS. Also, they found that this model was actually usable in predicting and/or explaining the acceptance of M-learning by students in higher education institutions. With regard to specific constructs, Park et al. (2012) discovered that the attitude towards (AT) was the most important in explaining the causal process within the model. The second and third most important constructs were the MR and SM (Park et al., 2012).

In Iran, Mohammadi (2015) conducted a study to identify the factors influencing M-learning adoption. The main influential constructs on users' intentions and satisfaction were quality features, PEO, and PU. Also, the study indicated that intention and user satisfaction have positive relationships with actual use in E-learning. System quality and information quality were found to have a positive impact on E-learning usage (Mohammadi, 2015).

These studies are examples of why it is important to study systems quality and information quality and their influence on accepting M-learning applications, which has implications for user intention and satisfaction. Therefore, studying the quality of M-learning application needs to focus on particular and specific segments of society to determine the quality factors that affect intention to use and user satisfaction in dealing with M-learning application systems (e.g., Dhaheri & Ezziane, 2015; Mohammadi, 2015; Nassuora, 2012; Sarrab et al., 2014; Sarrab et al., 2013). Similarly, Alfarani indicated two factors that influence M-learning acceptance: resistance to change and perceived social culture, which were found to have a significant relationship with intention to use M-learning and actual current use (Alfarani, 2015). One side of M-learning requirements related to students is described in a study by Sarrab and others (2014), including learning knowledge, student perception, mobile knowledge, and the students' suggestions, which will be helpful to increase student acceptance of M-learning application use (Sarrab et al., 2014).

The TAM was created to explain the acceptance of technology within organizations for making work more efficient, more effective, and more satisfying for the user/worker. Additionally, it was used to explain the level of various technologies' and information systems' acceptance. In the present study, the TAM cannot be applied because it focuses on the acceptance of M-learning to measure behavioural intention to use rather than on the practical requirements that help increase M-learning applications' level of acceptance. In addition, M-learning is not done for pleasure or entertainment, but for gaining knowledge, just like traditional face-to-face learning. Having noted that, however, it is also important to add that even in the process of learning, there is a need for the information systems or technologies involved to be entertaining rather than boring. This could bring the aspect of learning for pleasure to the fore; this might mean that an alternative model to the TAM could be required to explain the uptake of information systems or technologies designed for learning for pleasure.

2.2. Unified Theory of Acceptance and Use of Technology (UTAUT)

Studies of M-learning's acceptance have formed part of the growing use of technology acceptance frameworks in researching new developments in E-learning and in M-learning in particular. Among the most widely used models for studying determinants of technology acceptance are the UTAUT frameworks developed by Venkatesh et al. (2003). The eight technology acceptance models on which the UTAUT is based are Social Cognitive Theory (SCT), the Model of PC Utilization (MPCU), the Combined TAM and TPB, the Theory of

Planned Behaviour (TPB), the Motivation Model (MM), the Theory of Reasoned Action (TRA), the Innovation Diffusion Theory (IDT), and the TAM (Venkatesh et al., 2003). Therefore, the UTAUT explains the intentions of users to use a given information system as well as the usage behaviour subsequently demonstrated (Venkatesh & Zhang, 2010). Furthermore, the UTAUT combines four main components and four related moderators that mediate the impact of these determinants on user motivation and intention to use a given technology. According to Venkatesh et al. (2003), the components are performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) (see Figure 1).

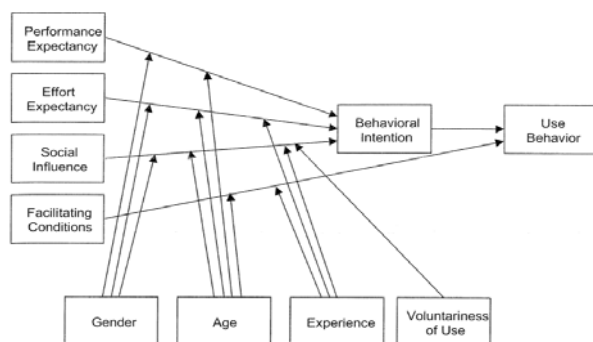


Figure 1: An Illustration of the Unified Theory of Acceptance and Use of Technology Source: (Venkatesh et al., 2003)

A review of the literature has demonstrated the trend in the M-learning field toward adapting the UTAUT model to account for the technological, psychological, and social peculiarities of mobile learning. Recognizing the strengths of the UTAUT framework, scholars of M-learning nevertheless believe that the framework can benefit from the inclusion of mobile-specific parameters. In his study of M-learning acceptance, Liu (2010) attempted to extend the UTAUT framework. In particular, the model he developed included such factors as self-efficacy, attainment value, perceived enjoyment, and self-management of learning (Liu et al., 2010). In contrast, Ju and others (2007) utilized the concepts of PU and PEOU derived from the TAM. In particular, they demonstrated that high perceived self-efficacy in M-learning positively affects PEOU, which in turn positively influences the PU of the M-learning technology (Ju et al., 2007).

Furthermore, the ELAM presents more details about the relationship between the TAM and UTAUT. The model was improved by Umrani-Khan and Iyer (2009) in India to measure the actual usage and behavioural intention to use the technology. Their study indicated that some constructs in the UTAUT model need additional elements and variables to test the model's validity,

especially when dealing with specific electronic systems such as M-learning, the focus of the current research. In the meantime, a limited number of studies on ELAM have discussed the factors affecting the acceptance of E-learning and M-learning by the target segment. Selim (2006) used the ELAM to carry out an investigation of the relationships among the various factors that influence students' acceptance of E-learning. The study was conducted at the United Arab Emirates University, and the sample included 538 student participants. The main success factors were identified to be information technology infrastructure, instructor characteristics, and support (Selim, 2006). Even though the study was conducted in the early stages of online learning in Gulf countries, it included some important questions that were beneficial for designing M-learning applications due to the convergence between E-learning and M-learning. Some examples of these questions are "How reliable are campus library online services?", "What is the state of E-learning initiative support?", and "What is the computer labs' technical support like?"

Abu-Al-Aish and Love (2013) also used UTAUT as a starting point from which to investigate the factors influencing M-learning acceptance among students. In particular, their study extended the UTAUT to include such variables as quality of service, personal innovativeness, and the social influence of lecturers, which replaced the "facilitating conditions" factor of the initial UTAUT framework. To test the impact of these variables as well as performance expectancy, effort expectancy, and influence of lecturers, Abu-Al-Aish and Love (2013) conducted a survey of 174 participants from Brunei University. They excluded the age and gender moderators of the UTAUT framework, as the majority of the sample selected was made up of males of roughly the same age. The study revealed that all factors and moderators have a significant impact on M-learning acceptance among Brunei University students. Effort expectancy was found to be the strongest predictor of students' intention to use M-learning (Abu-Al-Aish & Love, 2013). However, the authors acknowledged that the validity of these findings was limited in several respects. The limitations are the non-inclusion of actual M-learning usage in the research process and the potential bias of the sampling method (non-inclusion of female and elderly participants) (Abu-Al-Aish & Love, 2013).

Besides this, Sarrab and others (2013) indicated relevant expectations and requirements that should be included in M-learning systems. These systems have to be analysed to determine the practical M-learning application requirements contained in the system network architecture and M-service centre such as M-learning services storage (Sarrab et al., 2013).

A number of studies have addressed the factors that influence students' acceptance of M-learning and have

explored UTAUT as central in designing a successful M-learning system. These factors must be more fully investigated if we are to overcome all the challenges and difficulties of M-learning acceptance. Taken together, the above studies constitute a valuable contribution to our understanding of M-learning acceptance among students. In particular, the synthesis of the TAM and UTAUT model (or their extended use with M-learning specific parameters) seems to be the most promising methodological trend in the field. However, attention must be directed to the proper operationalization of such variables as perceived playfulness, attainment value, and other variables that suffer from numerous psychological connotations.

3. Theoretical Framework

3.1. M-learning Studies in Saudi Arabian Universities

Various studies have been undertaken in the fields of E-learning and M-learning in Arab societies, which indicates that Arab societies are increasingly embracing E-learning and M-learning technologies. One of these studies was conducted by Al-Adwan, Al-Adwan, and Smedley (2013), whose view was that the rapidly changing world is to be largely attributed to the increased influence that various technologies have on people's lives. These researchers, focusing on Jordan, argued that the technological changes in developing countries in general and those in the Arab world in particular indicate that these nations are finally taking the all-important steps to achieve technological growth. They are especially emphatic that increased use of technology in the education sector in Arabic countries is a likely indication that these nations have become quite innovative.

Additionally, the general context of M-learning in Saudi Arabia was addressed by Chanchary and Islam (2011), who explored the perceptions of 131 students in relation to the efficiency of mobile technology in learning, as well as the effects of teaching guidance on students' performance and their acceptance of this technology. The authors identified a number of limitations related to mobile devices (limited memory size, processing power, battery life) and factors related to M-learning in Saudi Arabia (improvement of Internet connections and coverage, mobile device usage in Saudi Arabia such as smartphones and tablets). The significant factors were confirmed by students' assessments, which stressed such limitations as the lack of visibility due to smaller screen sizes, incompatibilities of mobile OSs with M-learning applications and the limited adoption of M-learning-compatible mobile phones (Chanchary & Islam, 2011). Al-Barhamtoshy and Himdi (2013) also noted the need to take the technical limitations of M-learning into account when building such systems and/or models. In particular,

they argued that the smaller screen sizes of mobile devices require content optimization and connectivity risk prevention based on a system that updates the content of disconnected devices (Al-Barhamtoshy & Himdi, 2013). Some studies have focused on student intention to use the M-learning applications and determined the main factors raising target awareness and reuse of the M-learning systems. Al-Fahad (2009) discussed the factors that influence students' attitudes towards the usefulness of M-learning, concentrating on female students at King Saud University and finding significant factors to be immediate support, new learning opportunities anywhere and anytime, flexible methods of learning, improved communication among the students and their teachers, and getting feedback quickly. These five main benefits that improve the students' attitudes towards the usefulness of M-learning can be considered part of PE in the UTAUT model (Al-Fahad, 2009). The study is similar to that of Chanchary and Islam (2011), which sought to identify M-learning's prospects and challenges in KSA. The results showed that about 75% of university students sampled have positive attitudes towards M-learning because of its flexibility (Chanchary & Islam, 2011).

Several studies have applied the UTAUT model to the analysis of M-learning use intention among Saudi Arabian students. In particular, Nassuora (2012) indicated that M-learning is the next step in distance learning development. In a study that investigated students' acceptance of mobile learning in higher education in Saudi Arabia, he found that the level of acceptance was high and is still increasing. He surveyed 80 students from private universities to determine the relative weights of various UTAUT factors in M-learning acceptance. A significant correlation was established between the factors of the UTAUT model and M-learning acceptance. However, the validity of these findings may be limited in a number of ways. In particular, the study sample was not sufficient to satisfy generalization criteria. Additionally, another study was conducted by Al-Hujran and others (2014), which aimed to overcome the limitation of previous study by a larger sample size of 215 to measure participants' intentions concerning M-learning (Al-Hujran et al., 2014). The study indicated that the intention to use M-learning was affected by PE, EE, and SI. However, the FC had no significant relationship to intention to use.

Another study by Jaradat (2014) assessed the influence of M-learning technologies on students' performance and satisfaction at Princess Nora University in Saudi Arabia. A survey was conducted on 39 French language students, finding that the use of mobile phones in French language courses was instrumental in achieving a moderate improvement in undergraduate student performance. Specifically, versions with mobile tools were provided with material for reading, vocabulary acquisition, e-mail-based learning, instant messaging and

voice over Internet protocol (VoIP), all of which enhanced collaboration and improved the delivery of instruction (Jaradat, 2014).

Furthermore, the main limitation of a number of previous studies is the focus on the development of M-learning applications independently, without concentrating on measuring students' acceptance level. Therefore, the main question raised is whether these applications need to be studied mainly to develop and achieve the M-learning process goal, or to develop the M-learning process in the applications according to the users' perceptions and the requirements that help to increase user acceptance. The following section focuses on users' perceptions of requirements to increase the level of acceptance using M-learning applications.

3.2. The Importance of Quality Measurements in M-learning Application

Over the past three decades, researchers have sought to discover the service characteristics in electronic systems that contribute significantly to high quality. One focus of research is the Parasuraman model, which is divided into ten dimensions of service quality: tangibles, reliability, responsiveness, communication, credibility, security, competence, courtesy, understanding customer needs, and access (Parasuraman et al., 1985; Chao, 2019). Based on these, Parasuraman developed a model that compares expected quality and perceived quality (Parasuraman et al., 1985; Song, 2018). In another study, Parasuraman and others (1988) indicated that the Servqual approach represents the top five of the ten quality determinants: tangibles, reliability, responsiveness, assurance, and empathy. These five represent the global base measurement of service quality (Parasuraman et al., 1988; Aliaño et al., 2019). Accordingly, the fulfillment of customer satisfaction is a key factor for organizations and companies to consider when assessing the appropriate development of their technical services (Mushasha & Nassuora, 2012).

Therefore, E-learning and M-learning users want both technical learning tools and a variety of learning systems that help them reach their target goals. Thus, research in the learning quality field needs to be more extensive because of its importance to the development of the learning process and subsequent user satisfaction (Mushasha & Nassuora, 2012). Consequently, this study concentrates on requirements that represent great depth in the acceptance stages of learning via smart devices. Many studies have focused on the quality aspects of M-learning and have identified the significant relationship between general acceptances of electronic learning systems and the main requirements of M-learning (e.g., Acharya & Sinha, 2013; Aliaño et al., 2019; Calisir et al., 2014; Chao, 2019; Duarte Filho & Barbosa, 2013; Sarrab et al., 2015; Song,

2018; Wong, 2015). The most important aspect of quality requirements in E-learning systems and M-learning applications are those related to information quality, service quality, and system quality.

Several studies have been conducted in regard to quality requirements and issues. For instance, Acharya and Sinha (2013) argued that unless the quality of M-learning systems is considered, the benefits offered by M-learning over other forms of learning risk being eroded; there must be a check on the quality of the entire system, and this may be divided into two broad categories: learning characteristics and software systems (Acharya & Sinha, 2013). These two categories must be addressed if the M-learning process is to be successfully conducted so that the desired benefits are realized. It should also be noted that the end user could be the student who is the main stakeholder in this study, the teacher who prepares the course materials in the applications, and the mediators who provide and present the teacher materials in the mobile applications. The authors indicated several factors influencing the quality content of smart device applications, including the user's level of education, the learning curve, the age of the user, and the degree of user satisfaction (Song, 2018). For examples of these measurements, two questions could be asked: What minimum skills and appropriate age are necessary to effectively learn in digital content and M-learning applications? What are the minimum requirements to increase the end users' satisfaction for accepting and using the M-learning smart devices and applications more effectively (Wong, 2015)?

Briefly, the quality measurements have indicated the necessity of adding and modifying the elements designed by Parasuraman in 1985 to create a conceptual model of quality. Mushasha and Nassuora (2012) proposed and tested a multidimensional construct based on interface design, reliability, responsiveness, trust, and customization. The authors believed these dimensions are helpful in developing student perceptions of E-learning in a higher education environment (Mushasha & Nassuora, 2012). Thus, this research focuses on three main dimensions: the system quality, information quality, and service quality of the application. Each of these consists of several measurements that can be combined to calculate each dimension's level of importance separately. As we can see, it is important to include the quality perspective in M-learning applications to increase the level of acceptance of smart device learning applications.

3.3. Choosing an M-learning Theoretical Model for this Study

The study is conducted on the UTAUT for three reasons. Firstly, the interpretive power of the UTAUT framework reached 70%, which means that it is more

capable of dealing with electronic systems and studying the acceptance level of its target segment (Venkatesh et al., 2003). Secondly, the UTAUT model emerged in 2003 and UTAUT2 in 2012, making it more modern than the theoretical frameworks previously presented. Lastly, it combines eight different models, increasing its levels of verification, relevance, and credibility when clarifying behavioural intentions and the use of technology in various fields (e.g., Almatari et al., 2013; Williams, 2009; Abu-Al-Aish & Love, 2013; Umrani-Khan & Iyer, 2009). Almatari, Iahad, and Balaid (2013) investigated the factors that influence students' intention to use M-learning. They tested and validated a model based on the UTAUT using a sample of students from the University of Technology. Briefly, Almatari et al. (2013) sought to derive a new model to explain or conceptualize M-learning. They began by arguing that M-learning has the potential to enrich the education sector significantly by putting educational content in the hands of all students in any location (Almatari et al., 2013). Furthermore, Nikolopoulou and others (2020) carried out an assessment of M-learning's effectiveness compared to face-to-face learning. This investigation was undertaken to determine the specific extent to which students actually accept M-learning in general and the various methods used in M-learning in particular. Nikolopoulou and others (2020) used two main research models: the Unified Theory of Acceptance of Use and the Performance Model, which were used to determine the factors that affect the acceptance and subsequent use of M-learning (Nikolopoulou et al., 2020).

There are some measurements used in some previous studies that will be helpful to test in this study: self-management of learning, perceived usefulness, voluntariness of use, system accessibility, relevance for students' major, and self-efficacy. Furthermore, Abu-Al-Aish and Love (2013) studied students' past experience with mobile devices and its influence in acceptance of M-learning. The results indicated that prior experience has an effect on the M-learning process and other factors. Therefore, they recommend the extension of UTAUT by adding quality of service and personal innovativeness (Abu-Al-Aish & Love, 2013).

This study emphasises quality measurement requirements in M-learning based on previous studies and models in order to take advantage of these determinants in identifying the requirements for M-learning applications geared towards university students. Many previous studies indicated that it is necessary to add or modify elements from the Parasuraman scale to create a unique and comprehensive conceptual model of service and information and systems quality, depending on the appropriate nature of the learning sector (Badwelan & Bahaddad, 2021). Based on this, this researcher proposes testing a UTAUT multidimensional model with an added

quality construct for M-learning through smart devices, focusing on the influence of application qualities of other UTAUT constructs and student intention to use M-learning applications in smart devices.

3.4. Modified UTAUT for M-learning Application Requirements

There are four main constructs in UTAUT that influence smart device M-learning user acceptance. Our study will retain some of the PE & EE constructs, but will add three additional constructs to focus on the factors that may influence a university student's acceptance of M-learning applications in smart devices. Additionally, the lecturers' influence represents the characteristics similar to social influence, the main construct in the original UTAUT. Therefore, in this study the lecturers' influence is replaced by the social influence construct (Abu-Al-Aish & Love, 2013; Wang et al., 2009). Moreover, the facilitating conditions construct has been replaced by the construct of personal innovativeness because mobile technologies and smart devices are attractive to young people who want to experiment with new technologies; also, they engage individuals' motivation and desire to experiment with new technology (Padilla-Meléndez et al., 2013; Cheung et al., 2015). Additionally, this study focuses on identifying the technical and regulatory requirements that help increase the acceptance of M-learning applications, so it has added Mobile Application Quality as a new construct (Calisir et al., 2014; Sarraf et al., 2015; Wong, 2015) (see the theoretical framework in Figure 1). The main constructs are given as follows:

2.3. **Performance Expectancy (PE)** is a main construct in the UTAUT model. PE focuses on the degree to which the student believes that using the M-learning application via smart devices is useful and helps achieve the main learning objectives quickly (Venkatesh et al., 2003). Some studies noted that PE in UTAUT is the strongest indicator of behavioural intention to use information technology, concluding that perceived usefulness is the most common factor in determining the rate of dependence on technology. Therefore, this study suggested that students would find M-learning useful because it helps students learn more quickly than learning through traditional means (Padilla-Meléndez et al., 2013; Cheung et al., 2015).

2.4. **Effort Expectancy (EE)** includes flexibility of interactions between mobile learning systems. EE can also have a direct impact on behavioural intention (Abu-Al-Aish & Love, 2013). For this reason, Venkatesh and others (2003) indicated that concepts related to EE are stronger determinants of the

intentions for individual users (Vankatesh et al., 2003).

2.5. **Lecturer influence (LI)** is a suggested construct in the UTAUT model instead of social influence. Wang and others (2009) noted that the context in M-learning is not necessarily similar to that in other systems, so the original UTAUT model constructs may be insufficient when determining users' behavioural intent. Therefore, they suggested modifying existing models for M-learning applications in smart devices and consequently established lecturers' influence as a new construct (Abu-Al-Aish & Love, 2013; Badwelan et al., 2016; Wang et al., 2009). The LI is defined as the level of influence that would help academic trainers convince students to use M-learning services through using smart devices (Abu-Al-Aish & Love, 2013; Badwelan et al., 2016).

2.6. **Personal Innovativeness (PInn)** is willingness to experiment with new technology, as well as a student's level of innovation, openness to new ideas, and understanding of changes in new information technology (Agarwal & Prasad, 1998). Also, a number of studies have indicated the impact of personal innovation on user behavioural intention (e.g., Liu et al., 2010; Cheung et al., 2015; Jansen et al., 2012). The researchers also found that personal innovation indicators help measure the level of perceived usefulness and ease of use through UTAUT (Liu et al., 2010). Abu-Al-Aish and Love similarly concluded that most students do not have enough experience or knowledge with M-learning applications to help them formulate a clear opinion on the matter (Abu-Al-Aish & Love, 2013). Therefore, it is expected that students who have a high motivation to face risk have more intention to use M-learning in their studies because mobile technologies and smart devices are attractive to young people who want to experiment with new technologies (Abu-Al-Aish & Love, 2013).

2.7. **Application Quality (AQ)** is the defined quality in system as the characteristics needed by users to increase the level of trust and deal with websites effectively; thus, three basic quality dimensions are identified as technical adequacy, website content, and website appearance (Aladwani & Palvia, 2002). Gable and others (2008) indicated the importance of quality in applications as one of the overall criteria for evaluating information systems from two different aspects: the impact of information systems (IS) in the past and the expected impact of quality in the future development of information systems (Gable et al., 2008). Another definition of quality impact offered by DeLone and McLean is the value that promotes satisfaction, appropriate use, and positive impacts on

an individual or organization (DeLone & McLean, 1992). Thus, quality in IS affects the capabilities and IT practices such as user satisfaction. Additionally, the quality of M-learning applications in smart devices represents a new construct that should be used to measure the acceptance level of M-learning applications. Therefore, it is important that quality measurement aspects relate to the appropriate context of measurement (Stockdale & Borovicka, 2006). A number of researchers have used the term "service quality" in M-learning to connote providing high-quality service to clients that helps to gain user trust and gives fast and reliable service (Al-Mushasha & Farouq, 2008). Depending on the previous definition, the service quality includes information availability, usability, privacy, graphic style, fulfilment, accessibility, responsiveness, and personalization (Al-Mushasha & Farouq, 2008; Mushasha & Nassuora, 2012).

2.8. **Behavioural Intention (BI)** towards the use of an information technology as affected by the above factors.

3.5. Selection and Justification of the Research Model

The research gap identified in this literature review was the shortage of studies that focused on determining the students' successful learning requirements in M-learning applications for smart devices in the KSA. Traditional influences have a dramatic effect on electronic systems in general and in Saudi society in particular.

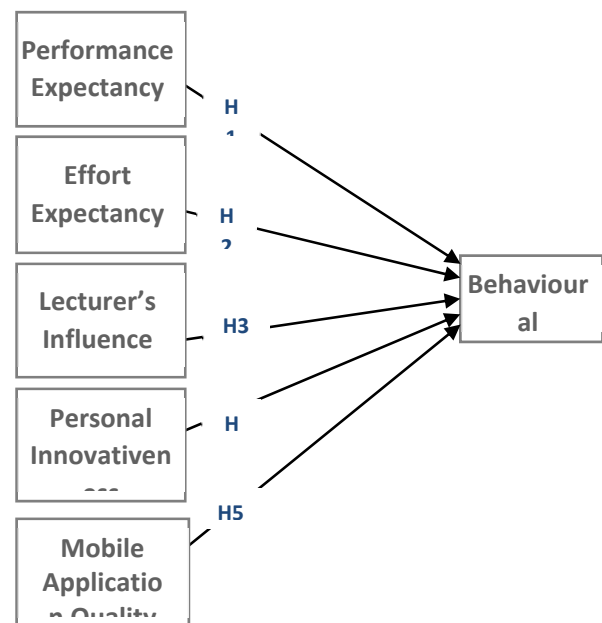


Figure 1: The UTAUT (Modified) Model for Successful

These influences significantly affect educational policies according to Islamic ideals, which focus on gender segregation at all stages of education. Therefore, the gap is addressed using three basic perspectives: determine the electronic systems requirements, identify the requirements of learning applications for smart devices, and determine the requirements of the study areas principally affected by traditional education requirements in Saudi Arabia. The significance of this study was to determine the requirements that are needed to increase the level of success for higher education students in universities and academic institutes, which can be used to analyse and design particular functions for successful platforms for Arabic societies in general and Saudi Arabian communities in particular.

Moreover, it is important to clarify the difference between learning and educating approaches in this research. Learning processes are carried out by the students only as they study the learning material designed by other educational stakeholders, which are the universities and higher educational institutions as well as the teacher, who builds the learning material in accordance with the vision and objectives of the course. Education processes take place through collaboration among the students, the teacher, and the learning material together in a shared learning environment such as a virtual classroom.

It is not required that the teachers participate in both the design of the educational materials and the related technical means that make them function on a mobile device; at the same time, the students should be able to accept learning using these new methods and means instead of more traditional environments. It might also be helpful to identify the learning requirements according to students' view of learning through M-learning applications, and then use their opinions to increase the level of acceptance of smart device use in online learning.

3.6. Study Framework and Methodology

Following the examples provided in the reviewed studies, the current research uses the UTAUT framework as a starting point for M-learning acceptance analysis. This framework has been positively assessed by various researchers and determined to provide an integrated vision of technology acceptance by exploiting the cumulative insights of other widely used frameworks (Abu-Al-Aish & Love, 2013; Chanchary & Islam, 2011). In addition, the UTAUT framework includes various moderating variables such as age and gender that are central to understanding how various technology acceptance factors may translate into the intention to use a given technology. Notwithstanding its benefits, however, the UTAUT framework would also benefit from being adjusted to the specific context of M-learning technologies. Various studies discussed in the literature review have used

adaptations of the UTAUT model that include additional factors such as perceived playfulness, personal innovativeness, attainment value, quality of service, and self-management of learning and self-efficacy, among others (Abu-Al-Aish & Love, 2013; Almatari et al., 2013; Iqbal & Qureshi, 2012; Selim, 2006; Umrani-Khan & Iyer, 2009; Wang et al., 2009). Proceeding from the critical analysis of the contributions offered in Chapter 2, the present study next advances an extended UTAUT framework that includes the following parameters. Each parameter is defined according to the objectives of this study.

4. Methodology

Creswell indicated that the theoretical framework consists of several fundamental variables, which are dependent on three fundamental principles. These principles are beliefs about the nature of knowledge, the appropriate methods for gathering data to answer the research questions, and the criteria used to measure knowledge and answer research questions (Creswell & Creswell, 2017). This study focuses primarily on determining the technical, organizational, and informational requirements of M-learning applications and on the audience's views that can provide an appropriate interpretation of the requirements of M-learning application systems. Therefore, the positivist approach helps to provide explanatory and illustrative aspects of the requirements of M-learning applications.

Qualitative methods were used. Data was collected from the targeted population of higher education students in Saudi Arabia to answer the research questions and identify the requirements they found useful to design an appropriate M-learning model. Two focus groups were interviewed. The characteristics and nature of the focus group questions were determined based on one of our previous studies that used quantitative methods in the analysis results. The qualitative aspect of this study helped to uncover the details of phenomena that affect M-learning's acceptance by the target audience.

4.1. The Research Paradigm Characteristics (Positivist Paradigm)

According to the objectives of this research and based on the hypotheses presented in the third chapter, it is important to ensure that the identified requirements lead to the success of M-learning applications in the target population. The positivist approach helps us study causal relationships, allowing for more comprehensive experimental studies. For example, the UTAUT model does not include the quality construct in M-learning applications, which can be divided into system quality, information quality, and service quality (Venkatesh et al.,

2003). Therefore, studying the causal relationship between the application’s quality and behavioural intention constructs is one of the fundamental aspects of this research. Furthermore, demographics constitute one of the main social characteristics that impact the acceptance of M-learning applications in Saudi Arabia. Taking into account the views of the Saudi community might help to build an appropriate model to improve the acceptance of M-learning applications in Saudi Arabia, so the positivist paradigm is particularly appropriate for our purposes.

4.2. Research Hypotheses

As already indicated, some of the hypotheses informing this study were related to previous studies of M-learning and E-learning, as well as to the UTAUT model. The literature review has also confirmed the importance of previous experience in the adoption of technology-based teaching and learning; the increasing exposure of decision-makers and the target audience to digital media also offers a great opportunity to maximise the acceptance of M-learning in higher education institutions (Abu-Al-Aish & Love, 2013). Accordingly, the study’s hypotheses can be split into main constructs associated with general study of the target segment (Hypotheses H1–H5).

4.3. Focus Group Design and Selection of the Target Population

The design was based on a number of criteria collated from the literature review. To elaborate on and answer the research question, the UTAUT framework was applied to

determine the acceptance requirements of M-learning in higher education institutions in Saudi Arabia using smartphone devices. The focus group had many open-ended questions for participants to provide their opinions of the requirements highlighted in previous studies. In the meantime, the focus group was run to investigate the expectations of participants who had previous experience in dealing with M-learning applications and to determine how these applications would attract students to learn through M-learning applications. Therefore, the sample of participants for the focus group was of students with previous knowledge of M-learning as they are at distance-learning colleges in universities that have a fundamental online learning infrastructure. The focus group concentrated on obstacles to overcome in learning applications and how these can be modified to activate or enhance M-learning applications through smart devices. The following conditional questions were used to filter participants who qualified as the main targets of this study:

- 2.9. Have you ever used E-learning systems before?
- 2.10. Do you use smartphone devices?
- 2.11. Are you a resident of Saudi Arabia?
- 2.12. Are you a higher education student? If yes, please enter your age (.....) and your degree program (Diploma/Bachelor/Master/PhD).
- 2.13. Thus, positive answers to all of these questions qualified the participant to participate in the survey.

The duration for conducting the study was three months for the focus group stage from April 2020 until the end of June 2020.

Table 1: Demographic Information on Focus Groups A and B

Group A (Expert Group)				
Participant	Age	Educational Level	Position	Internet Experience
A1	42	MBA	General Manager	13 years
A2	35	MBA	Senior Manager	11 years
A3	34	BSc	General Manager	12 years
A4	31	BSc	Manager Developer	8 years
A5	37	BSc	Senior Systems Analyst	9 years
Group B (Student Group)				
B1	20	IT – Year 4	Student at KAU	4 years
B2	21	IS – Year 3	Student at KAU	3 years
B3	23	ENG – Year 4	Student at UAU	5 years
B4	19	CS – Year 2	Student at KAU	4 years
B5	20	IT – Year 2	Student at KAU	3 years

CS: Computer Science, IT: Information Technology, IS: Information System, ENG: Computer Engineering, KAU: King Abdul Aziz University

The first group of participants consisted of five professionals who work for IT and development companies that specialise in educational application design. The second group comprised five E-learning students who are well versed in online learning. Table 1 displays the demographic information on these groups and the codes assigned to each participant (A1, A2... B1, B2, etc.).

4.4. Main Finding

The qualitative analysis was intended to determine whether there were any requirements that were crucial in enhancing the acceptance of M-learning applications, which had not been revealed in previous UTAUT studies or any other research on acceptance models for electronic systems. The qualitative data in this study was collected chiefly through the open-ended questions featured in the two focus group discussions, which were carried out to clarify the participants' views and suggestions regarding core requirements for increasing the acceptance and adoption of M-learning through smart devices (Creswell, 2017). These discussions paved the way to identifying the obstacles and challenges that confront technological acceptance among university students in Saudi Arabia.

5. Analysis & Discussion

5.1. Main Requirements for the Acceptance of M-Learning Applications

The main section of sample questions consisted of five open-ended questions that aimed to identify the main

requirements to increasing acceptance of M-learning applications. These requirements increase the chances for reuse of these applications and determine the user's desire to activate e-services, thereby driving acceptance by a target segment. The five questions and the percentages of responses to them are displayed in Table 2.

Many requirements that were mentioned by participants related to organisational, social, or financial aspects, and they exerted effects on the acceptance of M-learning applications. As argued by Algarni (2014), technological separation in societies must have minimal difficulties or challenges and must accord with the vision and supplementary requirements of communities (Algarni, 2014). The educational sector, however, encounters numerous difficulties arising from high expectations of the target beneficiaries of modern innovations; these expectations are inspired by the shift to learning technologies developed in other countries or in other languages (Algarni, 2014, Barrette, 2015). In the Saudi context, the requirements for technological acceptance are designed and established in accordance with the educational curricula in certain other countries rather than the Saudi curriculum. Consequently, the requirements developed are incompatible with the needs of Saudi society (Almatari et al., 2013; Al-Mushasha & Nassuora, 2012).

Table 2: Summary of Open-Ended Questions in Focus Group

No.	Question	Yes (%)	No (%)
1.	Have you ever heard about M-learning apps or have you used them before?	54.4	45.6
2.	Do you prefer learning through online learning channels?	70.1	29.9
3.	Do you think that M-learning apps can increase the quality of online learning?	63.5	36.5
4.	What other services do you think should be available online, or are there any suggestions that you would like to add in relation to this?		
5.	Are there any other suggestions that you would like to add?		

5.1.1. Responses to Question 1

The first question focused on the awareness of and previous experience with M-learning. The proportion of respondents with no previous usage of learning applications was high. Some of these participants attributed their lack of engagement to the weakness of learning applications from relevant government agencies and private sector companies that provide learning software support. One of the most appropriate and successful strategies for supporting the learning applications industry is to create innovations that develop the educational abilities and skills of a target population and raise their awareness of the advantages of learning

applications (Almatari et al., 2013; Jansen et al., 2012). Alshehri (2012) suggested that media channels are suitable avenues for raising the awareness and acceptance of M-learning applications; such avenues include web or social media advertising, TV advertising, channels that broadcast or publish banners and public seminars (Alshehri, 2012).

5.1.2. Responses to Question 2

The second question enquired into whether students prefer learning through online environments. Among the respondents, 70.1% favoured online learning, whereas 29.9% preferred learning in a physical classroom. A high

preference for online learning indicates a strong readiness of a large segment of society to accept online learning applications as a replacement for traditional education methods. The factors that drive this preference are the desire to save time and money, the increase in benefits obtained from electronic educational products, the improvement in the quality of these products, the provision of comprehensive support, and the provision of fast service (Balaji et al., 2016; Jansen et al., Al Gamdi & Samarji, 2016). Arkorful and Abaidoo (2015) discussed the tremendous advantages that a user derives while sitting at home and learning through online platforms; in traditional education, attending class involves a waste of time searching for the right option and travelling to the chosen location.

5.1.3. Responses to Question 3

The third question focuses on whether M-learning applications contribute to the quality of E-learning methods. The results indicated that 63.5% of the respondents believed such innovations to be contributory to quality, whereas 36.5% did not. The former also stated that M-learning applications are critical to increasing the quality of the E-learning process, as these technologies foster an interactive environment that advances interaction between learners and the online learning tools available through an application, an opinion supported by other researchers (Acharya & Sinha, 2013; Almaiah et al., 2016). These applications also afford learners an opportunity to develop sufficient knowledge on specific topics. M-learning applications can be configured to focus on specific learning topics and thus enable more intense concentration on the quality of presentation than on quantity of knowledge covered by a single application (Almaiah et al., 2016).

5.1.4. Responses to Question 4

The fourth question aimed to identify new services that can increase the use of learning applications. The participants were allowed to access these services when available. The recommendations of the participants are as follows, and the number beside each point represents the participants who have written this recommendation:

1. Provide an online training service that ends with employment (training and employment) - (5 responses).
2. Provide electronic courses with international certification - (10 responses).
3. Provide comprehensive classifications of training courses - (3 responses).
4. Translate learning materials into the official language of Saudi Arabia - (7 responses).

5.1.5. Responses to Question 5

A number of the participants proposed strategies for developing and improving learning applications. Some of these involved the development of communication among users and company efforts to design a learning process for these applications. The recommendations are summarised below:

- Provide a strong and modern infrastructure with high levels of security for government-sponsored learning platforms to ensure quality in the educational services provided to the public - (8 responses).
- Link learning resources in educational sectors using high-quality, secure connectivity to help target audiences access relevant information anywhere, anytime across Saudi Arabia - (9 responses).
- Provide an awareness campaign to augment knowledge of the advantages and features of online learning - (6 responses).
- Develop information technology capabilities of university students by providing developmental programs to increase knowledge and skills for using educational applications - (10 responses).
- Build M-learning applications on the basis of excellent quality standards and performance - (5 responses).
- Provide safety and privacy features for learning applications and data, and adequately optimise these features for users to access appropriate learning materials easily - (10 responses).
- Provide Internet services as basic learning resources for all customers at competitive prices or, if possible, at no charge - (9 responses).
- Implement sufficient advertising for online learning applications that provide appropriate and beneficial materials for target audiences. These initiatives can be carried out during numerous events held by government-administered educational organisations and offered to universities and private institutions in Saudi Arabia - (7 responses).
- Provide high-quality technical support services to all users - (3 responses).

These suggestions reflected the importance of an adequate and appropriate infrastructure for M-learning applications to satisfy the basic important requirements for widely implementing online learning applications, as recommended in previous studies (e.g., Alfarani, 2015; Iqbal & Qureshi, 2012; Khan et al., 2015). Considering these recommendations would result in developing services tailored to the requirements of Saudi stakeholders.

5.2. Additional technical requirements

Eight additional technical requirements were investigated that could be important to the current research. Some of these requirements have been mentioned

previous studies (Al Gamdi & Samarji, 2016; Arkorful & Abaidoo, 2015; Al-bakr et al., 2017; Binyamin et al., 2017). These requirements are presented in Table 1.

Correspondingly, the participants were asked to indicate the level of importance that they attach to the above-mentioned requirements using a scale of 0 to 4 (0 = unimportant, 4 = extremely important). Although all the requirements identified in many previous studies are essential and should be considered in the design of M-learning applications, the value that a user ascribes to a given requirement was underscored in the current research. This is valuable data because users are those who deal with the technological quality and applied interfaces of M-learning applications. A requirement that is assigned a level 4 importance and the manner by which interested parties address this requirement should receive more focus than a requirement that has only a level 1 importance. This information will help stakeholders identify and prioritise basic functions to increase acceptance of M-learning applications. See Table 3.

As can be seen, the provision of basic information that is needed by a user to employ M-learning applications was viewed by the respondents as the most important aspect of M-learning acceptance. This was also evident in the present study, which reflected the importance of the information required by users to run and explain the basic features of M-learning applications. As listed in the table, 51.8% of the respondents regarded R2 as important, and 33.4% considered this requirement very important. These requirements are implicitly included in the quality of an application to broaden its acceptance level. Security and privacy requirements are equally essential in the diffusion and acceptance of M-learning and other educational applications, as confirmed by researchers such as Hwang and Syamsuddin (2008). The authors reported that in many countries, low standards of security and privacy are the main reasons for the failure to handle various electronic systems (Al-Naimat, 2015; Hwang & Syamsuddin, 2008).

Table 3: Analysis of M-Learning Application Requirements from Students' Perspectives

Requirements	Important	Very Important
	%	
R1 Provide online support services for operating and activating M-learning applications through discussions with an experienced team.	34.0	59.7
R2 Provide basic information that a user needs to run an application (instructions).	51.8	33.4
R3 Provide basic information that explains the advantages and features of M-learning applications.	31.0	54.4
R4 Implement regulations and policies for education in general and M-learning in particular.	24.9	68.8
R5 Clarify rights and responsibilities, including those related to safety and privacy, in dealing with M-learning applications.	26.3	61.0
R6 Provide information and explanations that increase the acceptance of M-learning applications and confidence in using them.	37.3	55.5
R7 Provide data storage methods, whether these are in-device features or external repositories such as servers or cloud platforms.	28.4	65.3
R8 Ensure the availability and reliability of an electronic presence across different channels of communication for servicing E-learning and M-learning needs.	25.4	69.4

Another acceptance pillar is the provision of a user manual of basic features (R3), as this increases knowledge of innovations and the ability to engage with them. Among the participants, 31% deemed this requirement important, while 54.4% regarded it as very important. Acharya and Sinha (2013) contended that raising awareness of technology by providing a user guide covers the gap between a target audience's existing knowledge and ability and what they should learn in M-learning applications (Acharya & Sinha, 2013; Fernández-López et al., 2013).

Augmenting the confidence of users in the adoption of a given technology (R6) was regarded by 92.8% of the

participants as important in the diffusion of M-learning applications, and availability and reliability (R8) were deemed important in such diffusion by 94.8% of the respondents (see Table 2). The findings on R8 are consistent with those of Li (2003) and Alshehri (2012), who identified the lack of Internet access and awareness of online smartphone applications as one of the most serious obstacles to the spread of online innovations (Alshehri, 2012; Li, 2003). A high-speed Internet connection enables target beneficiaries to substantially benefit from Internet services; it positively affects handling M-learning applications and maintains the users' confidence in reliability to considerably increase the

acceptance of M-learning applications and services (Al Gamdi & Samarji, 2016). The lack of knowledge of M-learning applications can be addressed via marketing and promotions; one example is a campaign where audiences are asked to complete information on a given application in exchange for a free gift (Bahaddad et al., 2018). There are many electronic means of convincing and encouraging target audiences to accept and adopt electronic applications, including M-learning programs (Algarni, 2014; Barrette, 2015).

On the basis of online awareness and to mitigate a potential lack of appropriate knowledge about M-learning, it is important to make an inventory of the target population's main concerns with respect to M-learning applications, including the requirements identified in past studies. These main concerns are instructions, policies, rights, trust, privacy, security, support channels, storage, availability and reliability, which all play critical roles in the high and/or increased acceptance of M-learning applications (Arkorful & Abaidoo, 2015; Barrette, 2015; Chanchary & Islam, 2011; Mushasha & Nassuora, 2012). With reference to storage, the information displayed or stored in M-learning applications should be kept in a safe place to ensure confidence in the use of these innovations (Cheung et al., 2015; Fernández-López et al., 2013). This single aspect alone interfaces with rights, trust, privacy, and security.

M-learning applications are modern tools in many countries and educational institutions; similarly to other online applications, M-learning programs are adopted depending on the requirements of a target segment, regulations, and policies to protect both developers and users (Ndou, 2004). These regulations and policies must cover all application requirements such as email, e-payment, e-commerce (if applicable), or any electronic systems related to M-learning applications (Badwelan et al., 2017; Bahaddad et al., 2018). In Saudi Arabia, many regulatory authorities implement regulations and policies for e-transaction and e-training laws and policies (MOE, 2013). These rules and regulations are instrumental in activating the relationship between supporters of the educational process and students and thereby considerably advancing the development of the aforementioned process and its associated components (Badwelan et al., 2017; MOE, 2013). Providing such regulated systems associated with M-learning applications is crucial, but the process needs to be developed, activated, and updated to meet the requirements of the current era (Binyamin, 2017). In particular, the diffusion of information codifies the learning process and elevates its credibility through various electronic channels used by communities in Saudi Arabia.

5.3. Analysis of Results: Focus Group Discussions

The responses of Group A were analysed to discover the main relevant requirements that answer the research question and sub-questions according to relevant model constructs in the UTAUT framework. Therefore, focus group discussions were conducted to identify appropriate comments from two focus group teams. The focus group discussion participants covered research issues related to increasing opportunities to engage with M-learning applications and knowledge of the requirements of university students or their counterparts in various academic institutions and administrative bodies. Examining this issue was one of the main objectives of this study.

5.3.1. Responses of Group A & B

The first group of participants consisted of five professionals who work for IT and development companies that specialise in educational application design. The second group comprised five E-learning students who are well versed in online learning. Table 18 displays the demographic information on these groups and the codes assigned to each participant (A1, A2... B1, B2, etc.).

5.3.1.1. Performance Expectancy

All the participants agreed that using online learning applications enriches the learning process in educational institutions and universities more quickly and easily than a traditional learning style. A1 pointed out that online learning systems afford users ubiquitous interaction without the need to be present in a physical location. This advantage is the principal justification for the importance of online learning systems.

The participants also agreed that E-learning applications offer users a fair chance at accessing online learning, initiating self-development and easily and efficiently accomplishing coursework. A2 added that "E-learning services, which are available in online learning applications, will help all interested people who are working to develop the abilities and skills of participants in different stages of the education field or beyond." A strong consensus (90% of the respondents) was reached as to the effectiveness of learning applications in substantially facilitating the quick and easy completion of learning tasks, with such applications considerably reducing time and effort. The time saved in engaging with online applications is usually wasted travelling to and from educational institutions and finding a good parking space.

All the participants strongly agreed on the importance of developing infrastructure that significantly improves learning quality. Both developers and users were considered to benefit from increased learning

productivity through learning applications. Of the respondents to the quantitative questionnaire, 92.5% expressed the belief that learning applications enhance the productivity of students in different educational stages; increasing the skills of learners was thought to elevate their productivity markedly in different tasks. Additionally, A4 and A5 asserted that using learning applications establishes good connections between various elements of the learning process in both formal education and personal learning through short courses.

Another aspect of agreement among the participants was the importance of learning applications in improving students' educational performance. It was mentioned that electronic educational technologies, including online learning applications, provide favourable opportunities to establish learning objectives prior to the commencement of an educational stage or training course, which in turn helps educators focus on student improvement and their completion of learning tasks. A3 and A5 declared that E-learning applications facilitate the design of strategic objectives for each educational subject, and that such innovations come with online assessment tools that accurately measure a user's absorption of information—features that also advance efforts to complete learning tasks in M-learning applications.

With regard to expected performance in Group B, all participants were fully aware of the benefits of using E-learning applications in general and described diverse efforts to develop various features that increase the appeal of innovations in the information world. They criticized current applications and software programs, stating that these features had limited explanations or educational activities, which then only narrowly promoted the development of student learning in regular and formal study.

B2 and B5 expect the spread of learning applications in the region to increase the financial value that students attach to these products. As explained by A2, "I advise everyone to use all types of M-learning applications because these help them save time, effort, and money." B3 noted that the availability of learning applications contributes considerably to the improvement of mutual cooperation and increases learning opportunities for participants through the numerous channels that accompany these innovations. B4 explained further that learning applications gradually enhance students' learning performance, as they contain reliable learning resources and are based on quality standards that greatly increase user confidence in these technologies. These features enhance performance and facilitate gradual engagement with M-learning applications.

On the basis of the arguments above, the participants deemed PE as exerting a strong impact on the BI to use online applications in general and M-learning applications in particular.

5.3.1.2. Effort Expectancy

The focus group discussion revealed many important expectations of the participants. A2, A3, and A5 stated that they anticipate M-learning applications to be easy to learn and manage, adding that anyone with simple knowledge should be able to engage with these innovations, and that ease of use should be guaranteed through a user guide that details the best way of handling M-learning applications. A1 and A3 emphasised the use of multimedia methods in explaining appropriate ways to operate M-learning technologies.

All the participants agreed on the importance of a high-quality, high-performance Internet connection so that users can readily access data, information, and basic resources. Experience in dealing with the Internet likewise contributes to a user's effective interaction with online learning applications. Increased skills and acceptance in turn enable deriving useful features from online learning applications.

Also, B4 and B5 confirmed that previous experience with websites made them fully aware of how to engage with modern online applications and enabled them to understand their benefits and features easily.

B1 and B2 claimed that students with limited Internet experience evaluate themselves as having minimal ability to explore online applications easily. B2 recounted his previous experience with online learning applications in smartphones, explaining that he had been using these technologies for approximately three years and asserting that anyone can learn and use these applications, even those without prior knowledge. B2, B4 and B5 emphasised that reaching professional-level skill in dealing with electronic educational applications necessitates the development of basic knowledge of handling the Internet and electronic innovations.

They added it is important for all learning applications to be available in Arabic or the most commonly used languages (such as English) that are adopted in a number of different educational institutions in Saudi Arabia. They claimed the shift from Arabic to English would not affect engagement with M-learning applications. B1, who has an IT background, indicated that his current moderate level of experience helps him operate electronic applications, but he also mentioned that learning applications should be very easy to use.

Finally, all participants expressed the belief that users are interested in using mobile websites or electronic applications. Companies should thus provide electronic services that are easily operable and that incorporate multimedia into their designs to facilitate the handling of learning applications. This will also offer diverse options to different educational sectors for the large-scale diffusion of technological knowledge.

As shown in the discussion above, the participants' opinions confirmed that EE strongly and directly affects the BI to use M-learning applications.

5.3.1.3. Lecturer's Influence

The participants shared views on what services should be provided in M-learning applications for the training of providers or course instructors. All the focus group participants agreed that the use of M-learning applications is affected by an academic's recommendation or extensive training and development experience. As explained by A1, "individual decision-making by M-learning application users should be followed by advice from experienced practitioners, because this helps increase the breadth of learning from reliable sources." Experienced advice enables users to shorten the time and effort to find out the best practice use of such applications. Agreement was also reached with regard to the use of M-learning applications for the purpose of expressing personal opinions, beliefs, and experiences with respect to the importance of LI. Regarding the lecturer's advice on using particular learning smartphone applications, A3 referred to the importance of personal conviction, knowledge, and scientific sources that help individuals embrace the right opinions and approaches. Correspondingly, support channels between technical and academic teams are important resources that ensure the provision of updated information to a target group and thereby enable making the right decisions on whether to use M-learning applications.

B1 and B3 shared the experiences of some of their friends, who were directly influenced by a teacher's recommendations regarding the adoption of M-learning applications. Some platforms provide learning materials and are therefore recommended because of their focus on the E-learning field. B2 noted that the recommendations of academic staff might assist informed decision-making among students, given that they have good experience in many educational fields.

B5 shared the opinions of B4, stating that "The role and impact of any person on my convictions or experiences should not exceed normal levels." He added that he follows some of his trusted colleagues who pursue many hobbies and have accumulated diverse types of knowledge. Sometimes he finds himself taking advantage of peer experiences in addressing sensitive problems, such as how to deal with the use of a device or how not to use a particular experience in his learning, work, or private life. In this regard, B5 also followed official instructions from supervisors in charge of online applications, whether they are members of a technical or academic team, to increasingly maximise the benefits of his experience with smartphone applications and enhance his professional dealings with such innovations.

All the participants stated that an important requirement in improving the effectiveness of learning applications and enhancing their acceptance by a target audience is the provision of technical and logistical support by sufficiently experienced teams. They also called attention to the importance of increasing self-motivation to benefit from others' experiences in identifying appropriate M-learning applications and implementing professional approaches to engaging with these applications.

In sum, the participants diverged in their views about the importance of LI variables, but the final outcome showed that LI affects the BI to reuse online learning applications to a lesser degree than do the other constructs in this study.

5.3.1.4. Personal Innovation

The focus group participants noted the importance of personal motivation and its reflection on individual personal innovation in independent or collaborative learning and the usage of M-learning applications or learning through various online resources, which is supported by some previous studies (Cheung et al., 2015; Jansen et al., 2012; Liu et al., 2010). All the participants believed that the target group (i.e. university students) had insufficient experience in using smart device applications and their basic features. Nevertheless, the respondents also declared that these youth have a strong motivation to face risks and adequate intentions and motivation to use online learning applications in their study because the online learning features might be beneficial to their education and give them extra experience in using online learning resources appropriately. Moreover, smart device applications offer many creative technologies to present online learning resources attractively for young people who want to increase their experience with new innovations (Badwelan et al., 2017). Thus, it would be beneficial for the target audience to leverage their motivation as they deal with M-learning applications without any reservations.

In areas where the Internet connection is weak, people have low motivation to access online applications. This was confirmed by the proportion of participants who regarded motivation as an important aspect of acceptance—this did not exceed 60%, which is below the average percentages for the other variables. A1 mentioned that Internet cafes are spread across many cities and villages around Saudi Arabia, and most provide a high-speed Internet connection, making these establishments one of the options for areas that do not have high-speed connectivity to homes. Notwithstanding the value of this recommendation, such a situation remains an unsuitable environment for the use of M-learning applications, given that learning in an online environment requires focus—an aspect that cannot be guaranteed in crowded and noisy places like cafes.

B1 and B2 recognised that providing Internet accessibility to all cities and small towns affords users sufficient access to learning applications in a timely manner through normal means or more creatively (e.g., being connected through satellite and Thuraya mobile provider)(The Space Review, 2008); the current situation is that high-speed Internet connectivity is available only in major cities (CITC, 2017).

Confirming this observation, B4 offered the following: "I think a high percentage of users of online applications have at least a desktop computer or a laptop, so gaining an Internet connection is easy for them."

All the focus group participants declared that students could fill learning gaps and reach learning goals through their previous experience with M-learning applications, the motivation to learn, and the existence of diverse learning sources. Accordingly, all the respondents expressed the belief that PInn positively affects the BI to reuse M-learning applications in smart devices in the future.

5.3.1.5. M-Learning Quality

All focus group participants emphasised different categories of quality, which encompass many characteristics. A1 and A2 called attention to the importance of providing quality features, stating that these lead to optimally satisfying the requirements for M-learning application acceptance. A1 noted that the software development department of his company follows the highest international quality standards and applies these in all stages of electronic application development. Adding to this, A5 proudly reported that online learning services provided under more than 20 learning service packages were identified with reference to the requirements of his company's target customers. In a similar vein, A3 and A4 stated that international standards should serve as grounding in defining the basic requirements and by extension the aspirations of end users of M-learning applications. A5 pointed out definitively that the integration of tools that work collaboratively in online learning applications also promotes M-learning applications' acceptance.

All the participants were fully aware that the quality of online applications is a key aspect that determines acceptance and adoption by a target segment, and that such quality is associated with BI and future reuse. One of the components that they identified as vital to the quality of M-learning applications is the existence of security and privacy features. B1 pointed out that the interface and service quality of M-learning applications is lower than expected, thereby affecting the actual use of online applications. B2 emphasised that well-designed electronic applications present many advantages, the foremost of which is the presence of a mechanism for the easy search for learning materials. Thus, the failure to satisfy these

user expectations seems to in from the poor quality of system and service features (Almaiah et al., 2016; Al-Mushasha & Nassuora, 2012; Alshehri, 2012).

B3, B4, and B5 also emphasised the importance of the informational content of M-learning applications. Sometimes in Arabic websites, content may be outdated, unreliable, or contain poorly understood ideas or misspellings. B4 discussed a website that she visited as an example. The site featured modified versions of information on learning about smartphones a number of times over the past three months, and the administrators posted the same news and events on the site's home page. The last update to the stories was more than six months old. Similarly, B5 mentioned that learning websites or applications are sometimes poorly updated. B5 and his colleagues see these websites as unsatisfactory platforms for learning and acquiring updated information compared with the learning websites or applications offered in different languages (Bahaddad, 2017).

In sum, the discussion above indicated the importance of the quality of M-learning applications and its positive effect on the BI to use smart device applications.

5.3.1.6. Behavioural Intention

A3 pointed out the strong relationship among actual use, increased motivation to work on M-learning applications, and the satisfaction of various requirements in the applications. These requirements increase the usage of applications. All participants indicated that increasing the level of reactive BI is directly affected by the satisfaction of basic requirements in learning applications. Of the quantitative survey respondents, 90.7% agreed that focusing on satisfying diverse requirements in M-learning applications encourages systematic usage in the future (BI1). A2 explained that BI facilitates the development of trust, and this BI arises from increased use of M-learning applications. Confidence is built by the satisfaction in safety and privacy requirements, as indicated in the discussion of the responses to the open-ended questions earlier in this chapter.

A4 and A5 expressed belief in the importance of enjoying learning with M-learning applications, which is one of the factors that motivate repeated use. When a user senses enjoyment in engaging with M-learning applications, they may be encouraged to advise others to use such innovations as well. Finally, all the participants concluded their suggestions regarding increasing M-learning application acceptance by linking the enjoyment of engagement to the high-quality satisfaction of technical requirements that directly influence effectiveness. The availability of excellent technical features directly elevates the future usage of M-learning applications from the optional to the compulsory level.

Focus Groups A and B specifically revealed that both actual use and intention for future use are positively affected by PE, EE, LI, Plnn, and MQ.

5.3.2. Summary of the Analysis of Focus Group

Discussions

As mentioned earlier, the focus group discussions were conducted to complete the verification of the quantitative results and clarify the views and convictions of the respondents for the purpose of answering this study's research question and sub-questions. Both the quantitative and qualitative results supported the hypotheses.

Some of the suggestions put forward by the focus groups' participants are important but unrelated to the main concept of the UTAUT framework. They are enumerated here, as they may still prove valuable in efforts to satisfy the requirements for the acceptance of M-learning applications and directly support development teams. The suggestions are summarised below:

- Address technical shortages and specialisation issues in the IT field to advance a more systematic definition of technical requirements for M-learning application acceptance.
- Provide a global standard for computing infrastructure at all stages of electronic application design.
- Formulate and enact privacy and security policies that can be used to identify users' needs as participants in online learning applications. These policies should be updated as needed.
- Provide technical support by fostering cooperation among users of M-learning applications and academic technical teams to provide a sustainable environment to solve all outstanding problems in the technical or other knowledge domains.

6. Implications

On the basis of the outputs and principal findings, a number of implications and guidelines were formulated with respect to the phenomenon of interest. These are relevant to application developers, particularly in regard to the creation of appropriate solutions from a technical perspective. They are also useful to academic teams, as the implications cast light on the development of informational sources and materials for M-learning applications. Finally, these implications and guidelines are intended to enhance the effectiveness of M-learning applications as learning avenues for students in universities and academic institutions in Saudi Arabia.

6.1. Awareness

Increasing awareness among the target population is imperative in building an integrated learning system through electronic applications (Abu-Al-Aish & Love, 2013; Wang et al., 2009). Elevating the awareness of acceptance requirements for M-learning applications will also augment the reliability and usability of these applications in the future (Sarrab et al., 2016). Awareness can be raised by developing associated basic materials in a holistic manner, which can familiarise target segments with related theoretical frameworks, fill gaps in current knowledge about these innovations and answer all the questions of a new user (Badwelan et al., 2016; Sarrab et al., 2016). The availability of these basic materials can increase acceptance and use of educational applications. Awareness can likewise be improved over entire communication channels available in an application (Sarrab et al., 2015). Educators should take advantage of electronic applications in social media, audio channels and visual communication avenues, whether written or otherwise, as these are equally suitable ways of communicating with target users and solving the problems of existing users (Gikas & Grant, 2013). The availability of awareness-raising materials will contribute to the development of appropriate environments in which to accept and use M-learning applications (Abu-Al-Aish & Love, 2013; Abu-Al-Aish & Love, 2018; Sarrab et al., 2016).

6.2. Improving application quality and support systems

Quality in electronic applications is recognised as a fundamental requirement that affects the acceptance and use of electronic applications in general and M-learning applications in particular in Saudi universities and academic institutions (Alali, 2015; Al Gamdi & Samarji, 2016; Sarrab et al., 2015). Stakeholders interested in designing electronic applications at a professional level comprise design and development companies, which take into account the basic requirements of target customers (Algarni, 2014). Academic institutions are responsible for providing sufficient information resources for the successful use of M-learning applications (Al-Adwan et al., 2013; Al Gamdi & Samarji, 2016). Both these groups (i.e., technical and academic teams) should conform to high standards in satisfying the MQ requirements highlighted in this work. Another imperative in increasing the acceptance, effectiveness and efficiency of M-learning applications is incorporating features such as information sources that are small in size and compatible with download mechanisms of high quality; periodic updates to information; clear mechanisms for browsing information (e.g., one headline on each screen and one font size for headings); complementary services such as fast browsing,

searching for fixed addresses over search engines, complete application maps; and various channels for communication with application developers and information providers (Calisir et al., 2014; Sarrab et al., 2016). In addition, it is important to project no more than four types of fonts and colours on one screen and ensure the on-demand availability of M-learning applications through the provision of different means of communication and a help centre that will resolve cases when an application is outside of coverage (Badwelan et al., 2016, Bahaddad et al., 2017).

6.3. Strategic planning

Providing strategic plans for implementing M-learning projects is another fundamental step in drawing a clear roadmap for the basic elements of M-learning applications (Khan et al., 2015). The plans should cover the goal, mission, and general objectives of M-learning applications as well as information resources that can be accessed through them (Almaiah et al., 2016). Strategic plans should also involve procedures such as establishing practical policies and payment mechanisms (if available), addressing developmental problems in hardware or software, developing operational plans for applications beginning from the basics to determine a suitable learning environment, providing external information resources, and offering internal training to parties interested in the operation and development of M-learning applications for Saudi universities and academic institutions (Almaiah et al., 2016; Alotaibi, 2013; Carter & Belanger, 2005).

7. Limitations and future directions

Each study in the technological field is characterised by strengths and limitations that can be helpful in the development of future research and filling current research gaps. The present work is no exception, having a number of limitations similar to those of scientific and social research. Specifically, the limitations are encapsulated in two fundamental aspects: namely, the limited preparation for the focus group discussions and the treatment of university academic teams as secondary stakeholders.

The qualitative data analysis was intended to support the study's main findings. For the focus group component, only two participant groups were involved online. Focus group discussions were conducted in two major cities of Saudi Arabia, namely Riyadh and Jeddah, because these locations host many software companies that implement various electronic systems in different fields. This study therefore chose Riyadh as the city in which to contact companies interested in designing applications. These companies comprised the first group of participants. The second group consisted of students interested in using M-

learning applications; these participants were from Jeddah, specifically King Abdulaziz University and Jeddah University.

Involving concentrated groups in major cities may generate somewhat different results from the findings derived from studies of respondents from small cities or the countryside. Implementing focus group discussions in these areas, however, may present difficulties because the residents of smaller urban and rural locations do not have the basic technological qualifications and experience required for the analyses in this work.

In future research, a better approach would be to carry out additional focus group discussions or individual interviews that ideally involve various core stakeholders not included in this study. Additionally, the general level of maturity in using online learning applications could be limited in such areas in Saudi Arabia (Bahaddad et al., 2018), which might offer some complementary insights to the current study.

The final limitation was the treatment of academic teams as secondary stakeholders, who might have been able to identify additional quality requirements. These teams were treated as such because the target population in this research was only the student community. If students do not use M-learning applications, the efforts of technical and academic teams will neither directly nor indirectly affect student acceptance of M-learning applications. The activation of M-learning applications should therefore be grounded initially in students' needs, and the application framework designed should be suitable for this target segment.

Nevertheless, academic teams are expected to improve the design of M-learning application features and possibilities for usage after an initial version is completed and after a comprehensive assessment of tools and features has been performed to increase student effectiveness and benefit from the capabilities of M-learning applications to transfer knowledge from M-education to M-learning. Also, future research could be extended to identify extra benefits from both support teams (educational and developer) to implement more features that represent added value in M-learning applications and are useful to increase students' acceptance of using such online learning applications.

8. Conclusion

Mobile learning (M-learning) via smart devices represents one of the most important E-learning environments in institutions of higher education. There are shortages to be addressed in educational opportunities and quality for Saudi communities that require a high level of privacy and separation of genders in education. The KSA is in the process of digital transformation. Most

government agencies operate within the new Vision 2030, which requires them to accept and deal with this transformation easily and effectively. Many research studies on approaches to acceptance of E-learning were conducted in Saudi Arabia between 2017 and 2020. Many of these previous studies have focused on the factors influencing M-learning acceptance in KSA; however, there is a shortage of the main practical requirements that can be influenced by particular societies or traditional requirements related to the KSA community background. Thus, it is useful to pay particular attention to the requirements of students at universities and other academic institutions in order to understand and design an acceptable framework for creating learning materials delivered via smart devices. In this study, the focus was to identify requirements that could increase the level of acceptance for the target audience. The results may be useful in terms of adding to the quality of a number of areas of M-learning such as M-government or M-services, which can be activated in certain for-profit sectors, non-profit government entities, and private enterprises inside and outside Saudi Arabia.

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