An investigation of the acceptance of mobile learning by high school students in the K-12 context in the Kingdom of Saudi Arabia

by
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To my nearest and dearest:

My parents, Khalifah and Nama,

my wife, Ahlam,

my three little angels, Sofanah, Sarah and Randah

with all my love.

Abstract

Governments around the world are investing more than ever in the education of their citizens, eager for them to compete, and to help their countries compete, in the global economy. As Nelson Mandela (2003) noted, 'Education is the most powerful weapon we can use to change the world'.

In the 21st century, this means not just education for knowledge, but learning new ways of accessing knowledge, including the use of digital information and communication technologies (ICT) and information systems (IS), particularly the Internet, tablets, laptops, and mobile phones. In March 2017, as part of its efforts to modernise and enhance education, the Saudi Arabian government announced a plan to digitise its education system by replacing books with mobile technologies in K-12 education (5 to 18 years old) by 2020. However, a detailed review of the literature in mobile learning acceptance revealed that little research has been conducted into the factors that influence students' acceptance of mobile learning in K-12 education.

A strong need, therefore, exists for policy makers in the Saudi Arabian Ministry of Education to understand what factors are likely to affect the acceptance of mobile learning (M-learning) in order to plan how to support its introduction. The research described in this thesis is a response to this need through its investigation of the probable factors influencing mobile learning acceptance among students in high school (16 to 18 years old) in Saudi Arabia. The study makes an important theoretical contribution of a model for M-learning in high school by integrating the technology acceptance literature (specifically UTAUT) with factors from the education and broad IS literature (*hedonic motivation, system quality, self-management of learning*).

The mixed-methods research consisted of three different phases. In Phase 1, an online questionnaire, including both closed and open-ended items, was used to ascertain the attitudes of high school students towards M-learning in order to refine the conceptual model for the research. In Phase 2, a second online questionnaire was used to collect data to statistically test and validate the research model using structural equation modelling (SEM). For Phase 3, an M-learning application (app) related to English language learning was developed and provided to students for use on their mobile devices, and a third online questionnaire was used (after using the app) to confirm and validate the findings of the statistically tested model in Phase 2. Phase 3 also provided an opportunity to identify any factors which had not been covered by the research model. The findings of the three phases were triangulated to test their validity.

Data analysis confirmed the influence of *performance expectancy, effort expectancy, hedonic motivation, system quality* and *self-management of learning* on the acceptance of M-learning among the student cohort. On the other hand, the results indicated that *social influence* did not affect behaviour intention to use M-learning. Moreover, the results indicated that gender as the moderating factor was not supported for the research sample. Furthermore, the results of the M-learning software experiment confirmed and validated the findings of the statistical model (extended UTAUT), while revealing a potential factor, *affordability*, to be significant in the acceptance of M-learning.

The research has both theoretical and practical implications. The thorough and extensive literature review demonstrated that M-learning studies related to the acceptance of digital learning in K-12 education in the Middle East and Arab region are rare. The study has made a vital theoretical contribution of a model for M-learning acceptance for high school education by integrating the UTAUT, education and information system literatures. Additionally, it is the first study to develop a purpose built app to practically confirm and validate the factors that significantly influence Saudi Arabian students' acceptance of M-learning. The outcomes of the study, therefore, not only offer insights and information that will assist, even encourage, future researchers, but the methods used in the study are also instructive for future research in K-12 education. Furthermore, the findings will assist the Ministry of Education in developing workflows and plans for the implementation of their 2017 policy for the modernisation of education.

Declaration of Originality

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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Tamim Khalifah Alkhalifah, 2017

Publications

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Abbreviations

AGFI	adjusted goodness-of-fit index
AMOS	analysis of moment structures
AVE	average variance extracted
BI	behaviour intension
CFA	confirmatory factor analysis
CFI	comparative fit index
CR	composite reliability
CSS	cascading style sheets
C-TAM-TPB	combined models of TAM and TPB
DF	degrees of freedom
EE	effort expectancy
EFA	exploratory factor analysis
EFL	English as a foreign language
GFI	goodness-of-fit index
GNU	general public license
GOF	goodness-of-fit
HM	hedonic motivation
HTML	hypertext markup language
HTTP	hyper text transfer protocol
ICT	information and communication technology
IDT	innovation diffusion theory
IFI	incremental fit index
IS	information systems
IT	Information Technology
JSON	javascript object notation
MI	modification index
M-learning	mobile learning
MM	motivational model
MPCU	model of personal computer utilization
NFI	normed fit index
PBC	perceived behavioural control
PCA	principal components analysis

PE	performance expectancy
PHP	personal home page
PNFI	parsimonious normed fit index
PRATIO	parsimony ratio
RMSEA	root mean square error of approximation
SCT	social cognitive theory
SD	standard deviation
SEM	structural equation modelling
SI	social influence
SMoL	self-management of learning
SPSS	statistical package for social science
SQ	system quality
SQL	structured query language
TAM	technology acceptance model
TLI	Tucker-Lewis index
TPB	theory of planned behaviour
TRA	theory of reasoned action
UTAUT	unified theory of acceptance and use of technology

An investigation of the acceptance of mobile learning by high school students in the K-12 context in the Kingdom of Saudi Arabia

Chapter 1

Introduction

1.1 Chapter overview

The research reported in this thesis sought to develop a model of mobile learning for high school students in K-12 education in Saudi Arabia. Mobile learning (M-learning) uses information and communication technologies, such as mobile phones, notebooks and tablets, for educational purposes.

This chapter presents an overview of the research undertaken. Firstly, the research background is presented. Secondly, M-learning acceptance in general and in Saudi Arabia are briefly discussed to introduce the basic ideas relevant to the research. Following these introductory sections, the motivation for, and the significance of, the research are explained. Following this, the aims of the research are presented, along with the questions to be answered. Thereafter, the scope and boundaries of the research are delineated, and the structure of the thesis is outlined.

1.2 Mobile learning

The students of today have been referred to as 'digital natives' (Prensky, 2005). They belong to the 'digital generation', young people born between 1995 and 2005, during the time of the 'digital revolution', when electronic devices moved from being mechanical and analogue to being digital. The Internet is second nature to these students; they have embraced social networking, mobile phones and video games (Oblinger & Oblinger, 2005). These digital natives live in a world entirely run by technology; they are more accustomed to digital technology than any previous generation, and will rapidly accept changes and developments in technology (Levine, 2010; Lusk, 2010; Yakel, Conway, Hedstrom, & Wallace, 2011).

In response to these demanding and informed consumers, providers are having to adapt and set new standards for their applications; enhanced social networking, media sharing, collaboration platforms, search engines, communication methods and learning apps are all subject to this scrutiny (Prensky, 2005). Teachers should be supporting this generation's demands and desire for evolution, to promote the growth and diversification of the skills of the 21st century's future leaders.

Students who have grown up with this technology expect their learning establishments to be equipped with cutting edge technology and linked to high speed Internet. They are, however, often let down by the reality of old and barely functioning hardware and teachers with insufficient knowledge about computers and other devices (Norris, Mason, & Lefrere, 2003). If educators are hoping to equip the digital generation, and those following, with all the tools for the 21st century, it is vital that a change in school culture is brought about. Schools need up-to-date facilities and constant Internet access in order to perform this function (Tapscott, 2001). Wilson and Peterson (2006) report that when schools cannot or do not provide modern facilities, pupils are encouraged to have their own devices, in order to promote the personalisation of the learning environment and increase the use of technology inside and outside the classroom (Grimes & Warschauer, 2008; Inan & Lowther, 2010). Personal technology, such as smartphones, iPods, tablets and gaming systems, are employed to access learning materials from inside and outside the classroom, and the use of these devices is widening in education systems worldwide (Cheung & Hew, 2009).

Kukulska-Hulme (2009) stated that the wholesale ownership of mobile and wireless devices is altering the environment for learning supported by technology. Also, new technological developments are widely accepted to be altering not only the learning landscape, but also radically changing the cultural and societal customs in schools. As most students now possess a mobile device, educators have, on the whole, accepted that M-learning is no longer a new concept and that there are numerous benefits to the technology being used (Tu, 2005).

Devices are more powerful than ever and are not purely for phone calls and text messages in the modern world. They are portable computers, connected to the Internet at ever increasing speeds; and they are recording devices for sound, pictures and videos (Bartholomew et al., 2017). The modern student has become a multi-tasking, collaborative individual, embracing technology in many forms and using M-learning to its full potential (Bartholomew et al., 2017).

As a new style of computer support and off-site learning, M-learning has become part of a new way of thinking, and portable technology and the integrated networks support this at all educational levels, from primary schools to higher education establishments. M-learning

facilitates collaborative working and makes education accessible. As a progression from E-learning, M-learning pushes accessibility boundaries and makes education available whenever and wherever (Motiwalla, 2007; Sharples, Arnedillo-Sánchez, Milrad, & Vavoula, 2009; Trifonova, Georgieva, & Ronchetti, 2006).

This is education that is not constrained by time and place. This is also education that reacts to the learner and allows feedback virtually instantaneously. Wireless communication between teachers and students becomes possible, with learning content available whenever required. Salmon (2004) considered M-learning to be the 4th generation of electronic learning in 2004.

Self-study opportunities are presented to the M-learning user (Eschenbrenner & Nah, 2007; Jacob & Issac, 2008), by way of educational resources being available and able to be downloaded efficiently. In the classroom, M-learning encourages student/teacher interaction and yet idea exchanges are also facilitated outside of the traditional learning environment (Lam, Wong, Cheng, Ho, & Yuen, 2011).

1.2.1 M-learning in K-12 education

Many countries have adopted or wish to adopt a digital inclusion agenda which has an M-learning element. This engages the public and the community, offers opportunities for education and ensures that the population is a workforce fit for future demands. These digital agendas are putting increasing pressure on educational establishments and governments to make good on promises and deliver ICT systems fit for purpose (Perkins & Saltsman, 2010; Warschauer, 2009). However, the United Nations (2014, para 1) has reported that 'Some 125 million school children around the world remain illiterate [in spite of efforts to introduce ICT], even after four years of attendance – a waste of $129 billion a year'.

Across the world, in an attempt to create thriving communities and financial wellbeing, countries endeavour to deliver effective education, and technology offers the potential to reach out to students in remote areas or those with time constraints. Being a part of the digital society promises employment and upward social movement for all citizens as digital inclusion also brings education and training within the reach of all its citizens. According to McKay, Williams, Atkinson, and Levin (2014), quality education directly impacts on the number of entrepreneurs in a region who in turn influence economic growth. Access to digital media for

young children makes them ready for school at an earlier age, broadens their learning opportunities, and potentially closes learning gaps. The school day is effectively lengthened by using digital media after school and this has the effect of increasing school participation and completion rates (Cavanaugh, 2009).

The proliferation of digital technology has social benefits in addition to those mentioned. Crowded classrooms, budgetary deficits, the inclusion of gifted students or those with learning difficulties, a lack of teaching staff, are all offered solutions by M-learning (Ferdig, Cavanaugh, & Freidhoff, 2012; Ferdig & Cavanaugh, 2011). A particularly good example of the application of M-learning occurs in remote and isolated areas of Australia where ICT usage is well-established (Barbour, 2011). Countries that value education and lifelong learning tend to embrace mobile technologies and desire an economy based on knowledge. Such economies need continual intellectual input, but they achieve growth and the overseas sale of goods.

After a slow beginning in junior schools, K-12 education has started to embrace the use of technology as a learning tool, and positive results are being observed. Students are moving the learning beyond the classroom and the standard school day is being lengthened by the fact that learning can take place anywhere and at any time (Grant et al., 2015).

A number of researchers (Crompton, Burke, & Gregory, 2017; Kolog, Tweneboah, Devine, & Adusei, 2018), have looked at the types of mobile device used by 5-18 years old students. A desire to achieve some sort of global computing capability has resulted in a focus on handheld devices. The evolution of these handheld assistants in K-12 education started with PDAs and palm pilots and progressed through MP3 players and iPods to iPads and smartphones (Banister, 2010; Bomar, 2006; Greifner, 2007; Hastings, 2005; Hirsch, 2007; Kiger, Herro, & Prunty, 2012; Pegrum, Oakley, & Faulkner, 2013; Zhu et al., 2014).

The use of hand held devices has resulted in greater student achievement and improved skills in technology and literacy (Bomar, 2006; Patten & Craig, 2007; Shoemake, 2007), mathematics (Franklin & Peng, 2008), social studies (Dixon, 2007; Royer & Royer, 2004; Vess, 2006), earth sciences (Chou, Block, & Jesness, 2012), and general science (Green, Hechter, Tysinger, & Chassereau, 2014; Tinker, Horwitz, Bannasch, Staudt, & Vincent, 2007; Wallace & Witus, 2013), at K-12 level. Educational games are also popular and are proving to

have potential for future good practice (Dickey, 2015; Huizenga, Admiraal, Akkerman, & Dam, 2009).

The government of Saudi Arabia is prioritising education and investing billions of dollars each year to improve the educational sector in the kingdom. The Ministry of Education's financial budget is the second highest (after the military) among other sectors in the country (Jadwa Invesment, 2016).

1.2.2 M-learning acceptance

The ways in which technology finds acceptance since the widespread introduction of personal computers have been discussed in the research since early in 1980. The interest reflects the fact that technology acceptance is a 'critical factor in determining the success or failure of any technology' (Dillon & Morris, 1996, in Samaradiwakara & Gunawardena, 2014, p.22) or any information system project (Davis, 1993). Dillon and Morris (1996) argue that 'acceptance has been conceptualized as an outcome variable in a psychological process that users go through in making decisions about technology' (Dillon & Morris, 1996, in Samaradiwakara & Gunawardena, 2014, p.22).

Various researchers have sought to understand factors that affect students' acceptance of M-learning on two educational levels: the university context (Abu-Al-Aish, 2014; AlMarwani, 2016; Badwelan, Drew, & Bahaddad, 2016; Iqbal & Qureshi, 2012; Lowenthal, 2010; Nassuora, 2012) and the school context (Ali & Arshad, 2016; Osakwe, Dlodlo, & Jere, 2016). However, gaining acceptance for M-learning and helping students understand and use it is not a straightforward process. Different factors, including performance related issues (whether using M-learning will increase study performance), ease of using the M-learning system, technical issues, cost and social and ethical issues, may present barriers that must be investigated carefully to achieve success in the provision, adoption, and innovative use of ICT in K-12 education (Chou et al., 2012; Earle, 2002; Hew & Brush, 2007).

As noted in the literature review, there is a shortage of academic studies investigating the phenomenon of M-learning in Saudi Arabia in general and especially in K-12 settings. Several researchers have considered the perceptions and acceptance of M-learning in Saudi Arabian universities (Al-Fahad, 2009; Al-Hujran, Al-Lozi, & Al-Debei, 2014; Alfarani, 2015;

AlMarwani, 2016; Badwelan et al., 2016; Nassuora, 2012; Seliaman & Al-Turki, 2012). However, until now, there have been few studies that have investigated the pioneering nature of M-learning in the K-12 context in Saudi Arabia (Al-Kathiri, 2014; Alharthi, 2016; Alkhalaf, 2014; Alshammari, 2016; Oyaid, 2010). And these studies were investigating both students' and teachers' perceptions about M-learning in general. Limited studies have been conducted to determine the factors influencing the acceptance of M-learning.

1.2.3 M-learning in Saudi Arabia

M-learning has been shown to enhance educational aims across the world, but particularly in developing countries such as Saudi Arabia (Al-Fahad, 2009; Alkhalaf, 2014; Alshammari, 2016; Badwelan et al., 2016; Nassuora, 2012). Projects have enhanced access to learning materials, improved collaborations between teachers, students, parents and school managers. M-learning has also provided access to continued professional development. One of the most interesting applications from recent years, however, has been evidence gathered from the Arab Spring that the use of mobile technology encouraged young people and women to take greater control of their situation and facilitated the revolutionary behaviour the world witnessed (UNESCO, 2011).

Furthermore, given the traditional boundaries between the genders in Saudi Arabia that ensure the separation of males and females in classrooms from primary to tertiary education, communications technologies allow members of either gender to contribute to online discussions, offering ideas and insights from differently gendered perspectives without crossing customary physical barriers. Although the male and female students do not physically mix, therefore, technology encourages and allows them to share ideas and learn from one another.

The Saudi Arabian government believes that educational establishments (schools and universities) need to embrace and use technology, and have invested heavily in the technology and want it to be used to enhance learning and teaching across the region. It is important for educational institutions in the country to adopt technology to improve and enhance learning and pedagogy and not just to adopt and implement technology for the sake of it. To ensure that

money is successfully invested in a teaching and learning technology, students are the first consideration when implementing a new way of learning (Ministry of Education, 2017).

However, care must be taken to ensure that the actual needs of the students, not the institutions' pre-conceived ideas of the students' needs are taken into account. Research is needed to understand what these needs are. Therefore, engaging in conversation with them to understand their perspectives is crucial since technology by itself is not changing education; the students themselves are the driving force. Massive investment is often made in educational establishments anticipating the needs of the students, for example recreational facilities and halls of residence. Information technology is another way of investing but this requires an investigation into students' attitudes towards the technology to avoid spending on inappropriate systems.

In recent years, Saudi Arabia has seen a massive growth in the use of mobile technology, particularly smartphones, with more than 67% of the population over 16 owing a smart phone. Younger people are embracing the technology in even greater numbers, with nearly two thirds of young people having a smart phone (Nielsen, 2014). Saudi Arabia has a very large young population, so the scope for Saudi to remain a key growth market for technology (and education) is large.

In fact, 60% of the population in Saudi Arabia is made up of individuals under 20 years of age, and this is one of the reasons for the huge uptake of new technology (Alebaikan & Troudi, 2010). According to research from the Communication and Information Technology Commission in Saudi Arabia (2015), there were around 53 million mobile phone accounts in the nation, meaning that more than two thirds of the population had more than one device. However, there has been a steep decline in voice services in preference for data provision. This is encouraging for the implementation of M-learning as it demonstrates a readiness for accepting the technology that will make M-learning ubiquitous. Network providers are making the infrastructure for M-learning accessible and affordable. This means that research needs to be undertaken into the process through which M-learning can be first implemented in schools.

In order to determine the factors that influence K-12 students' acceptance of M-learning in Saudi Arabia, more research is necessary. As previously noted, there is a lack of research to identify and study the crucial factors that influence high school students' acceptance of M-

learning in the K-12 context in Saudi Arabia, an issue this study sought to address. In addition to identifying the factors that influence M-learning acceptance, the research sought to develop an M-learning system (app) to confirm and validate the findings of the quantitative study, and to identify the challenges that affect M-learning implementation in the Kingdom of Saudi Arabia.

1.3 Significance of the study

The findings of this study validated the use of an extension to the *Unified Theory of Acceptance and Use of Technology* (UTAUT) originally developed by Venkatesh, Morris, Davis, and Davis (2003). UTAUT was extended by the inclusion of three additional factors (i.e., *hedonic motivation, system quality, self-management of learning*) related to high school students' acceptance of M-learning in the K-12 context in Saudi Arabia. The results of this study are, therefore, the first to identify the factors that influence M-learning acceptance among high school students in Saudi Arabia.

Students using mobile technologies have been shown to achieve better results than those not using the devices and M-learning is proving popular across the disciplines; students are also enthusiastic about using it (Furió, Juan, Seguí, & Vivó, 2015). It is still crucial, however, in order to make sound investment decisions that research is done to assess the economic feasibility and the potential results to be achieved by incorporating M-learning into the schools in Saudi Arabia. The research will be of interest to all the stakeholders involved in K-12 education in Saudi Arabia – parents, students, educators, managers, administration and funders. It will also inform those devising future course structures in the Education Ministry.

Current polices in the kingdom's schools prohibit the use of mobile technologies in schools and classrooms. However, students use mobile technology freely elsewhere, and the idea of using mobile technology as a learning tool is not foreign to them. **While the research focus, therefore, had to be on their intentions and aspirations, it is hoped that the findings of this research will encourage the use of M-learning outside the classroom, and allow fast and accessible distribution of efficient and effective learning materials. Furthermore, M-learning offers a way of dealing with gender and geographically segregated schools throughout the kingdom, and large numbers of students.** That there are barriers and

obstacles that might prevent or hinder the use of mobile technologies in the K-12 context in Saudi Arabia was clear, and these were identified.

The study findings and the software app that was written as part of the research design to enhance and validate the findings are particularly apt, given the government's efforts to lower the country's dependence on oil and reform education. For example, in March 2017, as part of the Saudi Vision 2030 and the National Transformation Program 2020 (National Transformation Program 2016), the government of Saudi Arabia announced a 1.6 billion Riyals project to shift the educational system in the country to digital education (Nabbout, 2017), and the Ministry of Education is planning to remove all printed books from schools and replace them with mobile technologies by 2020.

According to the ministry, the project will consist of three phases, the first phase will see change in 150 schools, while phase two will include 1,500 schools. The plan will later be extended to all schools in the kingdom (phase 3) (Nabbout, 2017). At a press conference, the Minister of Education Ahmad Al Eissa stated that 'We want the teacher to change his [sic] role from instructor to mentor and we want the student to transform his [sic] role from a passive recipient to an active participant' (Toumi, 2017).

The findings of this study will help to inform the quite significant changes in education such a policy is intended to bring about.

1.4 Research aim and objectives

The motivation for this study has come from a distinct lack of research into the provision of M-learning in Saudi Arabia, particularly the provision of M-learning to K-12 students. Research is needed to understand, comprehensively, the factors that indicate an acceptance of M-learning on behalf of high school students in Saudi Arabia.

In order to achieve this aim, several objectives were developed:

A *to understand and measure the level of perceptions and attitudes that exists among high school students in K-12 education about M-learning in Saudi Arabia*

The current research sought to investigate the perceptions and attitudes of high school students towards using M-learning in their studies. This phase included investigating

different aspects of the use of mobile devices for learning, including familiarity with the concept of M-learning, the availability of mobile devices, access to Internet, using previous educational applications in their mobile devices, assessing students' attitudes towards M-learning via several Likert scale statements. In addition, this phase helped to identify the relevant factors responsible for the acceptance of M-learning.

B *to identify and study the factors that affect the acceptance of M-learning for high school students in the K-12 context in public high schools in Saudi Arabia*

Over the past decade, significant research has been done in M-learning acceptance in the university context, but very few studies were conducted in K-12 education. According to the review of the literature, the few studies conducted in the K-12 context were mostly investigating teachers' acceptance of M-learning. This study is the first to investigate and study the factors that influence high school students' acceptance of M-learning in K-12 education in a developing country such as Saudi Arabia where the use of mobile learning is not yet institutionalised. This research is therefore significant as currently scant investigation has been conducted into the factors that influence M-learning acceptance that specifically targets high school students in Saudi Arabia.

As many high school students are future university participants, their experience with M-learning in high school could be instrumental to their informed and confident use of technologies at university. Being prepared for online learning before university entry would benefit both the students and the university as these institutions seek to adopt advanced learning and teaching methods as quickly as possible.

C *to examine and evaluate the viability of an extended version of the UTAUT model as a proposed model for M-learning acceptance in public high schools in Saudi Arabia*

Structural equation modelling (SEM) techniques in IBM-AMOS software assisted with the development of a conceptual model. In order to verify the scale reliability of the students' questionnaire, an exploratory factor analysis (EFA) was performed. The assumption that the data matrix was sufficiently correlated with the variables justifies the application of the EFA (Hair, 2010). A confirmatory factor analysis (CFA) was conducted after the EFA to confirm that the model ideas induced convergent legitimacy, discriminant authority, construct cogency and factorial validity.

D *to propose, design and implement an M-learning application (app) for students and teachers to validate and confirm the findings of the UTAUT model. In addition, to discover any potential factors that have not been covered by the UTAUT*

In addition to the quantitative data collection and statistical analysis in Phase 2 of this research (objectives B & C), this study sought to collect supplementary data from students and teachers by devising an M-learning application (app). The online survey was conducted after the M-learning application had been used for four weeks. The survey aimed to confirm and validate the findings of the analysis of the data generated by the UTAUT model developed for this research. Furthermore, the questions sought to identify and discover any potential factors affecting high school students' acceptance of M-learning which have not been covered by the UTAUT model. It allows respondents to express their views, opinions, and make suggestions.

E *to investigate any potential barriers that might affect the use of mobile technologies for learning (from the perspective of government officials and teachers)*

This research sought to discuss and explore the challenges and obstacles that face the implementation of M-learning in high schools from the perspectives of teachers and education officials in order to present a comprehensive view and discover the common obstacles which need to be considered.

1.5 Research questions

A broad research question was created, in order to accomplish the research aim. The study investigated the question:

What are the factors that enhance the likelihood of acceptance *of M-learning for high school students in the K-12 context in Saudi Arabia?*

This question was subsequently divided into a number of sub-questions to facilitate the research:

RQ1: *What are the perceptions and attitudes of high school students towards using M-learning in Saudi Arabian schools?*

RQ2: *What are the factors that influence high school students' acceptance of M-learning?*

RQ3: *Is there any statistical difference due to gender on the behavioural intention to use M-learning?*

RQ4: *What are the students' opinions about the factors that influence their learning (extended UTAUT model) after implementing an M-learning project?*

RQ5: *What are the challenges that affect M-learning implementation in public high schools in Saudi Arabia from the perceptive of education officials in the government and teachers?*

The research involved designing and developing a new conceptual M-learning acceptance model and validating the model. In addition, an M-learning application (app) was designed and implemented to confirm and validate the findings of the UTUAT model. Finally, recommendations are proposed for decision makers (Ministry of Education, school management and teachers) in Saudi Arabia.

1.6 Research approach

A comprehensive literature review into M-learning acceptance was conducted in order to determine what research had already been conducted into the acceptance of M-learning in education and where the current research fit. The review was conducted systematically with a particular focus on K-12 education. Differing acceptance theories concerned with M-learning were considered. The material studied offered insight into the ways in which it was possible to answer the research queries.

This research was divided into three phases:

Phase 1 Refining the research model by exploring high school students' perceptions and attitudes towards M-learning

Using data from the literature review, a questionnaire was designed to identify students' readiness for M-learning and their expectations about how M-learning would work. The results of this exploratory phase (informed by the literature) helped to gain a better understanding of student perceptions of M-learning and helped to formulate the final research model.

Phase 2 Model validation

A second questionnaire was designed based on an extended version of the *Unified Theory of Acceptance and Use of Technology* (UTAUT), which was the proposed model from Phase 1. IBM-*SPSS* was used to perform the analysis of the quantitative data collected in this phase, whilst IBM-*AMOS* was employed to test and validate the conceptual model developed in Phase 1. Analysis in IBM-*AMOS* employed structural equation modelling (SEM) techniques. The use of such software allowed for confirmation or rejection of the research hypotheses in relation to each of the research questions.

Phase 3 Model in practice: App implementation

In this phase, a third questionnaire was designed after implementing an M-learning application (app) for high school students in Saudi Arabia. The purpose of this phase was to practically confirm, validate and to add depth and richness to the statistical data obtained in Phase 2.

In the methodology chapter, all the methods of each phase have been explained in detail.

1.7 Scope of the study

Many researchers have studied M-learning in a university context globally and in Saudi Arabia.

There have been, by contrast, relatively few studies asking questions about M-learning acceptance in relation to K-12 education in Saudi Arabia. Defining the scope of the study in order to keep the research focussed is essential. Without this, the study would be rambling and difficult to understand. The framework of this study was bounded by:

- The investigation of M-learning within the K-12 context (specifically, high school education) since the Saudi Arabian government is investing heavily in this educational cohort as the foundation of new economy that is not dependent on oil. The use of technology is one of the central features of the Saudi Arabian plan.
- Focus on specific handheld devices (i.e. smartphones, tablets) because the Saudi Arabian population appears to have a strong preference for using smartphones and tablets to access the Internet (Google, 2015).
- Focus on the personal and individual environment of high school students because they will benefit the most from M-learning because of the ages and potential future interaction with technology.

- In addition, their perceptions and the factors that influence their acceptance of M-learning.

1.8 Outline of the thesis

Chapter 1: Introduction. This chapter provides an introduction to the current study, with the research topic and research background outlined. The research aims and objectives are then presented along with an explanation of the significance of this research. The research questions and scope are discussed.

Chapter 2: Literature review on M-learning. This chapter provides a general literature review about M-learning and specifically M-learning in the K-12 context. In addition, theoretical models related to M-learning acceptance are also presented.

Chapter 3: Methodology. In this chapter, the research methodology is outlined, with a discussion of the methods, design and strategies employed for the purposes of this study. Each phase of this research is accompanied with an outline of the instruments, methods and procedures used, as well as details on the participants and a discussion of ethical considerations.

Chapter 4: Conceptual model development: Ascertaining students' perceptions of and attitudes towards M-learning (Phase 1). The analysis and results of Phase 1 are presented in this chapter. This chapter explores students' perceptions for M-learning, and their attitudes and expectations of M-learning services. Furthermore, the chapter refines, presents and explains the research model based on the findings of Phase 1.

Chapter 5: Model validation (Phase 2). The main quantitative analysis of the study is presented in this chapter (Phase 2). This chapter presents the findings of the statistical analysis of the proposed conceptual model using SEM techniques. Descriptive statistics are also provided and the assessment of the hypotheses is completed and explained.

Chapter 6: Model in practice: App implementation (Phase 3). This chapter describes the design and implementation of an M-learning application (app) for high school students to use in Saudi Arabia. A questionnaire was used to confirm and validate the findings of Phase 2 after the students engaged with the app.

Chapter 7: Discussion. This chapter offers a detailed discussion of the results and findings obtained from the three phases (Chapters 4, 5 and 6).

Chapter 8: Conclusion. This chapter provides an overview of the study, including the contribution to knowledge and the implications of the study, plus its limitations, and recommendations for future research.

1.9 Summary

The research concepts and problems, research questions and the scope of the study have been outlined in this chapter along with an overview of the Saudi Arabian M-learning acceptance problem as an element of M-learning acceptance in education overall. This chapter has explained the reasons for focusing the research on the Saudi Arabian context after discussing the status of M-learning in Saudi Arabia at present.

The research is grounded in the aims, questions and objectives outlined in this chapter, and the significance of the study has been outlined. A justification for the research has been provided along with the research parameters that impact the scope of the study. The thesis structure was then presented.

Whilst this chapter has provided an introduction to the study, the next chapter reviews the literature in the area of M-learning, including relevant acceptance models for technology and studies on users' readiness for technology adoption.

Chapter 2

Literature review

2.1 Chapter overview

This chapter provides a background to the research conducted in this thesis. The chapter is divided into two main sections. The first section defines the importance of ICT and its use in education and the use of ICT in education in developing countries. After that, the chapter introduces the concept of M-learning and its growth, features and benefits. Then, it reviews M-learning in the K-12 context.

The second main section identifies, compares, and contrasts main theories relevant to technology acceptance. After that, the use of technology acceptance theories in developing countries and in the education sector is reviewed before proceeding to review the previous M-learning acceptance studies. The chapter ends with justifying the need for conducting this research.

2.2 The importance of ICT

The part that information and communication technology (ICT) plays in day-to-day life has become critical to nearly every daily activity (Maryska, Doucek, & Kunstova, 2012), and it has transformed the field of education. ICT has revolutionised most aspects of the business of providing education, from the administrative processes and the management of thousands of student records, to communication with a whole student and staff body with a click of the mouse (Yadav & Mehta, 2014). It provides an efficient and accurate alternative to the paper-based records and communications of the past. When considered from the learning and teaching point-of-view, the impact is clear to see. Information and data are quickly accessed and compiled; academic references can be checked; and the delivery of a hugely diverse amount of content is now flexible, engaging and easily disseminated.

In the modern world, our lives are impacted by media and the technologies used to consume the media, such as computers, tablets, or smartphones (Collins & Halverson, 2018). The media is also delivered by more traditional technologies which have been enhanced, such as the radio, newspapers (produced with new technologies) and the television. While today we often consider the term ICT to mean high-tech equipment, these former analogue (now digital)

methods of media delivery also come under the definition of ICT. Today it is vital that we can access media in all its forms to keep abreast of the world around us.

Although there are many definitions for ICT (Alturise, 2016), it is perhaps best described by the United Nation Development Programme (UNDP), which maintain that ICTs are essentially tools for handling information. They define the 'tools' as goods, applications and services capable of producing, storing, processing distributing and exchanging information. It is clear that this definition is wide and includes both old and new technologies linked by fibre-optic cables and satellites, telephone and transmission towers that carry or wirelessly beam information to our various devices, from smartphones to car GPSes (UN, 2003).

2.3 ICT in education

As parts of the world develop and become more competitive in the global marketplace, education helps to ensure that these regions attract investment and offer competitive work opportunities. Education is considered one of the key indicators of prosperity and wellbeing in a community (Seligman, 2008). When first introduced, ICT was a discrete subject in the computer literacy curriculum. However, this situation has evolved and ICT has become an integral part of the provision of education, helping with the delivery of lessons (Siraj-Blatchford & Siraj-Blatchford, 2006). Learning delivered using ICT has been shown to be diverse, cost effective and of high quality; but, according to Kramer, Jenkins, and Katz (2007), educational establishments, such as colleges and universities, using ICT in their management, are also lowering their overheads and becoming administratively more effective.

2.3.1 Integration of ICT in schools

Students and teachers are empowered to develop and enhance their learning and teaching when using ICT in the classroom. Teaching methods and the content of educational materials are improved by the new opportunities ICT presents. Learners benefit from more interactive learning experiences which are at once motivational, entertaining and useful as a way of developing new skills in ICT (Bingimlas, 2009; Tairab, Huang, Chang, & Zheng, 2016).

The variety of the devices employed in the classroom is varied and the challenges of engaging with each of them is rewarding for students of all ages and abilities. It seems that the delivery of education across the curriculum can be improved using ICT in most subjects in addition to

social studies. In 2007, a study commissioned by the International Institute for Communication and Development (IICD) (2007), found that four out of five respondents felt that ICT in the learning environment had had a beneficial effect on their education, leaving them feeling more assured and empowered. 60% thought that teaching had been affected by using ICT.

Teachers are coming to terms with the fact that over the last 10 years there has been a change of focus in education from a teaching-centric approach to a more learner-centric style of learning and teaching. Collaborative and active learner settings are being enhanced by the incorporation of ICT to the extent that the student population as a whole is increasing its knowledge base, benefitting the entire student body. The quality and content of educational materials and the administration of the establishment is also further boosted by using ICT (Jawad & Wahab, 2014) .

One of the outcomes of an increased use of ICT in the learning environment is the shift from the teacher-led model of imparting educational content to a passive receiver to the more interactive learner-led experience. Schoolwork can now be completed, submitted and marked on a computer, and students need not even be in the same room or building as the teacher. All this flexibility means that students have a greater role in deciding how they wish to experience their learning environment, an environment vastly different to that from before the use of ICT (Douglas, 2011; Stacey, 2009).

2.3.2 ICT in education in developing countries

The education system now incorporates ICT at every level, enhancing education quality and effective administration, and supporting both economic and social growth and change. ICT is a crucial part of both learning and teaching, expanding beyond the curriculum and being integrated into both K-12 education and the wider education system (Hew & Cheung, 2013). The significance of ICT in education is constantly growing, with ICT-based teaching and learning methods undergoing continuous development (Younie & Bradshaw, 2017).

The breakneck speed of growth and change observed in the developing world could have been greatly supported by the introduction of ICT into education systems. However, as has been noted by the United Nations Commission on Science and Technology for Development (UNCSTD), and outlined in Martínez-Frías (2003) paper, that the benefits of ICT have not and cannot be maximised in much of the developing world due to a lack of human resources and

infrastructure. This UNCSTD observation reflects the fact that the 'developing world' is not a homogenous thing, and that categorising countries remains contentious. Three circumstances are generally observed in the developing world – *high levels of poverty*, as measured by gross national income and *economic vulnerability*, as measured by agricultural or manufacturing instability, displaced persons in the population (often due to natural disasters), and over-dependence on a single product or commodity. In addition, *human resources are weak* based on measures of literacy and education, nutrition and health.

Using these criteria, the 'developing world' can be divided along many lines, with some countries possessing few natural resources with which to build wealth or lacking the necessary social capital, or both. The poorest, most vulnerable national economies, with the least educated and knowledgeable populations actually have little if any opportunity to develop any sort of infrastructure, much less ICT, compared to wealthier developing states with greater national incomes, better educated populations and greater economic stability (Cole, Greenwood, & Sanchez, 2016).

Developing countries with stronger economies and human resources, however, could pursue their objectives more vigorously if they gave greater attention to educational reform, including more focus on the use of ICT. As Abbott (2001) points out, schools in developing countries could improve learning and teaching, expand access to learning materials, enhance students' skills, and modernise their curricula by using ICT strategically. However, the basic, and often conservative, curricula found in the majority of developing countries does not include ICT sufficiently.

This being said, developing countries could pursue their objectives more vigorously if they gave greater attention to educational reform, including more focus on the use of ICT. As Abbott (2001) points out, schools in developing countries could improve learning and teaching, expand access to learning materials, enhance students' skills, and modernise their curricula by using ICT strategically. However, the basic, and often conservative, curricula found in the majority of developing countries does not include ICT sufficiently.

Alturise (2016) notes the poor ICT integration in Saudi Arabia in particular, where the learning environment is characterised by weak infrastructure, resources and potential capacity. Enhanced standards in K-12 education in Saudi Arabia rely on the increased adoption and

integration of ICT in the sector. And improving education is critical if Saudi Arabia is to succeed in efforts to become a player in the global marketplace, with more to offer than oil (Albugami & Ahmed, 2015).

The implementation of ICT into the education system has been emphasised in both developed and developing nations due to the desire to obtain technological, education, social and economic benefits. Consequently, much investment has been made in the areas of education technology application in order to improve students' learning experience. Not only is technology now becoming increasingly acknowledged as a key part of education, it is also being highlighted as a key factor in job opportunities and the labour market, with computer skills now being perceived as mandatory in many fields.

Furthermore, it is crucial for countries to develop a tech savvy labour force if they are to compete with other countries in the global arena. Thus, the focus now is how technology can be implemented in the education system in order to bring advantages to all individuals impacted by the system, and the debate as to whether technology is useful in the school environment can now be considered obsolete. Any nation that falls behind in terms of advances in ICT and education risks losing competitiveness, even relevance, in the global community and market (Avgerou, Hayes, & La Rovere, 2016).

2.4 Innovative use of technology in education

The 21st century has witnessed seismic changes in the way in which we communicate and process information. The rate at which the world is changing, according to Brotchie, Hall, Newton, and Nijkamp (2017), is nothing short of a dramatic social and technological revolution. Nistor, Mocanu, Stanescu, and Groza (2017) point out that community groups and those with whom we associate are no longer those we merely live the closest to; we are now free to be a part of social groups based on such diverse things as our interests, and our work patterns, for example.

2.4.1 Mobile technologies

Mobile devices (such as smartphones) are not simply communication devices, but they have become a catalyst for the new social 'tribes' that are being created (Ally & Prieto-Blázquez, 2014). These devices not only allow us to speak with others over distances, but put the world's

knowledge at our fingertips through the Internet, store our data and allow us to manage our lives and our work. Indeed, they let us complete our work in many cases, with applications that allow us to word process, send emails, transfer files, produce web sites and input data into spreadsheets (La Polla, Martinelli, & Sgandurra, 2013).

The potential harnessed by mobile technologies for communication and information access can drastically alter our perception of place and reduce our dependence on static, physical places in which to work (Alrasheedi & Capretz, 2018). The scope of the new environment for learning and education has been exponentially widened (Anderson, 2016). Training can be delivered in new and exciting ways, although challenges for the new technology become apparent when people expect it to be entirely bespoke to their needs because of the capabilities of the technology (Kivunja, 2014). It has also been said by Peters and Lloyd (2003) that students are expecting to be trained at a time and pace that suits them and not necessarily following a traditional classroom approach.

Recent years have seen an explosion in the use of mobile technology. Zare (2010) believes it is the sheer fact that the technology is portable that has revolutionised the use of ICT hardware and applications. Over the past years, people were using M-technologies to store data and keep it about their person, in the same way as a person might carry a handbag or a wallet, or wear a watch (Goggin, 2012).

People have constant access to messaging, the Internet and communication in ways that are easier than ever due to the mobility of the technology. Younger generations are embracing M-technology as if it were second nature and have more motivation and enthusiasm to use it than previously was the case when new technologies were introduced (Hjorth, 2012). Shuler (2009, p. 39) quoted Elliot Soloway, saying that, ‘The kids these days are not digital kids. The digital kids were in the ’90s. The kids today are mobile, and there’s a difference. Digital is the old way of thinking; mobile is the new way’.

According to Krannich (2010), M-technology can be categorised into three types of device (see Figure 2.1). Although there are potentially a great number of individual devices, it seems convenient to use Krannich’s categories, which are based on portability, their capacity, connectivity, weight and component parts (Krannich, 2010). Therefore, we have transportable,

mobile and wearable devices. For the purposes of this research, the M-technology being discussed will be the types of device that can be handheld – smartphones and tablets.

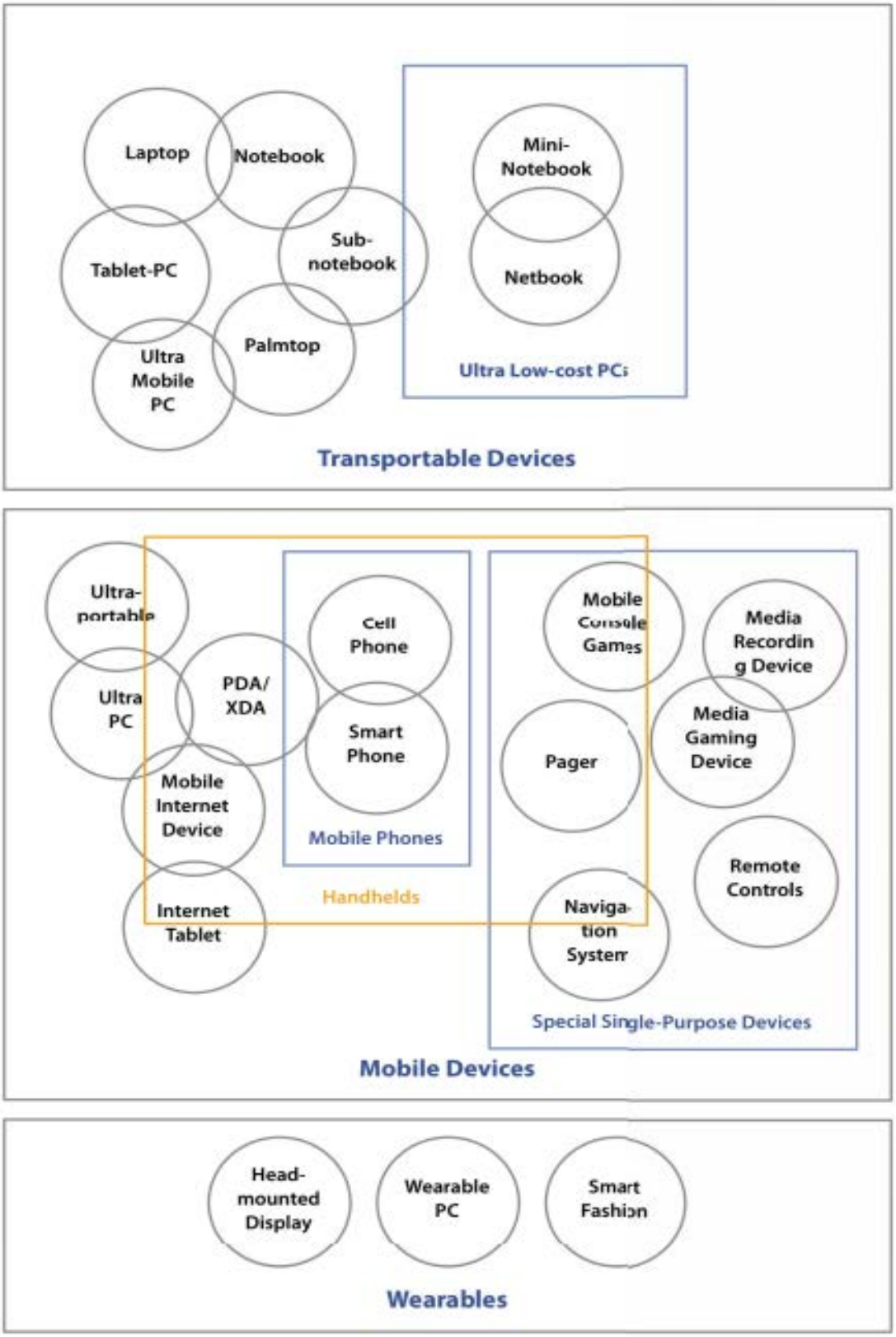

Figure 2.1 **The figure demonstrates how mobile technology can be categorised into three: mobile phones, both smartphones and cell phones; handheld devices such as PDAs and single-purpose devices such as barcode scanners.**

2.4.2 Mobile learning (M-learning)

There are many similarities between M-learning and E-learning, with M-learning being a successor to E-learning (Alkhalaf, 2015). Features such as the way in which information is input, received, the types of applications used, and the way in which information is stored are essentially the same, meaning that there is the potential for cross-over theories of learning between the two concepts (Al-Yahya, George, & Alfaries, 2015). Allen (2016) distinguished M-learning from E-learning by stating that where M-learning was the publication of electronic learning media via a mobile device, E-learning is the preserve of the personal computer.

In 2005, Keegan (2005) foresaw the modern mobile device when he imagined handheld technology that would be capable of taking photos and recording sound and video, connecting wirelessly to the Internet, would be able to keep data secure and allow the user to collaborate with others via integrated communications features. Keegan also anticipated that these highly complex devices would possess great processing power but would be small enough to be readily portable in a pocket or handbag. As Zare (2010) concedes, Keegan was correct in his predictions and now we are accustomed to exactly the kinds of device that were anticipated.

Klopfer, Squire, and Jenkins (2002) considered five attributes of mobile devices that could be thought of as unique to education, these were:

- portability
- social interactivity
- context sensitivity
- connectivity
- individuality.

Devices that would allow for mobility, support interaction between users, be fully capable of delivering data to the learners wherever and whenever they wanted it, allowed for connectivity across networks, but at the same time, supported individuals learning by themselves.

The attributes of modern mobile devices can be used to augment teaching and learning. Functions such as games, messaging, communications and access to the Internet are capable of being at once educational and engaging, enabling teachers and students to communicate

creatively with each other and deliver lessons across a variety of media (Kukulska-Hulme, Lee, & Norris, 2017). As an increasing amount of functionality is added to these mobile devices, Murphy, Farley, Lane, Hafeez-Baig, and Carter (2014) have argued that they are beginning to surpass the scope of static desktop computers.

The meaning of mobile learning. The theory of mobile learning (M-learning) has developed quickly, and it is no longer just something that those with a special interest in mobile devices and technologies discuss in conceptual terms. Sung, Chang, and Liu (2016) state that M-learning is being discussed more and more and is becoming a mainstream topic when reviewers are discussing trends in education.

Over the last decade, the discussion has moved on from the types of devices being used to deliver training (Soloway et al., 2001) to the richer consideration of context (Sharples, Taylor, & Vavoula, 2010). The fact that M-learning enables complex, context-relevant methods of delivering education has been accepted by the likes of (Crompton, 2014), but additionally it is more and more apparent that M-learning is concerned with location and mobility and the fact that education or learning opportunities can be delivered to students wherever they may be, unrestrained by physical geography (Parsons, 2014).

The definition of M-learning is, however, continuing to be debated and the term is evolving. It seems that a useful definition may be required to put M-learning in context within an educational setting (Al-Emran, Elsherif, & Shaalan, 2016). A number of attempts at such a definition have been made. Crompton et al. (2017) would see M-learning defined in relation to the hardware or technology involved and the software interfaces used by the learner, but Traxler (2007b) takes a more conceptual approach to the definition, followed by (Pachler, Bachmair, & Cook, 2010).

M-learning to those researchers, it seems, is less about the technology and more about the learner coming to terms with the new concept of society and being able to adapt to new ways of receiving information, feeling comfortable with a constantly shifting learning environment and embracing a new approach to the learner experience.

The definitions of M-learning are helping to increase the debate and understanding of the concept. Whether the definition focuses on the technology, the geography, or on philosophical notions about the way we learn, the simplest way to understand the concept of M-learning is by simply considering the word itself. M-learning as a portmanteau word of 'mobile' and 'learning' is really just that. Learners can access the education they need, whenever and wherever they want it facilitated by the use of portable technology.

For the purpose of this research M-learning is defined as the use of handheld mobile technologies to support teaching and learning anywhere and anytime; and to create a blended learning environment, which contributes to learning in individualized or in collaborative settings, and in which the learner is central to the process of learning.

Features of M-learning. Huang, Zhang, Li, and Yang (2012) point to five different features of M-learning are:

- *Affordability and accessibility*
  M-learning devices are more affordable and accessible than a typical desktop for learners. They also stated that mobile devices such as cell phones, PDAs, tablet PCs, smartphones etc. are not only cheaper than desktops but also portable and accessible. Learners can utilize these devices to acquire learning in a wider network coverage. By using such devices, learners enjoy the freedom of truly learning anytime and anywhere; learners can control the time and location of learning and learn whenever and wherever they need (Oyelere, Suhonen, Shonola, & Joy, 2016).
- *Individualized, self-regulated and just in time*
  By 'individualized learning', we mean that learning is undertaken based on individual learning styles, approaches and abilities. As 'self-regulated', learners, students can set their own objects, select their target content and follow their own schedules and pace to fulfil the overall goal of learning (Hargis, Cavanaugh, Kamali, & Soto, 2014).
  Learning can take place in both formal and informal settings through collaboration, chat services, and data transfers between learners directly on the mobile device, where teachers may or may not be absent from the entire learning process. Moreover, M-learning provides the opportunity for learners to learn 'on the go'. For instance, learning while travelling on the bus to the campus or in the library (Looi et al., 2016).

- *Distributed learning*

  M-learning is distributed, which involves individual inquiry and/or group collaboration. Mobile technologies have transformed learning from formal to informal acquisition of knowledge and skills, providing students the time to satisfy their thirst for knowledge. For instance, students can use the apps available on their smartphones to check the English vocabulary. Moreover, learning is distributed. Students learn either in a classroom, on campus, at home, on a field trip or on the way to wherever they might go (Ally & Tsinakos, 2014).

- *Knowledge navigation*

  In M-learning students/users have the opportunity to know what they want to know through knowledge navigation in terms of exploring possible answers to real-world problems that they may experience through the use of wireless mobile devices. These mobile devices are flexible enough to allow students to pursue personally relevant goals, which allow students to be self-motivated to perform learning tasks. Further, they try to locate the resources they need in solving the problems. Such resources might be text, graphics, audio, video or multimedia, or in the form of collaboration partners, such as peers, teachers, or other more acknowledgeable individuals (Koole, 2009).

- *Authentic contexts*

  Finally, learning takes place in authentic contexts, where resources are abundant. Students engage themselves in authentic learning through encountering and mastering situations that resemble real life (Herrington & Herrington, 2007).

2.5 The growth of M-learning

Parsons (2014) and Jacob and Issac (2014) have identified M-learning as the future of learning. It is true that the area is expanding and that M-learning is offering solutions to barriers to education in new and innovative ways. Along with greater access to learning, Traxler (2007b) identifies that wireless, personal mobile devices are also the reason for new forums of discussion and new access to knowledge whilst at the same time challenging accepted notions of art and language. On the other hand, new opportunities for deprivation and crime have arisen alongside new avenues for employment and commerce. Traxler (2007b) goes on to assert that due to the proliferation of knowledge and information at anytime and anywhere, the relevance of formal education is being challenged. Technology, education and society have an interplay and boundaries that are more flexible than ever before. Applications for use on

mobile devices can be seen as tools designed to facilitate the learning process (Leinonen, Keune, Veermans, & Toikkanen, 2016), and now there are many stakeholders with good reason for turning M-learning into something which needs all possible outcomes examining.

M-learning is having the effect of freeing people from the constraints of their desktop computer; they are able to collaborate and work in groups, although not necessarily in the one location. Importantly, the individual learner can be just as empowered as a community due to the nature of the tools of mobile learning and their duel functions.

M-learning has features that entirely set it apart from E-learning and cannot simply be considered as just an extension of E-learning or computer based training. The distinguishing features, as previously discussed, and the didactic capabilities are distinct in M-learning and the interaction between learners and educators is unique to the technology. Learners are not confined to a particular location and the flexibility of the media is built into the structure of the learning activity. M-learning adapts to content, and the interaction between learners becomes crucial to the learners' understanding. As the learner interacts socially via the media, they also interact with physical objects.

The Internet seems to be geared towards distance learning, as evidenced by the increase in the number of tools available for this. M-learning requires several resources to be available, such as high-quality Internet connectivity, large databases powering the applications and sympathetic font-end access. The M-learning systems themselves are responsible for a huge number of interactions across networks and learning forums. They are good for contextual learning in a dynamic way and allow for collaborative exchanges of advice and cooperation within real life scenarios. M-learning can ensure that time wasted can become a useful diversion. Often one of the problems with learning in a traditional classroom environment has been the loss of content when the learning has been applied to the outside world. However, M-learning negates this issue by putting the learner in context. This new culture of learning in context and the transfer of directly applicable situational learning is a product of M learning.

2.5.1 Benefit of mobile learning in the learning environment

Researchers such as Denk, Weber, and Belfin (2007) have considered the advantages of using M-learning in more traditional learning environments, and found that M-learning encourages a

more collaborative and dynamic approach to education. The interaction between teachers and students is improved by the use of the technology which encourages feedback from both sides (Ooms, Linsey, Webb, & Panayiotidis, 2008). Mobile learning removes ambiguity and the student can identify their weak points more readily. The teacher is then in a position to address the issue immediately and adjust their teaching methods to meet the need.

Diaz, Moro, and Carrión (2015) assert that mobility is the most important characteristic of M-learning. Students are free to learn anytime, wherever they wish and keep in touch with their teachers and fellow students when away from the classroom. The students are able to increase the scope of their learning environment over and above the restrictions of the lecture theatre and classrooms by taking advantage of the fact that mobile devices give flexible, portable and independently accessed learning materials (Jan, Ullah, Ali, & Khan, 2016).

The lively interaction between students, lecturers and between each other is a feature of M-learning, and the technology fosters collaboration (Lai & Hwang, 2014). The learner to lecturer and student to student discussions bring about an efficient exchange of views and a constant stream of feedback throughout the learning process. The teacher can monitor progress and comment in real-time on assessments and questions, for example. The mobile device will have built in applications for this type of interaction, such as messaging services, email, forums and blogs. This kind of constant communication and scrutiny will inevitably lead to a higher quality of learning experience (Ciampa, 2014).

Among the other benefits of M-learning, it is also useful in coordinating activities for learners by ensuring that resources are available and booked and timetabled for students. The management of teaching is a complex task, but mobile devices facilitate the distribution of course materials, assignment management, such as due dates and return of work and the booking of workshops. M-learning usually takes place outside the classroom, and is a catalyst for lifelong learning through informal practices (Mehdipour & Zerehkafi, 2013).

M-learning was and still is, of course, an aspect of electronic learning that has evolved beyond the desktop and laptop, the classroom and the projector, to be much more portable and nimble. However, correctly prepared and performed, M-learning activities produce benefits similar to generally more detailed and static E-learning lessons. These have been identified by Aubusson,

Schuck, and Burden (2009) and again by Hashemi, Azizinezhad, Najafi, and Nesari (2011). They can be summarised as such:

- access to resources such as document libraries and various other media; video and sound clips
- the ability to study independently
- instant self-assessment and teacher feedback, course evaluation
- a platform to exhibit work by the student
- the ability to work at a time suited to the student by reading postings asynchronously.

2.5.2 M-learning in the K-12 context

Teaching methods are sensitive to external conditions and environments, particularly cultural and social changes. Over the last ten years, educational organisations have become more willing to adopt technology (Alqallaf, 2016). The proportion of schools showing an interest and an eagerness to assimilate M-learning and other forms of technology is at an all-time high. This is because more teachers agree with the idea that technology has a positive effect on pupil achievement and the application of skills. One of the biggest advantages is that it offers an alternative to traditional 'lecture' based instruction and a move towards more interactive tasks. According to Luckerson (2014), around 75% of secondary school teachers in America now employ technology in a motivational fashion. They are actively engaged in trying to make technology accessible and enjoyable (Eyyam & Yaratan, 2014). The consequences for learning have been so resoundingly positive that interest in IT and M-learning adoption is only going to diversify and expand in the future (Luckerson, 2014).

Recently, the contemporary passion for IT adoption and assimilation resulted in a greater tolerance for using different types of mobile devices in schools (Crompton et al., 2017; Kolog et al., 2018). Using mobile devices as part of K-12 learning has transitioned from PDAs and palm pilots (Baumbach, Christopher, Fasimpaur, & Oliver, 2004; Lary, 2004; Norris & Soloway, 2003; Penuel, 2005; Rose, 2001) to MP3 players, iPod Touch, smartphones, and iPads (Banister, 2010; Bomar, 2006; Greifner, 2007; Hastings, 2005; Hirsch, 2007; Kiger et al., 2012; Pegrum et al., 2013; Zhu et al., 2014).

Alongside the idea that this technology is a good way to amplify the retention of IT skills, supporters consider the assimilation of handheld devices to be a gateway to enhanced pupil performance and achievements. There is a lot of evidence to suggest that they are right, particularly in the case of educational games (Dickey, 2015; Huizenga et al., 2009), mathematics (Franklin & Peng, 2008), geography (Chou et al., 2012), reading (Bomar, 2006; Patten & Craig, 2007; Shoemake, 2007), science (Green et al., 2014; Tinker et al., 2007; Wallace & Witus, 2013), and social studies (Dixon, 2007; Royer & Royer, 2004; Vess, 2006).

For contemporary pupils, developing technologies like M-learning, Internet learning, and digital content are extremely exciting, because they offer the potential to construct entirely new learning conditions and environments. For a long time, creativity and innovativeness have been lacking in educational systems. The assimilation of technology not only increases interaction with contextually based content, it also supports more adoption of customised learning programs. It encourages pupils to investigate and acquire skills in a limitless fashion and this is a great way to nurture the imagination. Yet, it should also be noted that pupils perceive mobile devices in a different way to their parents and tutors and this has important consequences for productive academia (Khan, Al-Shihi et al. 2015).

Over the past decade, a number of studies have investigated the perceptions of using M-learning and documenting the M-learning experience in the K-12 context. Lin, Wong, and Shao (2012) carried out an experimental study to explore broader learning achievements, the quality of pupil resources, learning attitudes, interactive trends, and skill retention associated with the use of a mobile device (tablet PC). The outcomes indicated that pupil attitudes towards IT based cooperative mapping are largely positive. The study participants claimed that it enhanced their passion for the subject (social sciences) as a whole and that it had the potential to affect other courses in the same way. Furthermore, most were confident about the use of ITCs as being a good way to improve group cohesion and performance.

The work of Ozdamli and Uzunboylu (2015) explored attitudes towards M-learning among pupils and teachers in the Turkish Republic of Northern Cyprus. The study involved 1659 pupils and 534 teachers, all selected from a sample of 32 high schools. The results showed that

teachers and pupils feel very positively about the adoption of M-learning in their classrooms. They were happy to keep utilising technology as part of lessons both now and in the future.

Grant and Barbour (2013) describe an initiative called the Professional Development for Mobile Technology Integration scheme. It was set up by the Michigan Association for Computer Users in Learning and involved four participating teachers, each from a primary school. The teachers were all given iPads and asked to incorporate them into lessons. Each one had positive experiences, but it should be noted that they did begin the trial with positive attitudes towards technology in schools. They all felt confident that the iPad could be used as a very effective instructional device. On the other hand, they had certain worries about pupil access to the technology, particularly when not connected to lessons. They acknowledged the potential for misuse and the expense associated with funding ubiquitous use of iPads and other handheld technologies.

In another study, Huizenga et al. (2009) explored the incorporation of mobile game-based learning in the K-12 environment. The study focused on pupils aged 12-16 years at schools in the Netherlands. The results demonstrated that M-learning for games is a very efficient way to increase performance and skills retention.

Rau, Gao, and Wu (2008) discovered that mobile phones increased the quality and frequency of interaction between pupils and teachers. The pupils felt more interested and passionate about lessons, because they were constructing deeper links to their tutors. Faure and Orthober (2011) carried out an investigation with high school pupils to determine attitudes towards the use of personal cellular phones in class for instant messaging. The results indicated that pupils believe in-class texting can be used in a way which supports and enhances learning.

The work of Messinger (2011) explored attitudes and opinions about the use of mobile phones to increase performance in lessons and generate greater learning opportunities outside of school among secondary school pupils and teachers. The study gathered data from survey questionnaires and follow up discussions. The results indicated that, even though pupils and teachers generally felt positive about the value of mobile phones for learning and teaching, it was clear that the teachers required additional training to handle and manage an M-learning environment. Similarly, pupils must acknowledge the need for regulation and control,

particularly when it comes to appropriate use of the technology. The issue of using the technology to socialise proved to be most pressing. It was clear that there needed to be some way to ensure that pupils were not using mobile technology to socialise when they should be learning.

The work of Thomas, O'Bannon, and Britt (2014) explored attitudes and the tolerance of mobile phone use in lessons among 1,121 teachers in Tennessee and Kentucky. The results suggested that teachers rarely deal in absolutes on this subject. Most believe that technology is a powerful learning aid, but worry about misuse. The teachers discussed several concerns and problems which might degrade the potential of M-learning in schools. These included:

- use of technology to cheat
- cyberbullying
- sexting
- the availability of unsuitable content
- interruptions in class
- misuse of apps
- the possibility that texting might negatively affect writing and spelling skills.

In this case, the number of teachers who did not feel confident about assimilating mobile technology with classroom learning was slightly greater than those who did feel confident combining the two.

From a Saudi Arabian perspective, there are a number of investigations which have focused on opinions and attitudes of M-learning in classrooms among K-12 pupils and teachers. For instance, Oyaid (2010) explored attitudes towards the adoption of ICT resources both inside and outside the learning environment in Riyadh schools. Six schools were involved in the study. The results indicated that there was a high proportion of mobile owners among high school students. Furthermore, students reported positive attitudes towards using ICT technologies in education. The students expressed very positive feelings towards the current adoption of ICT technologies, but most were keen to see a greater assimilation and more technology in education.

Similarly, Alkhalaf (2014) distributed an online questionnaire with the aim of exploring attitudes and opinions about the current limitations to M-learning acceptance in schools among K-12 teachers. Six responses were collected (out of forty high school teachers). The teachers discussed a number of key problems associated with bringing mobile technology into the classroom, including access to learning resources, the misuse of devices, the lack of a robust infrastructure, and a general lack of experience among staff.

In 2014, Al-Kathiri (2014) carried out an investigation with the aim of determining attitudes towards M-learning for English learning among female pupils. The results showed that pupils feel very positive about the potential of mobile technologies when it comes to English lessons and language retention. The study gave participants a specialised mobile app (referred to as *Edmodo*) to use alongside their lessons (Al-Kathiri, 2014). Feelings towards M-learning grew progressively more positive the longer the pupils interacted with the app.

According to Al-Kathiri (2014, p. 198), the combination of traditional in-class instruction plus an online classroom community created through *Edmodo* proved to be effective in generating more positive attitudes towards learning English. Al-Kathiri also believes that the continued application of such technologies is going to lead to more efficient and effective learning environments in the future.

Other work of Alharthi (2016) has explored opinions and feelings towards the acceptance of M-learning among K-12 teachers with a sample of 34 teachers. The results indicated that, even when teachers do not regularly incorporate mobile technology in English classes, most still express very positive opinions of its potential and value. The statistical outcome demonstrated that teachers felt positively about M-learning. According to Alharthi (2016), however, further investigations are needed to find out whether pupils are keen to add mobile technologies to their English language lessons. He also recommended that schools invest in formal training for teachers, so that they can better regulate and control the use of M-learning processes.

In 2016, Alshammari (2016) investigated attitudes towards M-learning in classrooms among 100 teachers, 50 males and 50 females. The results indicated that the two genders share very similar opinions and both feel positive about using mobile technologies in schools. This was an outcome supported by the work of Alkhalaf (2014) and a number of other researchers. On the

other hand, the male teachers were more likely to raise issues relating to a lack of training, infrastructure, and availability.

2.6 Technology acceptance theories

While contemporary studies clearly demonstrate a positive attitude towards M-learning among students and multiple researchers have offered support for its value and potential in classrooms (Al-Fahad, 2009; Rogers, Connelly, Hazlewood, & Tedesco, 2010; Wang, Wu, & Wang, 2009), the fact remains that there are limitations associated with its use. Certain logistical, cultural, and social factors mean that there are challenges to overcome for educational institutions (Corbeil & Valdes-Corbeil, 2007; Traxler, 2007b).

Every day, all across the planet, people eat, work, walk, learn, communicate, sleep, and create in the presence of extremely powerful technologies. There is no doubt that they have great potential for the worlds of academia and business. It is clear that the propagation of M-commerce, M-finance, and M-learning will continue to change social norms, but our understanding of them must develop alongside their evolution. The potential socio-economic and cultural impact of handheld technologies is staggering, but their use requires further refinement and control (AlMarwani, 2016).

While there is a wealth of literature on the subject of technology acceptance and adoption – and much of it describes a great confidence towards assimilation – every new type of information system presents a different set of advantages and challenges. Each one, therefore, requires a unique approach. According to education experts, gaining a deeper insight into the human variables associated with M-learning adoption and teaching is the most important priority for researchers (AlMarwani, 2016; Huang, Lin, & Chuang, 2007; Park, Nam, & Cha, 2012). As an endeavour, it can uncover key integrative solutions which can minimise the amount of time, money, and work needed to incorporate mobile technologies. In addition, gathering more information on opinions, beliefs, attitudes, and expectations is a good way to determine pressing concerns about misuse, lack of access, and other limitations (AlMarwani, 2016; Uğur, Koç, & Koç, 2016).

For a long time, researchers have been interested in how and why people respond to new technologies in the way that they do (Davis, Bagozzi, & Warshaw, 1992; Igbaria, Parasuraman, & Baroudi, 1996; Taylor & Todd, 1995c; Venkatesh, Thong, & Xu, 2012). Several acceptance

models have been constructed to calculate and interpret user intentions and behaviours, particularly towards emerging information systems. They include:

1 *the theory of reasoned action (TRA)*
2 *the theory of planned behaviour (TPB),*
3 *the technology acceptance model (TAM)*
4 *the innovation diffusion theory (IDT)*
5 *a model of PC utilisation (MPCU)*
6 *motivational model (MM)*
7 *combined TAM and TPB (C-TAM-TPB) 1995*
8 *the social cognitive theory (SCT)*
9 *unified theory of acceptance and use of technology (UTAUT)*

Even more recently, the *unified theory of acceptance and use of technology* (UTAUT) was developed and formalised to include eight earlier systems of technology acceptance models and theories (Venkatesh, Morris, Davis, & Davis, 2003). Venkatesh et al. (2012) further expanded the UTAUT by refining the comprehensive simulations, applications, and expansions into the broader ranging UTAUT2. It should be noted that, for a deeper insight into the construction and conception of UTAUT and UTAUT2, each of the eight individual systems which came earlier must be scrutinised. Ultimately, Venkatesh et al. (2003) have, with their development of UTAUT, found a solution for the challenge of trying to select the most appropriate method for a research project.

2.6.1 *The theory of reasoned action*

The *theory of reasoned action* (TRA) was developed by Ajzen and Fishbein (1980) and Fishbein and Ajzen (1975) to model the links between an individual's beliefs, attitudes, norms, intentions, and behaviours. Intention is a state of mind, a readiness to voluntarily perform a behaviour, when it conforms to an individual's beliefs, attitudes and valued norms (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Hale, Householder, and Greene (2003) suggest that the TRA resulted from discontent with predictable attitude-behaviour research, which found many weak parallels between attitude measures and performance of volitional behaviours.

TRA assumes that there are two constructs related to the intent to perform a behaviour (IB): attitude towards the behaviour (A) and the subjective norm (SN) (Figure 2.2). Attitude towards the behaviour is explained as being a person's desire to partake in certain actions while the

subjective norm is explained as an individual's awareness and belief of how the people around him expect him to behave (Fishbein & Ajzen, 1975). According to this theory, the attitude toward a behaviour and the subjective norm can predict a person's behaviour (IB = A + SN). The TRA has been applied widely in forecasting and clarifying behaviour across many areas. Most of the literature related to technology acceptance has used the TRA to examine the causal elements of IT innovation handling behaviour (Han, 2003).

Focusing on attitudes and subjective norms, the model has been successful in predicting behaviours towards information technologies and computer use in several studies (Han, 2003; Mishra, Akman, & Mishra, 2014). On the other hand, Ajzen (1991) has pointed out that only those behaviours that are intentionally considered before they are actually executed can be explained by the TRA because of the assumption underpinning the TRA, which regards behaviours as completely conscious decisions. However, the TRA does not give significant attention to other predictors of behavior, such as effort expectations and performance expectations, which might have considerable impact.

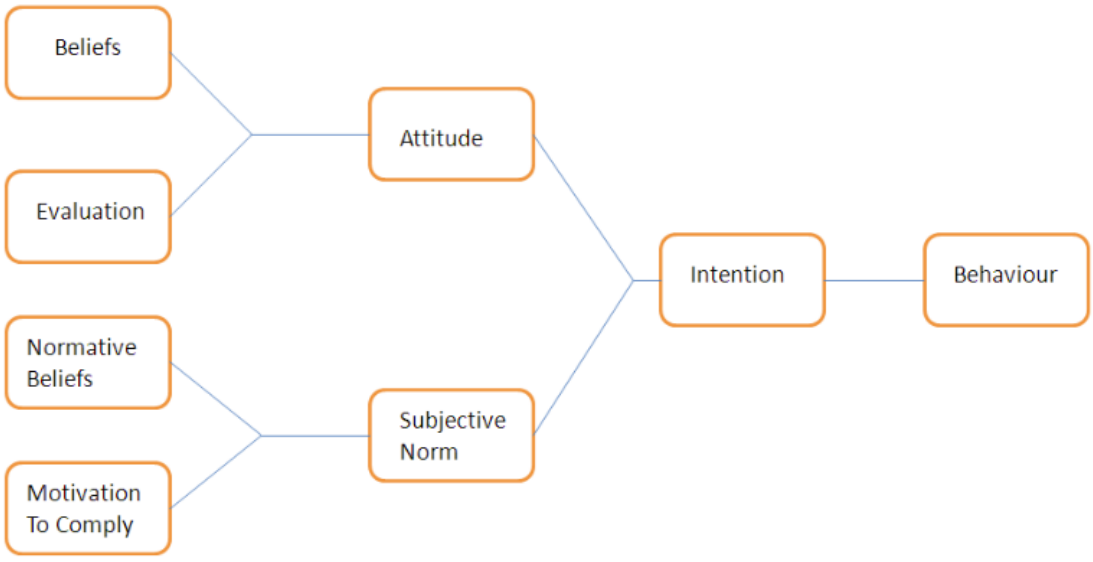

Figure 2.2 Theory of reasoned action developed by Ajzon and Fishbein (Ajzen & Fishbein, 1980)

2.6.2 *Theory of planned behaviour*

Ajzen (1985) suggests that the *theory of planned behaviour* (TPB) can further address the problem of incomplete volitional control in the TRA. The TPB is extensively used to forecast and clarify human behaviour while also taking into account the part individuals and social systems play in this progression (Ajzen, 1991). (Ajzen, 1985, 1991) also suggests that the TPB

was intended to include determinants of *perceived behavioural control* (PBC), and it differs from the TRA because it incorporates the PBC, in which a person or individual has limited rather than complete control over their behaviour.

Different situations and actions show the differences (Ajzen, 1991). The TPB places the construct PBC within a framework of relationships among attitude, beliefs, intentions, and behaviour. PBC influences both intention (direct influence) and behaviour (interactive influence) as shown in Figure 2.3.

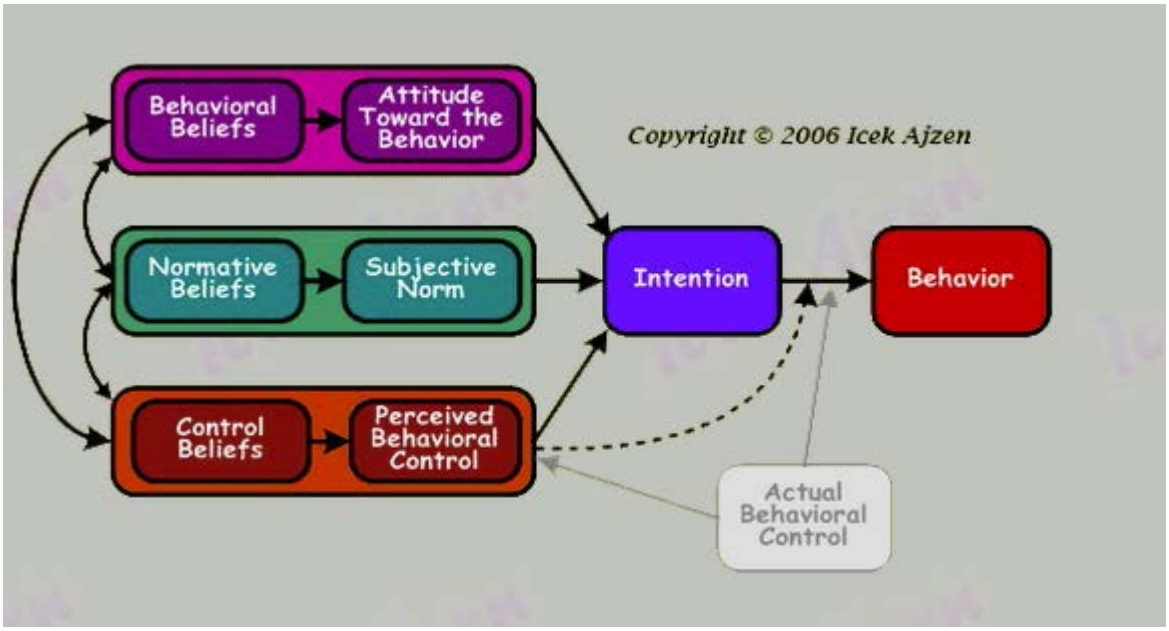

Figure 2.3 Theory of Planned Behaviour (Ajzen, 2002)

The TRA shows that when a circumstance or behaviour gives a person total control over their behaviour, their intentions will define their behaviour. Ajzen (1991) argues that when BI is sufficient to influence a person's behaviour even marginally, PBC should be separately critical of behaviour. BI and PBC are vital in predicting behaviour, but one may be more important than the other depending on certain conditions. As can be seen in Figure 2.3, the TPB deals with constructs of attitude, subjective norms, and perceived behavioural control. The TPB assumes that certain beliefs are a result of specific behaviour, and these beliefs determine a person's intentions and actions (Ajzen, 1985).

Those who disapprove of the TPB argue that the model does not explore how intention and behaviour are related, because there is usually a lot of unexplained variance. The TPB does not take into account demographic variables and takes for granted that all users will experience the

model's processes in the same way (Elliott, Armitage, & Baughan, 2003). It also does not account well for change in behaviour (Armitage & Conner, 2001). The use of PBC in TPB as a preventive measure to all non-controllable elements of behaviour is not viewed as practical (Taylor & Todd, 1995b). Beliefs behind the PBC were combined to create a gauge. This combination was condemned for not explaining precise effects that could forecast behaviour and the prejudice it would probably create (Armitage & Conner, 2001).

2.6.3 *Technology acceptance model*

The TAM was developed by Davis (1989), and is important in influencing how individuals acknowledge and use IT/IS. The TAM is a variation of the Fishbein and Ajzen (1975) *theory of reasoned action (TRA),* which is used to demonstrate the factors which affect why users agree to use technology. Perceived usefulness and ease of use are the characteristics employed by users to make their choices.

Perceived usefulness is the way in which a potential user assesses the capacity of a device to effectively do the job required. The ease with which a person believes they can use the device is the *perceived ease of use*. A device or a system that seems simple to use is more likely to be adopted (Davis, 1989). The TAM has become an influential way of signifying the precursor of system handling through beliefs about these two constructs. The use of computers is informed by an individual's desire to use them, and whether he feels that he will benefit from computer use.

The original TAM suggests that a positive attitude and the potential benefits of a computer system will most likely influence an individual to use the system. On the whole, the association between usefulness and intention suggest that an individual assumes that their job performance will be affected, whether positively or negatively (Davis et al., 1992). The external variables in the model refer to different sets of variables, including: objective system design characteristics, computer self-efficacy, training, user participation in design structuring, and the execution process (Davis & Venkatesh, 1996).

Nevertheless, as the model evolved, new variables emerged as external variables that affect *perceived usefulness, perceived ease of use*, *behavioural intention* and *actual system use*. Some of the newly emerged constructs were *system quality*, *compatibility*, *computer anxiety*, *perceived enjoyment* and *experience* (Lee, Kozar, & Larsen, 2003). Davis (1989) assumes that

the TAM is meant to explain the variables that affect user behaviour in various end-user technologies and populations. The basic elements of the technology acceptance model are presented in Figure 2.4.

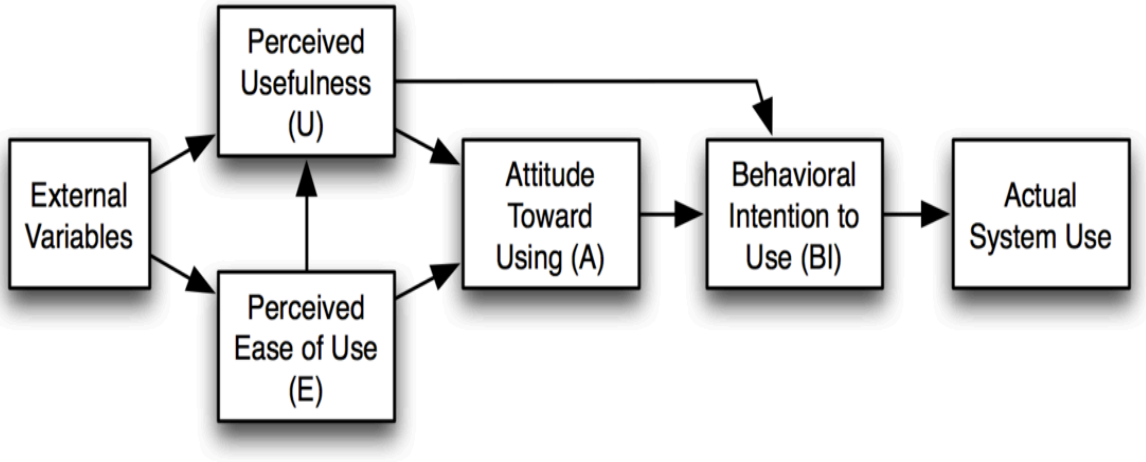

Figure 2.4 Technology acceptance model (Davis, Bagozzi, & Warshaw, 1989, p. 985)

The TAM has been condemned because it does not take into account how social and human factors affect technology use (Fu, Farn, & Chao, 2006; Mathieson, 1991). Venkatesh and Davis (2000) extended the TAM to TAM2 by incorporating social and cognitive variables, such as skill, job significance, representation and voluntariness. The TAM2 is more complex than the original technology acceptance model. In the TAM2, subjective norms are re-inserted and other external factors, such as image, job relevance, or output quality may influence a person's decision (via perceived usefulness) to utilize a technology.

Even though the original model was expanded by the TAM2, some scholars believe that the new model still does not properly explain the factors that influence a technology's ease of use. To tackle this deficit in the TAM2, Venkatesh and Bala (2008) created a third version of the model, TAM3, which aided researchers in understanding how factors influenced technology users' perceptions of a technology's usability. The biggest difference between the TAM2 and the TAM3 is the inclusion in the later model of anchors and adjustments (Venkatesh & Bala, 2008). Anchors reference pre-existing personal beliefs regarding computer and technology usage (Venkatesh & Bala, 2008). Adjustments refer to system characteristics that can change over time depending on the experience of an individual. As the technology acceptance models evolved, they became more complex in an attempt to identify and weigh the behavioural predictors (Venkatesh & Bala, 2008).

2.6.4 *Innovation diffusion theory*

Outlined by Rogers (2003), the *innovation diffusion theory* (IDT) shows how innovations spread in the public and how organizations and individuals agree to modernization. It contains two closely related processes – the diffusion process and the adoption process. Rogers (2003) differentiated between the two processes, suggesting that the diffusion process takes place as a group action within society, while the adoption process is associated with an individual. Rogers (2003) believes that diffusion is the process of communicating the qualities of an innovation to different individuals in a fairly cohesive group. Adoption, on the other hand, is the choice by an individual to use a product.

Rogers model consists of five phases that an individual tends to pass through on the way to adopting or rejecting an innovation (Rogers, 2003).

1 The first phase, ***Knowledge,*** comes about when a person discovers about an innovation and decides to find out how it is used.

2 In the ***Persuasion*** phase, the supposed qualities of the innovation create a favourable or unfavourable impression on the potential user.

3 In the ***Decision*** phase, the individual makes choices that will make him adopt or reject the innovation.

4 In the ***Implementation*** phase, the individual agrees to make use of the innovation. Implementation causes obvious behaviour changes in the individual as they utilize the innovation.

5 Finally, ***Confirmation*** is the decision of the user to adopt or refuse an innovation; they might change their mind from positive to negative if the innovation is found to be defective or inadequate as the user's familiarity with it grows (Rogers, 2003).

The IDT theory has several limitations which have been explained by various researchers. Clarke (1999) points out that the theory is only a descriptive tool that does not explain much and inadequately predicts outcomes and provides few directions on how adoption can be speeded up. Doubt is also cast on the ability of the theory to produce refutable hypotheses. In addition, the theory has many elements which strongly relate to specific cultures of North

America in the 1960s, from where it originated, and is irrelevant in other parts of the world (Clarke, 1999).

According to Attewell (1992), DOI focuses on innovation demand instead of innovation supply. Attewell (1992) suggests that those who offer innovation could influence diffusion because they usually centre their marketing and educational strategies on a specific range of businesses, meaning that the chances of adoption are reduced. He further argues that with sophisticated innovations, information about the innovation and its advantages and benefits could be extensive, which could actually deter potential users. Figure 2.5 also contains the five elements of the central diffusion of innovation theory.

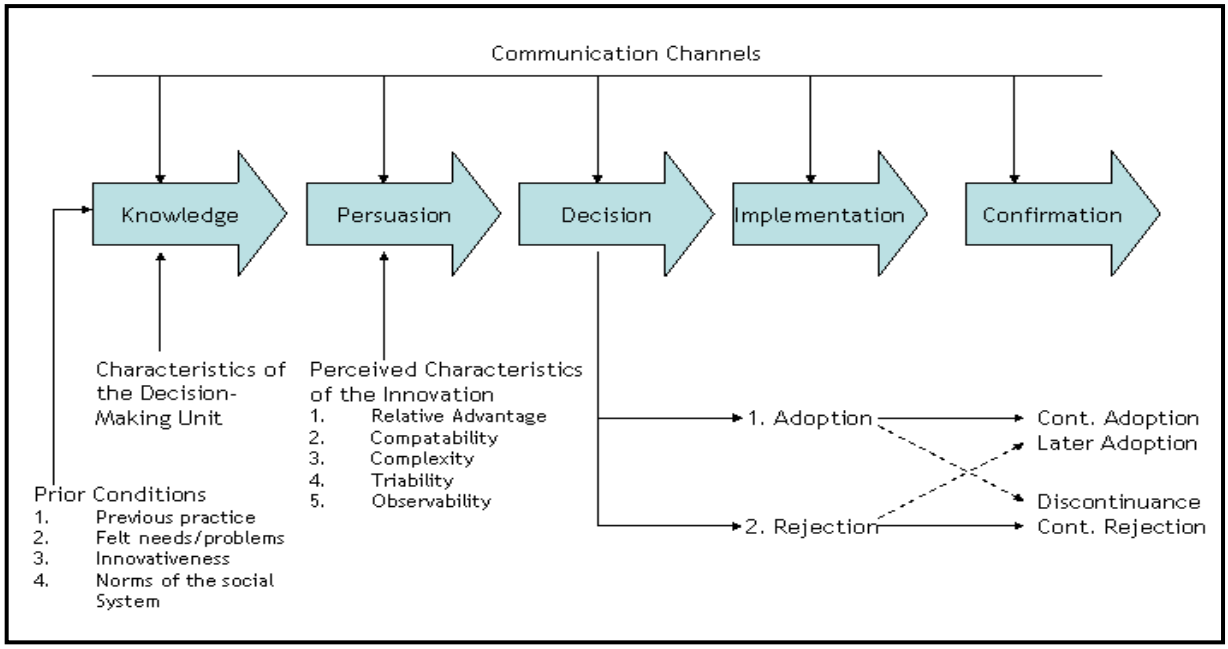

Figure 2.5 Model of five stages in innovation decision process theory (Rogers, 2003, p. 163)

2.6.5 *Model of personal computer utilization*

Originally obtained from the theory of human behaviour (Triandis, 1977), the MPCU model was developed by Thompson, Higgins, and Howell (1991). Thompson et al. (1991) added improvements to Triandis (1977) model to forecast PC operation behaviour. The variables of this model are job-fit, complexity, long term consequence, effect towards use, social factors, and facilitating conditions. The results demonstrate that social influence (social norms), difficulty of use, suitability between the job and PC abilities, and lasting consequences strongly effect how the PC is utilized. The model therefore aims to forecast user behaviour rather than intention (Thompson et al., 1991). Furthermore, they found that:

Behaviour is determined by what people would like to do (attitudes), what they think they should do (social norms), what they have usually done (habits), and by the expected consequences of their behaviour. (Thompson et al., 1991, p. 126)

They found that user behaviour is measured by attitudes, social norms, habits, and the expected consequences of their behaviour (Thompson et al., 1991). The concepts of job fit, complexity, long-term consequences, social factors, and facilitating conditions, variables represented in MPCU, are also available in different technology acceptance models. For instance, the job-fit variable captures the concepts of *performance expectancy*, *perceived usefulness*, *relative advantage*, and added *motivation* that are available in different technology acceptance models. The MPCU model is presented in Figure 2.6.

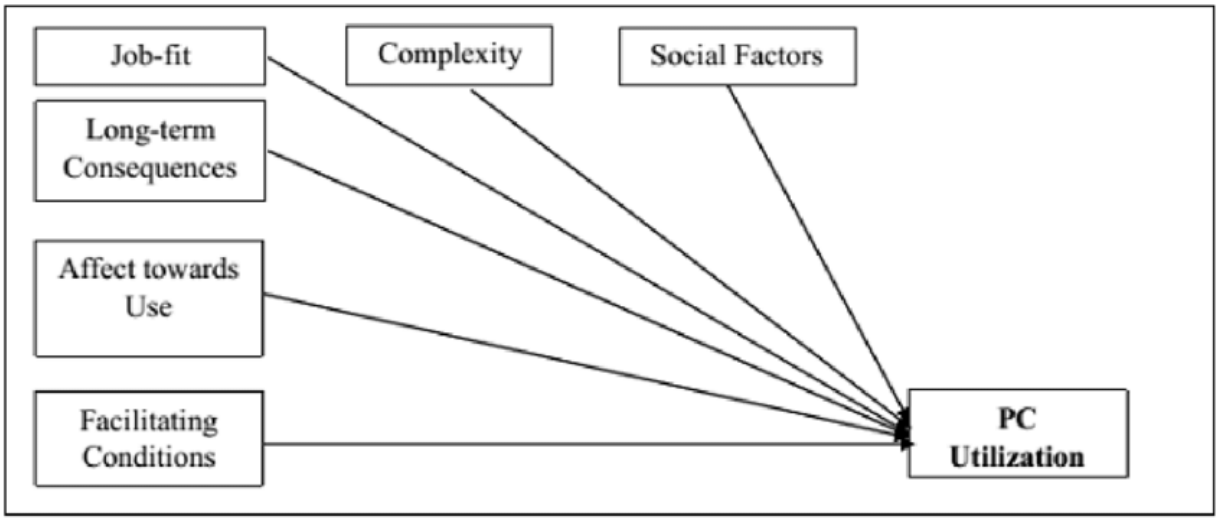

Figure 2.6 Model of personal computer utilization (Thompson et al., 1991, p. 131)

2.6.6 *Motivational model*

Davis et al. (1992) applied motivational theory to the process of technology acceptance to develop the *motivational model* (MM). The model discriminates between the effects of extrinsic and intrinsic motivation on the level of technology acceptance. Extrinsic motivation is the desire to do an activity because that activity will help them to achieve certain outcomes. Intrinsic motivation is the desire to carry out an activity for no reason other than to perform it (Davis et al., 1992).

The results of their study indicate that people use computers at work because they have been influenced by how effective the computer can be in improving their job performance, thus increasing their pay or earning them a promotion (extrinsic motivation) and the satisfaction they get from using it (intrinsic motivation). Davis et al. (1992) and Igbaria et al. (1996) found

that the *motivational model* (MM) is useful in understanding new technology adoption and use. The concepts of extrinsic and intrinsic motivation have been used previously in other technology acceptance models using different constructs.

For example, *perceived usefulness, comparative advantage* and *outcome expectation* are different variables that capture the concept of *extrinsic motivation*. On the other hand, *hedonic motivation* and *hedonic outcomes* capture the concept of intrinsic motivation. However, even though the MM was useful, the model explained only between 28% (Igbaria et al., 1996) and 62% (Davis et al., 1992) of the variance in *behavioural intention*. The fact that between 72% and 38% of the variance was unexplained suggests the need to conduct further research to find out if there are any unmeasured variables that could contribute to the variance in behaviour.

2.6.7 Combined TAM and TPB (C-TAM-TPB)

Taylor and Todd (1995a) developed the combined TAM and TPB model by combining the predictors of the TPB model with the *perceived usefulness* and *perceived ease of use* values from the TAM model. Analysing data from students using the facilities of a computing information resource centre, the C-TAM-TPB was found to reasonably explain user behaviours, with 'experience' as a moderating variable.

The findings of several studies, for example, Chang and Chang (2009), have indicated that the combined model is better than the TPB and the TAM individually in terms of their ability to explain behavioural intention. Furthermore, Samaradiwakara and Gunawardena (2014) have claimed that, with 'experience' as a moderating variable, the C-TAM-TPB is an acceptable model for measuring the behaviour of individuals with previous or no experience when dealing with a technological system. They determined that moderators, such as experience and gender, are necessary in for explaining the variables of all models (Samaradiwakara & Gunawardena, 2014).

2.6.8 *Social cognitive theory* (SCT)

In 1995, Compeau and Higgins (1995) developed and utilized *social cognitive theory* SCT) to provide a framework to explain computer usage. SCT is a widely accepted theory, which demonstrates how ongoing self-influence motivates and regulates human behaviour (Bandura, 1991).

In their developed model, Compeau and Higgins (1995) used some of the constructs included in the SCT to investigate the relationship between cognitive variables (e.g., *self-efficacy, performance-related outcomes expectations,* and *personal outcome expectations*) and affective variables (*inhibition, ego, anxiety*) and usage.

After developing and evaluating a measurement based on the proposed model, Compeau and Higgins (1995) conducted a survey of Canadian managers and professionals. They analysed the structural model using a regression-based technique (partial least squares PLS), and found that, in total, the model had the ability to explain about 32% of variance in computer usage. Results indicated that *self-efficacy* was the most powerful predictor of usage when compared to variables such as *outcome expectations* (especially those related to job performance), *affect*, or *anxiety*.

According to Ratten (2013), SCT has the advantage over other models and theories because it integrates both individual and organizational level analysis, which means that it incorporates technology innovation that is not always under the control of users but mandated by an organization as well. Despite the advantages of the SCT model, the remaining 68% of unexplained variance in use behaviour (Compeau & Higgins, 1995) suggests that further research be conducted to explore other variables and propose models that might explain user behaviour.

2.6.9 *Unified theory of acceptance and use of technology*

Research in the field of technology acceptance has received significant attention from different scholars around the world. Researchers have proposed different theories and models of technology acceptance to predict user adoption of technology. These models have been widely implemented and extended. Venkatesh et al. (2003), for example, carried out research which involved testing the constructs of previous models by reviewing the user acceptance literature, and experimentally comparing the models and their extensions to develop the UTAUT and validate it. According to the same study, the UTAUT was found to perform better than all eight other individual models.

It was able to explain how 70% of the variance in user intention to use IT (Venkatesh et al., 2003) while the eight previous models gave 17% and 53% of the variance in user intention to

use an information system. Thus, the UTAUT appeared to be the best model for providing a functional instrument for managers wanting to evaluate the possibility of successfully introducing a new technology. Additionally, the UTAUT facilitates the understanding of the reasons of user acceptance and adoption, in order to effectively design interventions, including instruction and marketing aimed at users who might not be interested in adopting and using new technology (Alwahaishi & Snásel, 2013; Venkatesh et al., 2003) .

The original UTAUT model contains several constructs that determine the relationship between an individual and their acceptance of a technology. These factors include *performance expectancy, effort expectancy, social influence,* and *facilitating conditions.* The moderators in the model include gender, experience, age, and voluntary use. These moderators arbitrate the impact of the constructs on *behavioural intent* and *usage* (Venkatesh et al., 2003).

The evidence-based results obtained from previous work (Kijsanayotin, Pannarunothai, & Speedie, 2009; Wills, El-Gayar, & Bennett, 2008; Zhou, 2008), proved that the UTAUT model generates improved acceptance of *behavioural intentions* and *usage* of different technologies compared to previous acceptance models (Venkatesh et al., 2003; Wu, Tao, & Yang, 2007). Accordingly, Venkatesh et al. (2012) have stated that UTAUT has acted as a median model since the time it was created, and has been used in the study of various technologies in different organizations. Figure 2.7 identifies the individual elements of the UTAUT model and demonstrates their directional interaction with one another.

Venkatesh et al. (2012) further defined and extended their model to create UTAUT2 by adding three variables – *hedonic motivation, price value,* and *habit*. They also discarded the moderator 'voluntariness' in order to tailor it to an end user use context, because the majority of consumer behaviours are intentional, thereby making the variable of voluntariness redundant. Their study authenticated the noteworthy constructs of *hedonic motivation, price value,* and *habit* in manipulating and controlling technology application in the newer model, which is customized to the framework of end user acceptance and use of technology (Venkatesh et al., 2012).

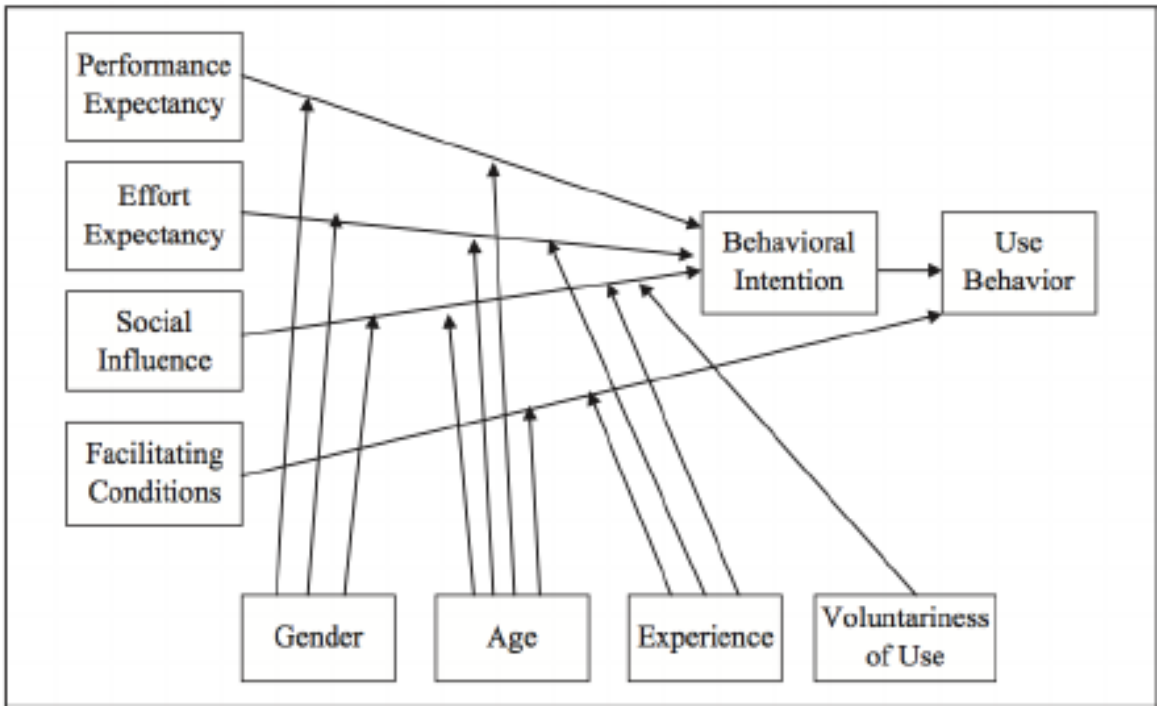

Figure 2.7 Unified theory of acceptance and use of technology (Venkatesh et al., 2003, p. 447)

The UTAUT was adopted for the current study (as a base model) because of its inclusiveness and high illustrative and predictive powers compared with other theoretical models. Previous models are relatively low in explanatory power in terms of *behavioural intention*, ranging between 30% and 40% only. The integrated acceptance model (UTAUT) reports a powerful explanation, amounting to 70% (Venkatesh et al., 2003). The UTAUT model is the most recent model to measure the acceptance and intention to use IT, developed by researchers who considered most of the previous work on technology acceptance to produce a powerful framework. For the purpose of this research, a theoretical framework based on the original UTAUT was employed, with the exception of *facilitating conditions* and *usage behaviour*, and adding external constructs.

From the perspective of the researcher, the eight reviewed models had their advantages and disadvantages, and are suitable for application in some research areas more than others, according to the needs of that research. However the UTAUT, which includes all the elements of these models, is one of the most comprehensive models that can be used in relation to information systems. Many experiments have proved its ability to predict, and explain, the phenomena being studied to reach reliable results. Although there is a UTAUT**2** as an extension of the original UTAUT, it was not considered suitable for this research because some

features of UTAUT**2** were not suitable for the study context. It was felt more appropriate to extend the original UTAUT with features from the students' perspective. (See Chapter 4 for more details about the refined research model.)

2.7 Technology adoption in developing countries

Numerous researchers, including Heeks (1999), Conceição, Heitor, Gibson, and Shariq (1998) and Saunders, Warford, and Wellenieus (1994) have highlighted ICT as a possible driver of socioeconomic development in the developing world. Additionally, studies such as those conducted by Slater and Tacchi (2004), Wilson (2004), Caspary and O'Connor (2003) and Chapman and Slaymaker (2002) have found that communities benefit from greater healthcare and education, better access to key resources and knowledge, and numerous income opportunities as a result of telecommunications infrastructure development. Hewitt de Alcántara (2001) asserts that much of the commentary regarding the developing world's adoption of ICT focuses on how sustainable acceptance is on a local level, as well as how ready the local community is to accept and embrace new technology. Essentially, therefore, there is an emphasis on how well ICT implementation fits the needs of local people and how likely it is that it will be accepted in the long run.

Numerous studies have explored the acceptance of technology in the developing world, with researchers focusing specifically on ICT contexts, including e-learning, e-health, e-commerce, e-government, and so on. Researchers suggest further investigation of the effects of different constructs included in their proposed theoretical models (AlMarwani, 2016; Alshehri, 2012).

Datta (2011) notes that few researchers have explained the reason behind different levels of user acceptance in the developing world despite the evident importance of technology in these regions. It is necessary for existing models and theories to be contrasted and re-evaluated, given the variance in adoption levels between the developed and developing worlds.

Specifically in the Arabian region, prior research has considered different facets of information technology contexts. For example, in an e-government context and individual level of acceptance, Alshehri (2012) proposed the UTAUT model to investigate the factors that influence e-government acceptance among citizens in Saudi Arabia. In addition, Alshehri (2012) proposed two additional constructs to the UTAUT model (i.e., *website quality* and

trust). Alshehri's (2012) results showed that the constructs of the UTAUT model were all significant towards behaviour intention except social influence.

Similarly, in Saudi Arabia, Alzahrani (2014) proposed the UTAUT model with the inclusion of three factors (i.e., *privacy, trust* and *culture*). The findings showed that *performance expectancy, effort expectancy, social influence, privacy, trust* and *culture* are the main determinants affecting the *behavioural intention* to adopt e-government services. *Facilitating conditions*, on the other hand, did not affect behavioural intention to use e-government services.

Several other studies have applied different acceptance theories in developing countries on an individual level to investigate e-government acceptance. In Lebanon, Fakhoury and Aubert (2017) applied an updated version of the UTAUT to investigate citizens' acceptance of e-government services. Similarly, Abu-Shanab (2017) applied the TAM and included *security and privacy assurance* as a separate factor to determine citizen's acceptance in Jordan. In Oman, AlSalmi and Hasnan (2016) incorporated *perceived risk and trust* into TAM to investigate citizens' acceptance.

The work of Ibrahim, Hilles, Adam, Jamous, and Yafooz (2016) investigated the acceptance of e-government services in Nigeria by proposing a model that combines elements from TAM (*perceive usefulness* and *perceived ease of use*) and UTAUT (*social influence, facilitating conditions*) and proposing additional constructs (self-efficacy). In Indonesia, Susanto and Goodwin (2013) conducted an initial survey to determine the factors that influence citizens' acceptance of SMS-based e-government services to formulate the research model. Susanto and Goodwin (2013) applied an extended version of TPB with several factors identified from their exploratory survey (for example, *perceived reliability and quality of the information, perceived cost, perceived personal relationship, perceived compatibility, perceived risk, perceived responsiveness*).

Other recent studies investigating e-government acceptance in different developing countries include Kuwait (Alenezi, Tarhini, Masa'deh, Alalwan, & Al-Qirim, 2017), Qatar (Al-Yafi, Hindi, & Osman, 2016), United Arab Emirates (Rodrigues, Sarabdeen, & Balasubramanian, 2016) and Egypt (Mostafa, 2014).

On an organizational level, Alghamdi, Goodwin, and Rampersad (2013) proposed a framework for e-government based on a technology-organization-environment framework (TOE). The proposed framework of Alghamdi et al. (2013) integrated seven dimensions of e-government organizations. The dimensions include *strategy, user access, e-government program, portal architecture, business process, ICT infrastructure* and *human resources*. Similarly, Pudjianto, Zo, Ciganek, and Rho (2011) examined the factors for e-government assimilation in Indonesia by proposing a model based on the TOE framework.

A major determinant of the establishment of e-commerce in developing countries is the nature of the country itself. Several studies have noted that the technological, economic, legal, and financial frameworks in place in a country greatly influence the adoption of e-commerce (Molla & Licker, 2005). In the Arab region and individual level of acceptance in Saudi Arabia, Alqahtani (2016) proposed a theoretical model that combines several constructs from different models such as UTAUT, TAM and TBP to investigate online shopping adoption. In addition, Alqahtani (2016) proposed additional constructs that relate to e-commerce context and culture. Similarly, Alsharif (2013) proposed an extension to the UTAUT to investigate the factors that influence online shopping.

Al Ganideh and Yaseen (2016) applied the UTAUT to explain e-commerce acceptance by Jordanian travel agencies. In Iraq, Al-Najjar and Jawad (2016) investigated the perceptions of Iraqi citizens about using e-commerce, and their readiness to do transactions by this mean. Al-Najjar and Jawad (2016) proposed a model that includes several constructs such as *perceived usefulness* (TAM), *perceived security, perceived quality, perceived cost of use* and *perceived privacy.* The work of Khan, Talib, and Faisal (2015) examined the factors that influence the use of M-commerce in Qatar. Khan et al. (2015) proposed the UTAUT with the addition of one external factor (*perceived information security*).

On the other hand, the work of Al-Hudhaif and Alkubeyyer (2011) investigated e-commerce adoption in Saudi Arabia on an organizational level by using the *perceived e-readiness model* (PERM). Rahayu and Day (2015) applied the TOE framework to investigate the factors that influence small and medium enterprises (SMEs) in Indonesia in adopting e-commerce. Similarly, Ahmad, Abu Bakar, Faziharudean, and Mohamad Zaki (2015) applied the TOE

framework in Malaysia to empirically examine determinants of e-commerce adoption among Malaysian small and medium enterprises (SMEs).

In the area of e-health, several research studies have used technology acceptance models in developing countries, including TAM and UTAUT, to examine technology acceptance within health care organizations. Many previous studies have adopted and expanded TAM and UTAUT with additional constructs. For example, Nuq and Aubert (2013) applied the UTAUT to investigate e-health marketing services in five developing countries (Malaysia, Pakistan, Uganda, Bhutan, and Mexico). In Saudi Arabia, Aldosari (2003) used the TAM to examine physician attitudes toward electronic health record EHR adoption. In Thailand, Kijsanayotin et al. (2009) applied the UTAUT to investigate the factors influencing health information technology adoption in Thailand's community health centres.

2.8 Technology adoption in the education sector

Many classrooms are now beginning to implement technological tools to support teaching and learning, including the use of mobile devices, simulation and analysis software and course management programs. Additionally, greater educational value is being offered to users by schools through higher investment in new technologies.

Journals focused on education and related topics demonstrate a rise in the number of technology acceptance studies being conducted over the last number of years, which also signifies an increased focus on the interaction between technology and users in an education system amongst education researchers. With regards to educational technologies, the existing literature is underpinned primarily by technology acceptance models, reflecting a greater focus on the implementation of technology in the classroom, as well as the use of technology as a tool to help students improve their ability to solve problems independently.

Smaldino, Lowther, and Russell (2008) suggest that students find learning more appealing when it is enjoyable and fun, and technology therefore increases students' engagement in learning. Technology has indeed been found to improve students' learning, overall (Bitter & Pierson, 2001; Wiske, Rennebohm Franz, & Breit, 2005).

Students' engagement in learning increases in line with their motivation, on which educational technology has a positive impact (Smaldino et al., 2008). Educational technology is widely

recognised as not only supporting students, but also teachers (Ashburn & Floden, 2006; Egbert, 2009; Januszewski & Molenda, 2013; Jonassen, Howland, Marra, & Crismond, 2008; Kent, 2008; Trollip & Alessi, 2001; Wiske & Breit, 2013). Additionally, Wiske and Breit (2013) point out that teachers benefit from the integration of technology as it allows them to provide richer learning environments for students, thus making classroom time more effective.

It is asserted that students' learning outcomes are highly positively related to the proper use of technology within the educational setting. Additionally, the integration of technology has been shown to have collaborative benefits, encouraging greater sharing between teachers and students and allowing students to share their opinions with teachers more readily.

Over the last decade, various technology acceptance models have been applied in the educational context to investigate students' and teachers' acceptance of using different kinds of technologies for learning and teaching. On an individual level, Shen and Chuang (2010) applied the TAM with additional factors to investigate the intentions of elementary school students regarding the use of interactive whiteboards. Shen and Chuang's (2010) findings showed that interactivity, perceived self-efficacy, perceived ease of use, and perceived usefulness were positive and significant towards *behavioural intention.*

Similarly, Inan and Lowther (2010) proposed an acceptance model that is originated from TAM with additional constructs to investigate the factors that influence teachers' acceptance of integrating technology in the classroom in K-12 education. Inan and Lowther's (2010) findings indicate that school-level factors, such as availability of computers, technical support and overall support, significantly influence teachers' beliefs and readiness to adopt technology.

The work of Gu, Zhu, and Guo (2013) explored the difference between teachers' and students' acceptance of technology in K-12 education. Gu et al. (2013) proposed *outcome expectancy* (as *perceived usefulness*), *task-technology fit* (as *effort expectancy*), *social influence* and *personal factor (self-efficacy* and *personal innovativeness*). Their findings showed that personal factors were the most influential in terms of technology acceptance.

Furthermore, Chen, Huang, and Shih (2002) proposed the TAM to investigate the related factors that affect usage of web-based teacher training in elementary and high school. Several

additional constructs were included in the proposed model, such as *computer self-efficacy, autonomous learning, social relationship* and *external expectation*. Chen et al. (2002) showed that *perceived usefulness* and *perceived ease of use* have a strong, direct effect on attitude toward using.

There was an investigation of tolerance towards IT in schools among K-12 teachers in Canada by Birch and Irvine (2009). The study used a mixed method design and employed the UTAUT. The results suggested that *social influence, effort expectancy, facilitating conditions,* and *performance expectancy* all had a substantial impact on levels of tolerance and acceptance among Canadian teachers.

Šumak, Polancic, and Hericko (2010) proposed the UTAUT to investigate undergraduate students' perceptions about using *Moodle,* which is a learning management system (LMS). *Performance expectancy*, *effort expectancy* and *social influence* were found to significantly influence *behaviour intention* to use *Moodle*.

On an organizational level, Karim and Rampersad (2017) proposed a conceptual framework to investigate the factors that influence cloud computing adoption in Princess Nourah University in Saudi Arabia. Karim and Rampersad's (2017) proposed model combines the TOE framework with the Hofstede model to include cultural factors (including language and religion). The results showed that *relative advantage*, *compatibility*, *top management support, readiness, competitive pressure, regulatory support,* and *high masculinity* have a positive influence on the adoption of cloud computing, while *security concerns*, *high uncertainty avoidance,* and *high power distance* have a negative influence. However, the results showed that *language* and *religion* do not have any significant influence on cloud computing adoption.

2.9 Previous studies in M-learning acceptance

Over the last few years, an abundance of M-learning acceptance studies has been featured in academic texts and learning resources. The studies differed based on the acceptance model used [the *technology acceptance model* (TAM), *theory of reasoned action* (TRA), the *theory of planned behaviour* (TPB)], the sample population (pupils, lecturers, tutors, shareholders, and administrative staff), the conditions (university, K-12 schooling), the subject (mathematics, business, science, languages, IT, engineering), and the mobile devices (tablets, smartphones).

The work of Wang et al. (2009) uses a university setting and the UTAUT acceptance model to explore the factors that influence M-learning acceptance. Wang et al. (2009) incorporated two additional constructs (i.e., *self-management of learning* and *perceived playfulness*) into the model. Furthermore, to find out whether gender and age have a substantial impact on the acceptance of M-learning. When it comes to gender and age, their findings suggest that age variations temper the impact of social influence and effort expectancy on M-learning intention and that gender variations regulate the impact of self-management of learning and social influence on M-learning use intention. They discovered that *performance expectancy, social influence, self-management of learning, perceived playfulness,* and *effort expectancy* are all substantial determinants of behavioural intention in relation to M-learning acceptance (Wang et al., 2009).

In conducting an online survey, Huang et al. (2007) aimed to identify the variables which affect acceptance of M-learning in Taiwan universities among graduates and undergraduates. The study added additional constructs to the TAM model (perceived mobility value and perceived enjoyment). The findings confirmed the suggested hypothesis and showed that the effect of *perceived ease of use, perceived usefulness and perceived enjoyment* towards *behavioural intention* is mediated by attitudes. Furthermore, the effect of the *perceived mobility* value towards *behavioural intention* is mediated by perceived usefulness (Huang et al., 2007).

The work of Cheon, Lee, Crooks, and Song (2012) explored students' intentions towards M-learning in a university at the United States. Using structural equation modelling (SEM) to conduct aspects of their analysis, and according to their findings, the factors of attitude, subjective norm and behavioural control were significant, and the decision to apply the theory of planned behaviour (TPB) model was successful, as it explained students' M-learning readiness very well (87.2% of intention to adopt M-learning). The researchers considered it worthy of note that almost all of the pupils owned mobile phones (Cheon et al. (2012).

In an earlier study, selected variables of the UTAUT model were used to explore the variables most likely to influence *behavioural intention* towards M-learning technologies among pupils (Lowenthal, 2010). The variables explored were *effort expectancy, self-management of*

learning, and *performance expectancy*. The moderator variables in this study were gender and age. Lowenthal (2010) discovered that *self-management of learning* was unlikely to be influential. Similarly, gender and age were unlikely to have any significant effect on the constructs either. On the other hand, *effort expectancy* and *performance expectancy* did have the potential to positively affect *behavioural intention* among students (Lowenthal, 2010).

Iqbal and Qureshi (2012) chose to combine the UTAUT and TAM acceptance models. They focused more heavily on the TAM constructs of *perceived ease of use* and *perceived usefulness.* The UTAUT constructs featured were *facilitating conditions* and *social influence*. Crucially, the researchers categorised *perceived playfulness* as a factor defined by 'intrinsic motivations' or, in other words, a personal enthusiasm for technology. The findings showed that *perceived ease of use, facilitating conditions,* and *perceived usefulness* have the potential to change pupil attitudes towards M-learning. *Social influence* actually had a negative impact on the willingness to embrace M-learning. Finally, *playfulness* was unlikely to have any kind of substantial impact (Iqbal & Qureshi, 2012).

The work of Abu-Al-Aish (2014) explored the variables influencing student acceptance of M-learning at Brunel University. The study focused on a sample of 174 subjects, each of whom completed an online survey. The results can reasonably be said to explain 55% of the intention to use M-learning demonstrated by this targeted group. Abu-Al-Aish (2014) used the *unified theory of acceptance and use of technology* (UTAUT), but withdrew the factors of *facilitating conditions* and *use behaviour*, while adding *personal innovativeness* and *quality of service* to the model. Like earlier research, it found that *personal innovativeness, effort expectancy, quality of service, performance expectancy,* and *the influence of lecturers (social influence)* all have a substantial impact on *behavioural intention* towards M-learning. It should be noted that the effects of gender and age were not included and tested in the model. However, previous experience of using mobile devices was found to impact the constructs towards *behavioural intention* (Abu-Al-Aish, 2014).

In the Saudi Arabian context, Seliaman and Al-Turki (2012) applied the *technology acceptance model* (TAM) as a way to explore the use of mobile devices for learning, such as interacting with learning resources and educational data via mobile devices. The study data were gathered via the use of a survey. It was made available to pupils at the College of Computer Science and

Information Technology at King Faisal University. Unfortunately, according to the researchers, there are a number of key weaknesses associated with the study design.

For example, the researchers used quite a basic correlation method to interpret the findings. Even more of a problem is the fact that only male pupils were invited to take part (Seliaman & Al-Turki, 2012). This meant that the results have a low level of applicability. Of the individuals targeted, 55 produced a complete survey. Pearson correlation analysis was used to interpret the results and determine the legitimacy of the study hypothesis. The outcomes indicated that *perceived innovativeness* was the only factor to significantly impact *behavioural intention* (Seliaman & Al-Turki, 2012).

Similarly, the work of Nassuora (2012) also investigates the acceptance of M-learning among Saudi Arabian learners. Nassuora (2012) employed a quantitative design, in the form of a survey. Responses were collected from 80 participants. The outcomes showed that a large proportion of Saudi Arabian students are happy and willing to embrace M-learning.

More recently, AlMarwani (2016) conducted a PhD study that utilized the extended *unified theory of acceptance and use of technology* (UTAUT2) to identify the factors responsible for *use behaviour* and the *behavioural intention* to use mobile technologies in learning and teaching English as a foreign language. The factors were:

- *performance expectancy*
- *effort expectancy*
- *social influence*
- *facilitating conditions*
- *hedonic motivation*
- *price of devices*
- *price of services*
- *habit.*

These factors could predict behavioural intentions to use mobile technologies in learning and teaching English as a foreign language (EFL) and use behaviour. Data were collected from 878 students and 65 faculty members by conducting two cross-sectional surveys at Taibah University in Saudi Arabia. According to her findings, the following five factors were responsible for the *behavioural intention* to use mobile technologies in learning EFL among

student, facilitating conditions, hedonic motivation, performance expectancy, habit, and *social influence.*

Badwelan et al. (2016) applied UTAUT to determine the factors that influenced the students' intention to use M-learning via smart mobile devices. Two factors were added to the original UTAUT model, *personal innovativeness* and *self-management of learning*. Data were collected from three universities in the kingdom, King Abdul Aziz University, King Saud University, and King Fahad University. Their findings indicated that all factors included in their model were significant in influencing *behavioural intention* to use M-learning (Badwelan et al., 2016).

In the K-12 context, Holden and Rada (2011) distributed a survey to 378 K-12 teachers by applying the TAM model. Out of the 378 surveys, 99 were returned. The findings showed that the redefined *perceived ease of use* construct, which included *usability*, and *technology self-efficacy* were vital in understanding teachers' technology acceptance and their technology usage behaviour. The recommendation was that extra teacher training sessions could help them to feel more confident about using M-learning.

In 2015, AlShemmari (2015) constructed a theoretical model for predetermining and justifying ICT applications (inclusive of M-learning) among female science teachers in primary schools. The study gathered data from 500 teachers in Kuwait. It focused on a variety of cognitive variables such as usefulness, external barriers, computer self-efficacy, subjective norms, attitude towards using ICT, and ease of use. The results suggested that the only factor which didn't have much of an effect was external barriers. Usefulness, computer self-efficacy, subjective norms, and ease of use all had a positive impact on perceptions of the value of IT for learning outcomes.

The work of Lin, Fulford, Ho, Iyoda, and Ackerman (2012) used a combined method design to explore perceptions, attitudes, and expectations of M-learning among teachers. They did this by incorporating elements of the TAM method. Only 10 study subjects were involved, which could negatively affect the study's applicability. Nevertheless, the outcomes suggest that teachers feel confident about assimilating M-learning into their schooling programs. The investigated factors, such as *attitude towards technical skills, perceived technology self-*

confidence, perceived ease of use of mobile technologies and *perceived usefulness of mobile technologie*s, were found to be significant predictors of M-learning acceptance (Lin et al., 2012).

By conducting a mixed method study, Osakwe et al. (2016) applied the original UTAUT model to determine the factors that influence learners' and teachers' acceptance of M-learning at Namibian secondary schools. Their findings showed that *performance expectancy, effort expectancy*, and *social influence* are significant predictors of M-learning acceptance.

Ali and Arshad (2016) proposed the UTAUT model be used to determine factors influencing students' acceptance of M-learning in high schools in Egypt. The researchers added enjoyment, interactivity and mobility to the original UTAUT model. However, their research paper did not report the results of the proposed model and its constructs. Table 2.1 summarises the studies conducted using the acceptance models in the literature.

Table 2.1 Summary of the previous studies in M-learning conducted using different technology acceptance models

Author	Theoretical model	Research purpose if available	Findings	No. of partici-pants	Context	Methodology	World region
Wang et al. (2009)	extended UTAUT	Investigate the determinants of M-learning acceptance and to explore whether age or gender differences play a significant role in the acceptance of M-learning	Performance expectancy, effort expectancy, social influence, perceived playfulness and self-management of learning were significant determines of M-learning.	330	higher education	quantitative	Asia / Taiwan
Huang et al. (2007)	TAM	To propose and verify that the technology acceptance model TAM can be employed to explain and predict the acceptance of M-learning	The effect of perceived ease of use, perceived usefulness and perceived enjoyment towards behavioural intention is mediated by attitudes confirmed hypothesis. Further, the effect of perceived mobility value towards behavioural intention is mediated perceived usefulness.	313	higher education	quantitative	Asia / Taiwan
(Cheon et al., 2012)	theory of planned behaviour TPB	Explores students' intentions towards M-learning at a public research-intensive university located in the Southwest, United States.	The factors attitude, subjective norm and behavioural control were significant towards behavioural intension to use M-learning .	177	higher education	quantitative	US
Lowenthal (2010)	partial UTAUT + additional factors	Examined the factors or determinates that impact the behavioural intention of students to use M-learning technology.	Performance expectancy and effort expectancy significantly influence behavioural intention while self-management of learning did not.	113	higher education	quantitative	Not specified
Iqbal and Qureshi (2012)	combination of UTAUT + TAM	To extend the understanding of student's M-learning adoption.	Perceived usefulness, perceived ease of use and facilitating conditions positively affect behavioural intention. Social influence and perceived playfulness were insignificant constructs towards behavioural intention.	250	higher education	quantitative	Asia / Pakistan

Author	Theoretical model	Research purpose if available	Findings	No. of partici-pants	Context	Methodology	World region
Abu-Al-Aish (2014)	UTAUT	to investigate the factors influencing university students‟ acceptance of M-learning	Performance expectancy, effort expectancy, lecturer influence, quality of service and personal innovativeness were found to influence behavioural intention towards M-learning acceptance.	174	higher education	quantitative	UK
Seliaman and Al-Turki (2012)	extended TAM	To examine the use of mobile technologies for accessing course materials and related information to their discipline, acquiring and sharing knowledge, and other learning activities	Perceived innovativeness was the only supported construct. No significant influence was found on behavioural intension from other factors Perceived usefulness, perceived ease of use, ICT anxiety.	55	higher education	quantitative	Saudi Arabia
Nassuora (2012)	UTAUT	To study main factors that affect using m- learning that focus on higher education students in Saudi Arabia.	Performance expectancy and effort expectancy positively influence behavioural intention. However, social influence and facilitating conditions did not influence behavioural intention.	80	higher education	quantitative	Asia / Saudi Arabia
AlMarwani (2016)	original UTUAT2	To identify the factors responsible for use behaviour and the behavioural intention to use mobile technologies in learning and teaching English as a foreign language.	Student results: performance expectancy, social influence, facilitating conditions, hedonic motivation, habit significantly influence behavioural intention. Furthermore, experience, age and gender were found to moderate the relationship between constructs and behavioural intention. No significant relationship was found between effort expectancy, price of device, price of service and behavioural intention.	878 students 65 lecturers	higher education	quantitative	Asia / Saudi Arabia

Author	Theoretical model	Research purpose if available	Findings	No. of partici-pants	Context	Methodology	World region
			Lecturer's results, effort expectancy and habit significantly influence behavioural intention. Gender was the only moderator that affected the relationship between supported constructs and behavioural intention. No significant relationship was found between performance expectancy, social influence, facilitating conditions, hedonic motivation, price of device, price of service and behavioural intention.				
Badwelan et al. (2016)	extended UTAUT	To investigate and determine the possibility of acceptance in M-learning and examine the main factors that affect using M-learning in higher education students in Saudi Arabia	All tested factors, performance expectancy, effort expectancy, lecturer influence, personal innovativeness and self-management of learning self-management of learning were significant variables in influencing behavioural intention to use M-learning.	401	higher education	quantitative	Asia / Saudi Arabia
Holden and Rada (2011)	extended TAM	To determine the influence of perceived usability and self-efficacy on teachers' technology acceptance.	Perceived usability was significant towards technology usage. However, computer self-efficacy did not significantly influence perceived ease of use.	378	K-12 teachers	quantitative	US
AlShemmari (2015)	extended TAM	To develop and assess a theoretical model that can predict and explain female primary school science teachers' use of ICT including mobile technologies	Findings showed that computer self-efficacy, ease of use, usefulness and subjective norms positively affect behavioural intention. No significant effect from external barriers on behavioural intention.	500	K-12 female teachers	quantitative + qualitative	Asia / Kuwait
Birch and Irvine (2009)	UTAUT	To investigate the factors that influence preservice teachers' acceptance of information and communication technology ICT integration in the classroom	Effort expectancy was the only construct to significantly influence behavioural intention.	82 quantita-tive phase	K-12 teachers	quantitative + qualitative separate paper	Canada

Author	Theoretical model	Research purpose if available	Findings	No. of partici-pants	Context	Methodology	World region
Lin et al. (2012)	extended TAM	To examine changes in teachers' attitude, beliefs, and perceptions on teaching, learning, and mobile technology.	Findings showed that teachers had positive perceptions about using M-learning to teach. Furthermore, factors such as attitude towards technical skills, perceived technology self-confidence, perceived ease of use of mobile technologies and Perceived usefulness of mobile technologies were found to be significant predictors towards M-learning acceptance.	10 six female four male	K-12 teachers	quantitative + qualitative	US
Osakwe et al. (2016)	UTAUT	To determine the factors that influence learners and teachers acceptance of M-learning at Namibian secondary schools	Performance expectancy, effort expectancy, social influence are significant predictors towards M-learning acceptance.	20 partici-pants from each of three schools	K-12 teachers and learners	quantitative + qualitative	Africa / Namibia

2.10 Research justification

Traxler (Traxler, 2007a) has confirmed that higher education students may be ready to adopt M-learning sooner than K-12 students because more college students have their own mobile devices. In the 10 years since Traxler was writing about his research, of course, mobile technologies have permeated Saudi Arabian society from top to bottom, and have been adopted substantially by teenagers who are growing up in a world where the Internet, cell phones, text messaging and other technology dominates communication and are integral to everyday life. According to a report from Nielsen (2014), Saudi Arabia is witnessing a continuing exponential growth in smartphone adoption. The report indicates that more than 67% of the population above 16 years use smartphone. The percentage is even higher among youth 73%. Moreover, with a large population under the age of 15, the report illustrates that Saudi Arabia will remain a key growth market for smartphone makers (Nielsen, 2014).

Findings of previous studies in the K-12 cohort have encouraged the use of mobile technologies in learning across disciplines, proved students' enthusiasm to use mobile devices, and recorded better achievement among students using mobile technologies. But still, with rapid change and advancement of these technologies, understanding students is essential to successfully implement M-learning, and to ensure the economic viability of K-12 education investments (AlMarwani, 2016; Blackboard K-12, 2009).

Analysis of the literature shows that there are few M-learning acceptance studies conducted within a K-12 context. Most of these studies investigated teachers' acceptance of M-learning. Several keywords were used to search for acceptance studies conducted within the K-12 context in different databases such as EdITLib, Academic Search Complete, INSPEC and Google Scholar. As can be seen from the literature, the number of studies conducted within the university context is greater than the K-12 context. In particular, no study could be found that had investigated the factors that influence students' acceptance of M-learning in the K-12 context in Saudi Arabia.

Although reviewing related literature indicates that research in the field of technology acceptance in general, and acceptance of M-learning in particular, is increasing, further research is required to develop a robust understanding of the uptake of mobile technologies and their introduction into education.

Recently, the government of Saudi Arabia announced 'Saudi Vision 2030' to transition the country's economy from an over-reliance on oil revenues to a more balanced, investment based model. The government believes that the success of the Vision will depend in large measure on reforms in the education system generating a better basis for employment of young Saudis. Based on this Vision, the Saudi Arabian government announced its intention to digitally transform K-12 education in Saudi Arabia by removing books and replacing them with mobile technologies.

This development makes it critically important to investigate the perceptions and the acceptance of M-learning at K-12 institutions in Saudi Arabia. Bearing in mind that technologies impact on the ways that people learn, and create effective learning and teaching environments (Beetham & Sharpe, 2013), for mobile technologies to be used widely and wisely, their implementation needs to be fully informed and practically applied with reference to the specific national, social and cultural contexts in which they will function, and all the associated embedded limitations and challenges (Liu et al., 2014).

The points below identify some interesting gaps in the literature regarding the studies in the field of M-learning acceptance:

- Most perceptions and acceptance studies of M-learning in Saudi Arabia have been implemented at the university level. Therefore, there is a need for large-scale studies covering other educational institutions, such as K-12 schools.
- The majority of acceptance studies conducted in the K-12 context focused on teacher acceptance. Together with the previous point, there is a lack of a consolidated body of knowledge about K-12 students' acceptance of M-learning.
- Reviewing the work of several M-learning studies in Saudi Arabia identified several weaknesses in the studies. For example, the work of Nassuora (2012) and Seliaman and Al-Turki (2012) used a basic analysis technique to investigate the constructs of their research model (i.e., Pearson correlation) which only measures the strength of the linear relationship between two variables. Furthermore, Nassuora (2012) and Seliaman and Al-Turki (2012) did not statistically validate their findings, which brings into question the validity of their results. And no moderators were included in their proposed research model, nor in the (Badwelan et al., 2016) model.

- According to the studies in the literature, such as (Alharthi, 2016), further studies should be conducted to evaluate students' perceptions about M-learning at the K-12 level.
- From the researcher's point of view, most of the technology acceptance studies conducted in the university and at K-12 levels do not confirm and validate their statistical findings by conducting an activity involving the actual use of technology. That is, most researchers collect data for their studies and apply statistical methods as part of their analysis, then report their findings in relation to the tested theoretical model (e.g., TAM, UTAUT). Study participants may have unexpected perceptions of the factors that affect the acceptance of M-learning that will be revealed only when they engage in a practical activity.

2.11 Summary

In Chapter 2, the literature relevant to M-learning with more focus on K-12 education was reviewed. Firstly, the chapter provided the context of ICT usage in education. After that, definitions of M-learning, its growth, features and benefits were discussed. Then, the use of M-learning in a K-12 context was reviewed (including in Saudi Arabia). Next, the main theories related to innovation and technology acceptance were identified. These helped form a foundation for the development of this study's statistical model, a model based on the UTAUT. Finally, the research studies investigating the factors that affect students' acceptance of M-learning globally and in Saudi Arabia were identified and explored.

The review of the literature showed that M-learning has the potential to impact positively on the K-12 education environment. Analysis of the available literature highlighted a gap in our understanding of the factors that should be considered when deploying M-learning in K-12 education in Saudi Arabia. In order to identify the relevant and possible factors associated with M-learning acceptance, specific to the K-12 context in Saudi Arabia, there was a need to assess high school students' perceptions and attitudes towards M-learning in order to develop and refine the research model (extend the UTAUT) (Phase 1). Afterwards, statistical methods were used to investigate the significance and the impact of these factors (Phase 2). And finally, an M-learning app was developed and then used to confirm and validate the findings of the theoretical proposed model (Phase 3).

The next chapter outlines the research methodology adopted for this research. In explains the research design. It includes the development of the questionnaire, selection of participants, and the data analysis approaches and procedures used for each of the three phases of this research.

Chapter 3

Methodology and methods

3.1 Chapter overview

A research methodology is an overall approach to addressing a research problem; it requires a firm theoretical underpinning, and involves data collection, analysis and interpretation. This chapter discusses the study's research methodology. It explains and justifies the approach identified as being the best suited to this investigation and details the method implemented.

The series of procedures employed for data collection and analysis and the reasons for selecting them form the research methods and the methodology (Bell, 2014). The methodology includes the approaches and the theoretical frameworks that guided the research design. It provides justification with regard to the choice of a specific approach to gathering and analysing data instead of another (Bell, 2014). This chapter begins with the research design, and then explains the benefits of conducting mixed-method research followed by justifying the use of survey method. After that, the methods for evaluating the scales used in this research are justified. In this chapter, the research design and methods employed to conduct this research are outlined.

3.2 Research design

According to Patton (1990), the research design represents the strategy adopted to investigate the research topic by logically and coherently integrating the various research elements. To be considered effective, a research design must ensure that data are gathered and analysed in a way that permits achievement of the research aims and comprehensively deals with the research issue. Thus, it could be said that the final research outcome and accomplishment of the target results are the overall objectives of the research design. Polit and Hungler (1997, p. 191) defined a research design as 'the researcher's overall plan for answering the research question or testing the research hypothesis'. Furthermore, as added by (Creswell, 2013), the sequential stages comprising the research design are intended to permit the researcher to explain and expand the findings of one method with another method. The steps of research design and work are presented in Figure 3.1

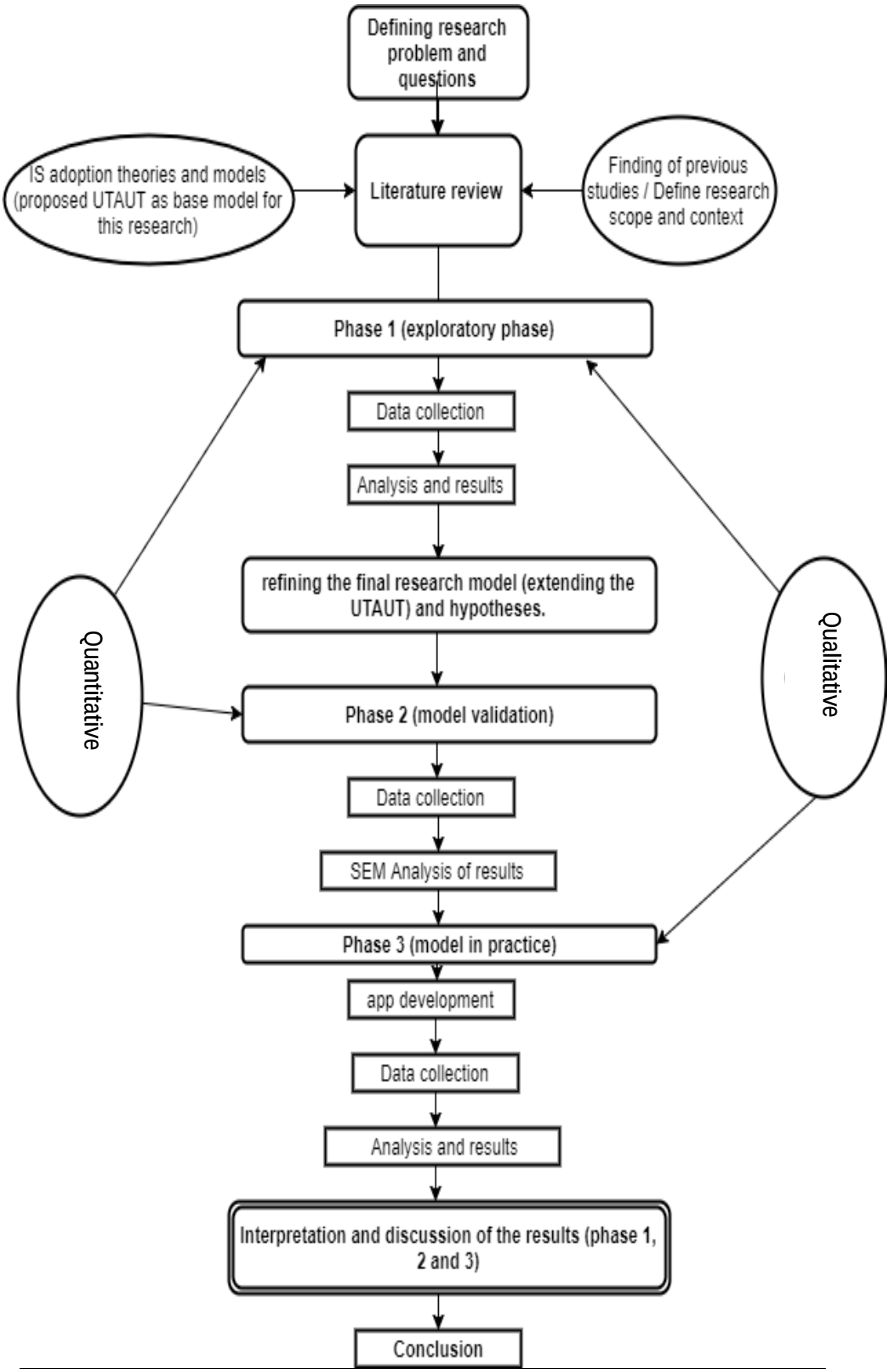

Figure 3.1 Steps of research design

3.2.1 Mixed methods research

Employing both quantitative and qualitative techniques simultaneously, the present research adopted a *mixed methods approach* (Creswell, 2013). As defined by Creswell and Clark (2007), the mixed methods approach is characterised by the fact that both quantitative and qualitative data are gathered, analysed and integrated in either a single or multiphase research approach. The use of the mixed methods approach was justified because it offers the advantages of the qualitative and quantitative research methods, and cancels out their disadvantages (Neuman, 2002). The research questions can be addressed from more than one angle, thus generating more comprehensive results, by integrating positivist and interpretivist philosophies and approaches (Neuman, 2002).

Quantitative research. Quantitative research uses numeric data and statistical analysis to search for causal relationships between the variables in the chosen research setting. It is an example of the philosophy of positivism at work. Quantitative studies are characteristically objective and must be repeatable in order to be considered reliable. Most quantitative researchers conduct surveys or experiments to generate data. Creswell (2013) and Myers (1997) explain that most quantitative studies involve a larger sample than qualitative studies, because they focus on achieving a statistical representation of the target population.

Questionnaires are amongst the most common methods used by quantitative researchers. A well-constructed survey or experiment can provide a wealth of data from large datasets with relative ease. In the social sciences, all participants are asked identical questions, and surveys can be administered online, through e-mail, by phone, in the mail, or face-to-face, and there are multiple tools available for conducting analysis. Questionnaire surveys are designed to produce quantifiable data, for example, by using ‘yes’ and ‘no’ answers or scales that indicate levels of satisfaction/dissatisfaction about particular issues, as well as quantifying demographic characteristics (Creswell, 2013).

Qualitative research. Social science researchers began to recognise the disadvantages of quantitative research during the 20th century, acknowledging that another approach might be more beneficial when studying complicated behavioural, relational, cultural, political and economic issues and relationships. Therefore, as Denzin and Lincoln (2002) explain, qualitative research began to emerge as a more popular approach in the social sciences. Qualitative research essentially aims to gain insight into human and/or social issues and events.

The research takes place in a natural setting; it is constructed through words; and the researchers take the whole context into account, that is, all of the complex factors and elements involved in the research environment (Creswell, 2013).

Qualitative researchers do not recruit participants randomly, and there are often only a small number of participants, unlike the large, random samples recruited for quantitative studies (Merriam, 1998). Yin (2013) and Myers (1997) add that qualitative studies are descriptive in nature, with researchers gaining and sharing insight through observations in the field, interviews, language and interaction. Merriam (1998) further notes that qualitative research is inductive, and that the observations are usually used to form conclusions, theories and concepts. As Mugenda (1999) explains, whilst quantitative research focuses on numerical data, qualitative research focuses on human language and words, as well as human experiences, cognition, perceptions and interpretations. According to Yin (2013), complex research topics and events are best approached through qualitative study, whilst Merriam (1998) asserts that qualitative research is most appropriate when exploring the 'how' and 'what' associated with an issue.

Mixed methods approach and triangulation. As explained by Punch (2003), when deciding whether to use either quantitative or qualitative methods or a mixture of both, researchers consider the question(s) they seek to answer and what kind of data they need. The mixed methods approach has been advocated by Kaplan and Maxwell (2005) because it affords a comprehensive insight into the research topic and at the same time enables the research results to be generalised. Being considered the most suitable approach to attain the research goals, the mixed methods approach was applied in the present study.

The use of mixed methods enables **triangulation.** Jick (1979) has argued that this approach is widely recognised as offering benefits through the use of both qualitative and quantitative methods to check the findings obtained through each. Findings are deemed more consistent and valid when the results of quantitative and qualitative data align.

3.2.2 Survey

In academic research, the method of gathering data from a sample of individuals is called the survey. Survey research is a popular and accepted method of collecting data. Moreover, if the sample population is large enough, generalisation of the finding is possible. Bryman (2008)

observed that questionnaires are the most common methods adopted for survey research. Surveys produce inherently statistical data for analysis. The aim of this research was to determine the attitudes and intentions of acceptance of M-learning by high school students in K-12 education in Saudi Arabia, and a survey questionnaire was a useful way to measure students' attitudes and intention to use M-learning.

A survey questionnaire refers to a set of questions or items carefully structured and assembled in a predefined order to be completed by participants (Payne, Payne, & Reference, 2004). Data for analysis is generated by respondents addressing the items in the questionnaire. The researcher then analyses the data and uses the conclusions of the analysis to address the original issue for which the questionnaire was designed. In this study, the research objectives were represented in the survey by a series of items to which participants responded on a Likert scale measure. The items and response format were standardised so that all participants were presented with the same choices.

The questionnaire survey was the primary method of data collection for the present study, and different questionnaires were designed and used for each phase. This was an economical and efficient way of covering the study population (several schools).

The measurement scale (justifying the use of five-point Likert scale). The Likert scale is a well-known technique used in surveys to elicit responses that reflect the attitudes and opinions of the respondent. Likert scales use ordinal numbers arranged on a continuum to indicate the degree to which an individual agrees or disagrees with an item in a survey (Bryman, 2008). In the present study, a five-point Likert scale was used instead of seven or eleven-points in order to show the responses as strongly negative to strongly positive, with the midpoint indicating a neutral response.

With the use of a five-point Likert scale, participants found it easier to read and respond to the survey items, whereas a lengthier seven or eleven-point scale would have demanded more time. In addition, the five-point Likert scale is the most commonly used type of scale in M-learning research studies, which made it easier to compare the results of this research with previous M-learning studies (Abu-Al-Aish, 2014; AlMarwani, 2016; Lai & Mao, 2014).

Translation into Arabic. All the questionnaires in this study were translated into Arabic using the double (two-way) translation method (Bailey, 2008). This method refers to a system where one person translates a questionnaire from English into Arabic and then another person translates it back from Arabic into English). If the result is different from the original questionnaire, then it is assumed that errors have occurred (Bailey, 2008). To guarantee that the Arabic version of the questionnaire conveyed the same meaning as the English, two professional translators were hired to undertake the double translation independently. Two professional translators were hired to make sure that the Arabic version of the questionnaires had the same meaning as the English ones. In addition, to ensure that the translation did not digress from the original, a panel of translation experts reviewed the Arabic translation before it was distributed. In response to the translators' recommendations, several statements were slightly modified.

Scales evaluation. Research is susceptible to human error, such as bias and inadequate research methods which can subsequently lead to irrelevant results (Worthington & Whittaker, 2006). The researcher was very cognisant of the fact that no matter how well the research was conducted, there was always the potential for inaccuracies to taint it (Carmines & Zeller, 1979). Hence scale measurement and instrument validation aimed at lessening the possibilities of inaccuracy were chosen.

The process of scale measurement followed in this study started by developing, testing, and using the survey instruments in order to avoid errors. Testing criteria included usability, reliability and validity (Finstad, 2006). This research tested the usability to identify how easily each survey instrument was understood by the participant; it also tested the reliability of the instrument to assess the stability of its measures (Carmines & Zeller, 1979). Wenger and Spyridakis (1989) posit that usability, validity and reliability are three important characteristics required to substantiate any research work, each consisting of a number of elements also outlined in Figure 3.2. The sub-section talks about those in turn.

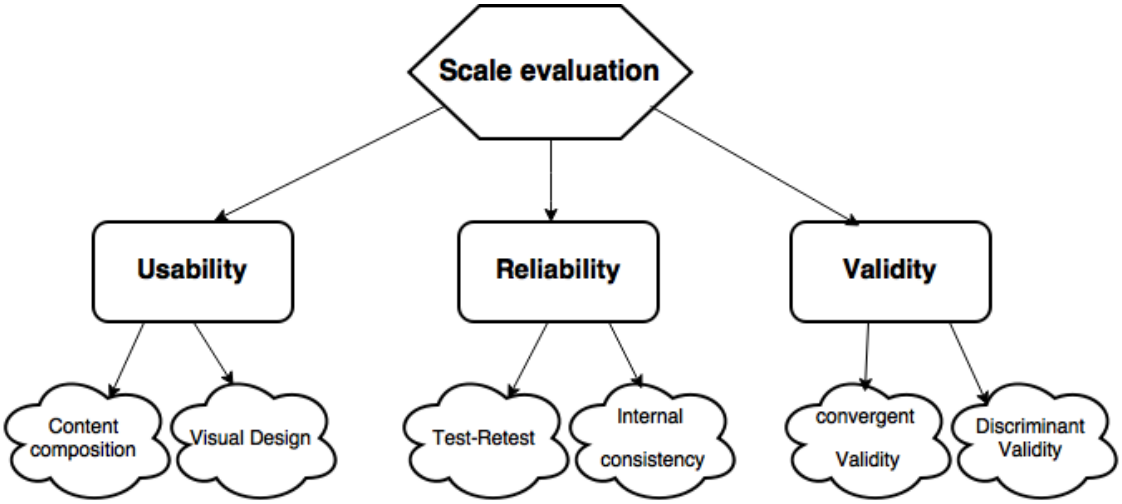

Figure 3.2 Scale evaluation steps

Usability

At the outset, this research assessed the usability of the content of the survey questionnaires. This assessment included the layout of the text, which should be legible, interesting and visually appealing. Barnum and Dragga (2001) describe usability as making systems easier to use, ensuring that they aligned with user needs and requirements. The basic elements of usability when creating visual designs include: the selection of typography, form, the unification of the text content hierarchy, and maintaining a balance between dull and overwhelming designs (Lumsden, 2007).

The questionnaires incorporated document formatting, content layout and visual design as suggested by the literature review (Smyth, Dillman, Christian, & Stern, 2006). The content was designed to be as readable as possible, so that the respondent was able to follow it easily. Care was taken to avoid lengthy questions that could exceed two lines. All of the sections of the questionnaire had simple and concise headings. The spacing between characters, words, lines and paragraphs were kept within the visual design standards which enhanced their legibility.

Reliability

One of the main concerns of this study was the reliability of the instruments and their ability to measure a construct consistently as intended (Hayes, Walton, Szomor, & Murrell, 2001).

Cronbach's alpha is the most common assessment performed to check on internal consistency (Santos, 1999). This test measures how well a survey addresses different constructs and provides reliable scores, by measuring two different versions of the same item within the same test. The Cronbach's alpha test gives a score of between '0.00' and '1.00.', A score of 0.7 is

generally accepted as a sign of reliability (Hair, Anderson, Babin, & Black, 2010). This acceptance level accommodates both the sample size and the number of available responses.

If the correlation is high, there is evidence that the questions are measuring the same underlying construct, therefore indicating a reliable scale (Hair et al., 2010). According to Tavakol and Dennick (2011), the alpha value should be at least 0.70 to achieve an 'adequate' scale and 0.80 to achieve a 'good' scale. A discussion of the reliability findings was conducted in phase 1 and 2 of this research.

Instrument validity (construct validity)

Instrument validity was tested by conducting convergent validity and discriminant validity tests. This is also termed construct validity. These tests are discussed in Phase 2 of this thesis (Chapter 5).

3.3 Research methodology implementation

Saudi Arabia was chosen as the context for the present study because the researcher is himself a product of the Saudi Arabian education system and is very keen to contribute to enhancing learning methods in his home country. Moreover, all participants were selected from Saudi Arabia because they were the easiest to recruit for the study, a 'convenience sampling' (Ritchie, Lewis, Nicholls, & Ormston, 2013), given that the researcher used to be a teacher in Saudi Arabia in Alrass city. He therefore had easy access to participants through his existing professional network.

This research investigated M-learning acceptance for high school students in Saudi Arabia in three different phases. It started with an exploratory phase (Phase 1) to formulate and refine the final research model. Then, the factors affecting students' acceptance of M-learning were investigated by hypothesising the theoretical conceptual model (validating the research model) (Phase 2). After that, the proposed factors in the model were confirmed and validated after an M-learning app was developed and distributed to the students (Phase 3).

The three phases were (Table 3.1):

Phase 1: An online questionnaire was distributed to investigate and review the attitudes of high school students towards M-learning to refine the conceptual model for this research. This phase enabled the development of the research model by considering the findings of this survey and reviewing the literature.

Phase 2: A second online questionnaire was used to investigate the proposed conceptual model developed in Phase 1. Structural equation modelling (SEM) techniques were used to test and validate the proposed model and research hypotheses.

Phase 3: A third online questionnaire was used after developing an M-learning application (English Education Quiz) to confirm and validate the findings of the UTAUT model and to discover other potential factors that affect student acceptance that had not been investigated in the UTAUT model. Furthermore, this phase identified the challenges and obstacles that affect M-learning deployment in K12 education in Saudi Arabia.

Table 3.1 Research methodology implementation

Methods	Phase	Data collection tools	Analysis
Quantitative + Qualitative	1 conceptual model development: student perceptions and attitudes towards M-learning	survey + open ended questions	descriptive analysis (quantitative) + thematic analysis (qualitative)
Quantitative	2 model validation	survey	confirmatory factor analysis – structural equation modelling.
Qualitative	3 model in practice	M-learning application (English Education Quiz) open-ended questions	thematic analysis (qualitative)

3.3.1 Phase 1. Conceptual model development: Ascertaining students' perceptions and attitudes towards M-learning.

The following subsection explains the methods used for conducting the first phase of this research.

Instrument development and measures. Students' perceptions and attitudes with regard to the use of M-learning were explored with the help of an online questionnaire. In the context of scientific inquiries, a questionnaire represents a cost-effective, reliable and uncomplicated tool for data collection (Hsieh & Huang, 2008). Exploration of Saudi Arabian high school students' perceptions and attitudes towards M-learning and identification of potential factors influencing those perceptions and attitudes were the main concerns of this phase. Furthermore, Phase 1 also sought to develop the research model. The five-sections questionnaire used to collect the

necessary data was developed based on questionnaires from a variety of other M-learning studies (Abu-Al-Aish, Love, & Hunaiti, 2012; Hussin, Manap, Amir, & Krish, 2012; Trifonova et al., 2006). There were five sections in the survey.

1 In the **first section**, general information regarding the study, completion of the questionnaire and ethical aspects was provided.

2 In the **second part**, the questions were intended to gather data about the demographic details of the participants, such as gender and level of education, without disclosing the identity of the participants.

3 In the **third part**, data about participants' attitudes regarding M-learning were derived from 13 statements based on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). An example of such statements is 'I need training to understand how to use a new mobile application'. The Likert scale is a commonly employed tool for investigation of participants' attitudes and perceptions towards M-learning (Abdall & Hegazi, 2014; Abu-Al-Aish, 2014).

4 In the **fourth part**, a list of M-learning services was outlined and participants were required to classify each one according to how useful they perceived them to be for the learning process. Participants were able to choose from five available scores, namely 1 = Not useful; 2 = Neutral; 3 = Useful. Previous studies on this topic have adopted this approach as well (Abu-Al-Aish et al., 2012; Corbeil & Valdes-Corbeil, 2007; Trifonova et al., 2006).

5 In the **fifth part**, a single open-ended question was included to give participants the opportunity to express their opinions regarding the concept of M-learning and its contribution to the learning process.

Procedures. For the purposes of data collection, formulation of an online questionnaire was undertaken in the second semester of the academic year 2015 (August) through the website *www.surveymonkey.com*. Prior to commencing the actual data collection process, a pilot study was carried out to assess how reliable and valid the questionnaire was. This phase involved 218 students at different levels of high school education. The questionnaire was distributed via an email link to every school that consented to take part in the study. The survey was estimated to take about ten minutes to complete.

As shown in Appendix A (A1 for the Arabic version), the cover letter attached to the questionnaire provided a short overview of the research objectives and goals, alongside explanations for the terms of E-learning and M-learning employed in the questionnaire. Furthermore, it was stressed that participants' personal information would not be disclosed and that involvement in the study could be terminated at any time. The cover letter also included the researcher's contact details in case the participants wanted to get in touch.

Participants. The total number of groups or elements relevant to a particular study constitutes a population (Gray, 2013). In the first phase of the current study, a single group made up the research population, namely, students from Saudi Arabia. More specifically, the survey questionnaire was distributed among Saudi Arabian students from the city of Alrass in the Alqassim province. With a total population of approximately 133,000, and located north of Riyadh and near the centre of Saudi Arabia, Alrass provided a good population to sample as typical of Saudi Arabia as a whole. The goal of the questionnaire was to acquire insight into students' perceptions and attitudes regarding the integration of M-learning in the educational process and to determine the factors likely to affect their willingness to accept M-learning. This phase of the research was carried out in August 2015, with the questionnaire being distributed to five different high schools (Emails were sent to 12 different high schools in Alrass, including both male and female students. However, only five schools responded and agreed to participate in the study). In the city of Alrass, female high schools are usually numbered without names. For example, The First high school, The Ninth high school etc. The participating schools were:

1 Alrass High School. (boys)
2 King Saud High School. (boys)
3 King Faisel High School. (boys)
4 The First High School. (girls)
5 The Third High School. (girls)

In addition to helping understand students' attitudes and perceptions regarding the use of M-learning, the data derived from this phase enabled the researcher to address the research questions and identify the additional factors that influence M-learning acceptance among students in high schools in Saudi Arabia.

From an approximate population of 1300 students, 218 students from different educational levels volunteered to participate in the online survey. Third year students numbered 129, followed by second year students at 58 and first year students with 31. Gender and educational level distribution are shown in Table 3.2.

Table 3.2 Participants of Phase 1

Item	N = 218	
	Frequency	*Percent (%)*
Gender		
Male	83	38.1
Female	135	61.9
Educational Level high School		
First Year (year 10)	31	14.2
Second Year (year 11)	58	26.6
Third Year (year12)	129	59.2
Total	218	100

Data analysis approach. To provide an overview of what the data indicated, descriptive statistics were employed in the initial phase. As explained by Borg (1993), the value of descriptive statistics is that they enable extraction of key aspects and themes from vast quantities of data. In this study, the process involved measurement of the mean value and standard deviation for every questionnaire answer, alongside development of diagrams to aid understanding and interpretation of some results. Moreover, thematic analysis was conducted to examine the data associated with the open-ended questions. The steps taken by the researcher in carrying out this procedure were becoming familiar with the sets of data, preliminary coding, and theme outlining, review and adjustment (Silverman, 2011).

3.3.2 Phase 2. Model validation

The following section explains the methods used for conducting the second phase of this study.

Instrument development and measures. Measures that were devised and legitimised by UTAUT underpinned the survey tool employed in this phase of the research. Where necessary, measures were adjusted to ensure that they reflected the concept of M-learning used in a high school setting. The assessment of the measures was undertaken by the researcher based on the feedback obtained from two members of academic staff from Flinders University and one academic staff member from Jeddah University in Saudi Arabia. The academics provided feedback for questionnaire refinement as well. The instrument was modified according to their feedback.

The reliability of the measures was then tested using a pilot study where the questionnaire was distributed to two schools (out of five) who agreed to participate. Out of approximately 150 students, 30 completed the test survey.

In the first part of the survey instrument, general information regarding the study, completion of the questionnaire and ethical aspects was provided.

In the second part of the questionnaire, demographic data were sought, and clarification about the concepts used in the questionnaire was provided. Multi-group moderation testing could subsequently be undertaken based on the demographic data, particularly to determine whether gender influenced the acceptance of M-learning. Additional questions in this section pertained to M-learning and M-technologies to gauge participants' familiarity with the concept. All the questions in this part were guided by the work of other researchers (Abu-Al-Aish & Love, 2013; Jairak, Praneetpolgrang, & Mekhabunchakij, 2009; Liu, Li, & Carlsson, 2010; Park et al., 2012).

In **part three** of the questionnaire, 27 questions related to different aspects of M-learning were also sourced from earlier studies (Abu-Al-Aish & Love, 2013; Jairak et al., 2009; Liu et al., 2010; Park et al., 2012; Venkatesh et al., 2003; Venkatesh et al., 2012), but they were adapted to the settings and aims of the current study. The purpose of the questions in part three was to extract data about the various constructs that might encourage participants to adopt M-learning. A five-point Likert scale was used to measure the constructs, with 1 and 5 respectively denoting strong disagreement and strong agreement. Each statement was given a score by the participants according to how important they thought it was in relation to M-learning. Table 3.3 shows the items used in the study and the literature from which the items were derived.

Table 3.3 Instrument constructs

Scales	No. of Items	Adapted from
performance expectancy (PE)	4	(Abu-Al-Aish & Love, 2013; Al-Hujran et al., 2014; Bere, 2014; Davis, 1989; Huang, 2014; Venkatesh et al., 2003)
effort expectancy (EE)	4	
social influence (SI)	4	(Cheon et al., 2012; Nassuora, 2012; Wang et al., 2009)
hedonic motivation (HM)	4	(Davis et al., 1992; Suki & Suki, 2011; Venkatesh & Speier, 1999; Wang & Wang, 2010)
system quality (SQ)	4	(Abu-Al-Aish & Love, 2013; Alshehri, Drew, Alhussain, & Alghamdi, 2012; Lin & Lu, 2000; Schaupp, Fan, & Belanger, 2006)
self-management of learning (SMoL)	3	(Donaldson, 2010; Huang, 2014; Huang, Jang, Machtmes, & Deggs, 2012)
behavioural intention (BI)	4	(Abu-Al-Aish & Love, 2013; Al-Hujran et al., 2014; Bere, 2014; Boontarig, Chutimaskul, Chongsuphajaisiddhi, & Papasratorn, 2012; Davis, 1989; Feng, Kong, Zhu, & Yang, 2015; Huang, 2014; Venkatesh et al., 2003)

The level of usefulness attributed by an individual to an information system as regards work performance and the extent to which the individual believes the use of the system will afford them ease are known as *performance expectancy* and *effort expectancy* (Venkatesh et al., 2003). The questions related to these aspects were drawn from earlier research (Abu-Al-Aish & Love, 2013; Al-Hujran et al., 2014; Bere, 2014; Davis, 1989; Huang, 2014; Venkatesh et al., 2003) and adapted to the context of M-learning at the level of K12. TAM and UTAUT were applied in the earlier studies to determine the extent to which the participants embraced technology and information systems.

Social influence can be defined as the degree to which students' usage of M-learning is promoted or influenced by other students, friends, teachers and parents. The questions were adapted from (Cheon et al., 2012; Nassuora, 2012; Wang et al., 2009). The questions were based on the observation that students' acceptance and intention to use M-learning were subject to social influence.

The enjoyment an individual derives from using a technology (M-learning in the present case) is called *hedonic motivation.* The questions related to this aspect were based on other studies on this topic (Davis et al., 1992; Suki & Suki, 2011; Venkatesh & Speier, 1999; Wang & Wang, 2010).

The extent to which the general M-learning system and the services it offers exhibit clarity, precision and reliability denotes system quality. The questions were inspired by earlier research

(Abu-Al-Aish & Love, 2013; Alshehri et al., 2012; Lin & Lu, 2000; Schaupp et al., 2006) but adapted to the topic of M-learning.

An individual's self-perception and their capacity to motivate themselves to learn is known as *self-management of learning* (Smith, Murphy, & Mahoney, 2003). The questions were derived from (Donaldson, 2010; Huang, 2014; Huang et al., 2012) and adapted to the topic of M-learning.

Procedures. For the purposes of data collection, an online questionnaire was created in the second semester of the academic year 2015 (October) through the website *www.surveymonkey.com*. Before the actual data collection process was initiated, a pilot study was conducted to determine how reliable and valid the constructs of the instrument were. Data were reported from 272 students at different levels of education. The questionnaire was distributed via an email link to every school that consented to take part in the study. The duration of the survey was around 10 to 15 minutes.

As shown in Appendix B (B1 for the Arabic version), the questionnaire was accompanied by a cover letter that offered a concise introduction to the research objectives and goals, as well as clarification for the terms of E-learning, M-learning and relevant constructs employed in the questionnaire. In addition, it was stressed that participants' personal information would not be made known and that participation in the study could be terminated whenever they wanted. The cover letter also included the researcher's contact details for the participants to get in touch if they wanted.

Participants. Similar to Phase 1, the population of Phase 2 consists of the same target group: Saudi Arabian students. The survey questionnaire was distributed among Saudi Arabian students at Alqassim province, Alrass city. The aim was to investigate the factors that influence high school students' acceptance of M-learning in the Kingdom of Saudi Arabia via validating the research model. The phase was conducted in October 2015 with the same set of schools used in Phase 1 (approximately 1300 students).

The online survey was distributed to students at all levels of education, with 295 questionnaires returned. Of the 295 responses, 23 were excluded due to incompletion. Therefore, the total number of valid responses was 272, with 139 responses from male students and 133 responses from female students. Respondent characteristics are shown in Table 3.4.

Table 3.4 Respondent characteristics of Phase 2

Variable		Frequency	Percentage
Gender	male	139	51.1
	female	133	48.9
Educational level	first	85	31.3
	second	66	24.3
	third	121	44.5
E-learning knowledge	very poor	7	2.6
	poor	14	5.1
	moderate	38	14
	good	72	26.5
	very good	141	51.8
Mobile devices	mobile phone	4	1.5
	smart phone	269	98.9
	tablet pc	99	36.4
	laptop	46	16.9
Mobile educational apps	yes	109	40.1
	no	163	59.9
M-technologies knowledge	very poor	0	0
	poor	2	0.7
	moderate	18	6.6
	good	52	19.1
	very good	200	73.5

Data analysis. Hair et al. (2010) recommend that researchers define approaches to data analysis early, to ensure that the instruments used are able to collect the appropriate data. This is certainly important, as otherwise, data collected may not be appropriate for the selected approach to data analysis.

It is advisable to establish the method of data analysis as early in the research as possible to make sure that the chosen tools of data collection can extract the necessary data (Hair et al., 2010). The outcomes of the chosen method of data analysis will not be relevant if the data are unsuitable.

Data analysis was performed with two statistical instruments in this phase. The software program *SPSS* (Version 22) was initially used to produce descriptive statistics that indicated the frequency, proportion and accumulative percent of participant characteristics, as well as to determine how reliable the data were (Cronbach's alpha). Data were analysed in order to confirm or reject the hypotheses relating to the various relationships in the proposed model.

Subsequently, structural equation modelling (SEM) was conducted to assess the validity of the hypotheses related to various relationships in the model. Model validation has been performed by numerous studies with the help of SEM or multiple regression and path analysis, both of which are incorporated into SEM (Carter & Belanger, 2004; Davis et al., 1989; Davis Jr, 1986; Venkatesh, 2000; Venkatesh et al., 2003). Compared to multiple regression and path analysis, SEM is deemed to be more advantageous because it enables identification and assessment of other relationships recommended by the software package according to the evaluation of the existing data, aside from assessment of hypotheses (Hair et al., 2010). Furthermore, effects like moderation, mediation and interaction can be tested easily with SEM.

SEM offers complete figures of model analysis. Its general use as a trial and error model that can be tested several times, and its capacity to progress stronger models by analysing philosophies on the quantified associations (Byrne, 2016; Hair et al., 2010; Rubio & Gillespie, 1995). This implies that with different tests, the strongest model would be accepted and would show the relationships with validity and reliability. SEM permits the concurrent investigation of up to the 200 variables, permitting the inspection of widespread connections among arbitrator and latent forecaster variable pointers (Al-Gahtani, Hubona, & Wang, 2007). More details about the SEM analysis are in Chapter 5.

3.3.3 Phase 3. Model in practice: App implementation

The following section explains the methods used for conducting the third and final phase of this research.

Overview of Phase 3. In addition to the quantitative data collection and statistical analysis in Phase 2, supplementary data were obtained from students and teachers by introducing an M-learning application (app) devised by the researcher. The aim of Phase 3 was to confirm and validate the findings of the analysis of the extended UTAUT model presented in Phase 2 by allowing the students to experience a simple M-learning tool. The third phase also sought to identify any other factors affecting students' acceptance and use of M-learning which had not been covered by the modified UTAUT model. Challenges and obstacles that affected the implementation of M-learning were noted.

The M-learning app. Phase 3 of the research involved an M-learning application (app) for learning English. It was developed to help students utilize their free time studying with the aid of their mobile phones or mobile devices. It was specifically designed for high school students in Saudi Arabia and the language exercises programmed into the app were all derived from the current textbook *KSA – Edition Traveller 6* (Appendix C4). It was developed on an Apple platform (Xcode) for iPhone devices using the iOS operating system. Figure 3.3 shows the main interface of the app.

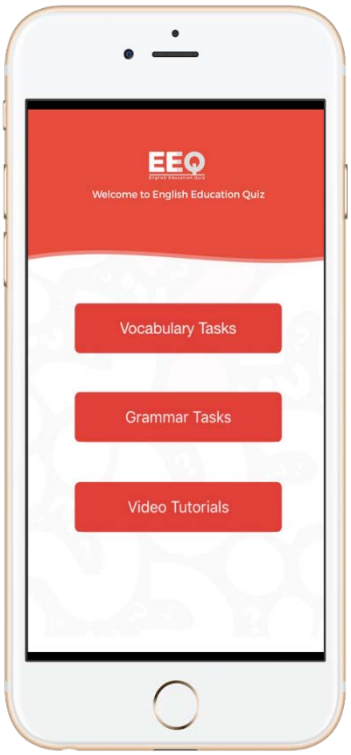

Figure 3.3 English app interface

Relevant tools and technologies (app development). There were several technologies and tools used for the development of the English app. These tools and technologies included: Proto.io, Apple Xcode, Objective-C programming language, PHP, MySQL, JSON, phpMyAdmin and an iPhone mobile phone. The tools and technologies are explained in detail in Chapter 6.

App design. Students access the part of the app that is designed to extend their skills, while teachers can access an Internet-based administration panel where they can upload videos or add questions and information. More details on the on the design can be viewed in Chapter 6.

Instrument development and measures. To gather data for Phase 3, two online questionnaires were developed in the first semester of the academic year 2016 through the website *www.surveymonkey.com*.

Questionnaire 1 (M-learning app evaluation)

Part 1 of the first questionnaire in Phase 3 welcomes the participant and provides a concise clarification about the application, general information about this phase, how to participate and download the educational app, and ethics related information.

Part 2 was designed to capture demographics-related information from respondents and provide any needed definitions to help respondents complete the questionnaire.

Part 3 of the questionnaire consists of open-ended questions targeting both students and teachers (for each factor) about their experience of using the English app for learning and teaching. The open-ended questions were derived from the same factors as in Phase 2 of this research. At the end of this part of the survey, an open ended question was asked to discover any other potential factors that had affected students' acceptance of M-learning, and which had not been covered by the UTAUT model.

Questionnaire 2

Questionnaire 2 in Phase 3 was designed to discuss and explore the challenges and obstacles that faced the implementation of M-learning in public schools from the perspective of teachers and educational officials in the government. The following open-ended question was asked in Arabic. *What are the challenges and obstacles that face the implementation of mobile learning in high schools in the Kingdom of Saudi Arabia*?

Procedures. Using *SurveyMonkey* (https://www.surveymonkey.com), an online survey was designed to elicit the app users' perceptions of their experiences with the English language mobile application. The first online questionnaire consisted of open-ended questions to which students and teachers could respond by writing broadly about their experiences and offer their opinions about the English language app (with teachers having separate questions). Using the open-ended question, the researcher could gather data relating to any potential factors that had influenced students' or teachers' acceptance of M-learning that had not been covered by the UTAUT. Denscombe (2014, p. 176) argues for the use of open-ended questions and allowing participants to 'express themselves in their own words'. It was felt that in the circumstances

open-ended questions were important because properly written open-ended questions could elicit responses that would provide insights into the respondents' experiences, beliefs, perceptions, and motivations at a depth that would not be possible with close-ended questions.

Completion of the first questionnaire was estimated to take approximately 15-20 minutes. As shown in Appendix C (C1 for the Arabic version), a cover letter was associated with the questionnaire, providing information about what the research intended to achieve and information about the app. Moreover, it was highlighted that participants' personal information would be undisclosed and that involvement in the study could be terminated at any time. The cover letter also included the researcher's contact details in the event that participants wanted to get in touch.

Similarly, the second online questionnaire (one open-ended question) was also distributed via an email link to every school that consented to participate in the study, as well as to the education authorities in Alrass. Completion of the questionnaire was estimated to take approximately 15-20 minutes. As shown in Appendix C2 (C3 for the Arabic version), a cover letter was associated with the questionnaire, providing information about what the research intended to achieve. Moreover, it was highlighted that participants' personal information would be undisclosed and that involvement in the study could be terminated at any time. The cover letter also included the researcher's contact details in the event that participants wanted to get in touch.

Participants. Three groups of participants were involved in Phase 3.

Participants for Questionnaire 1, Phase 3. The population for Questionnaire 1 in Phase 3 consisted of two groups: students and teachers. The survey questionnaire was distributed among students and teachers in Alqassim province, Alrass city via email link. The study was conducted in the second semester in 2016 at the same set of schools in Phases 1 and 2 (approximately 1300 students).

Responses were received from nine students who answered different questions related to the factors *performance and effort expectation, social influence, hedonic motivation, system quality, self-management of learning*. As for teachers, six agreed to participate by supplying responses to open-ended questions when they could. Participant characteristics are shown in Table 3.5.

Table 3.5 Open-ended questions participants (questionnaire 1)

Open-ended questions respondents			
ID	**Students**	**ID**	**Teachers**
S1	Male	T1	Female
S2	Female	T2	Female
S3	Female	T3	Male
S4	Female	T4	Male
S5	Male	T5	Male
S6	Male	T6	Female
S7	Female		
S8	Male		
S9	Male		

Participants for Questionnaire 2, Phase 3. Similar to Questionnaire 1 in this phase, Questionnaire 2 was submitted online to two groups: teachers and education officials in the Saudi Arabian government. The teachers and education officials were located in Alqassim province, Alrass city. The study was conducted in the second semester in 2016. Teachers and education officials (males and females) were asked to complete an online questionnaire. Table 3.6 shows the participants characteristics for questionnaire 2.

Table 3.6 Participant's characteristics for questionnaire 2

Participants			
Education officials		***Teachers***	
E1	Male	T7	Female
E2	Male	T8	Male
E3	Female	T9	Female
E4	Male	T10	Male
		T11	Male

Data analysis. Thematic analysis was undertaken to examine the data associated with the open-ended questions. The steps involved in this procedure were becoming familiar with the sets of data, preliminary coding, and theme outlining, review and adjustment (Silverman, 2011).

3.4 Response rate

Four different survey questionnaires were used in the course of the research (one in Phase 1 and one in Phase 2 and two in Phase 3), and different numbers of responses were received for each questionnaire. The response rate for Phase 1 was 16.7% and 20.9% in Phase 2. In Phase 3,

the response rate was 1.15% for questionnaire 1 and 18% for questionnaire 2 (officials and teachers).

In Phases 1 and 2, the response rate was quite satisfactory, based on our previous knowledge and considering the length of the questionnaires. A similar response rate was reported in previous M-learning studies in Saudi Arabia (AlMarwani, 2016). Visser, Krosnick, Marquette, and Curtin (1996) reported that studies with lower response rates provided more accurate measurements than those with higher response rates (above 50%).

The researcher believes that because Phase 3 (questionnaire 1) involved an experiment that required additional time and commitment, students were reluctant to participate and, therefore, many of them did not accept the invitation to take part in this phase.

3.5 Ethical permission

Ethical approval from the Social and Behavioural Research Ethics Committee of Flinders University was obtained prior to collecting data (Approval No. 6951; see Appendix D). The purpose and aims of the research were explained in a cover sheet. Participants were informed that the researcher had the responsibility to protect their confidentiality and anonymity and they had the right not to participate in the study. Therefore, no names or any other techniques were used to trace participants' responses back to individuals.

3.6 Summary

In this chapter, the research methodology, research design, research tools and techniques of data collection for each phase have been presented. The research methodology was addressed first and the choice of deductive and inductive approaches used to achieve the research goals was discussed. The research design was subsequently outlined, comprising three phases focusing on students' perceptions and attitudes towards M-learning, factors influencing students' acceptance of M-learning and the development, implementation and evaluation of M-learning application (app) for high school students. The employed research tools, participant characteristics, and data analysis were indicated for every research phase. Last but not least, ethical aspects were taken into account to avoid transgression of the ethical standards pertaining to research in the field of social sciences. The following chapter discusses the data from the field research and presents the data analysis of the results from the first phase.

Phase 1. Conceptual model development: Ascertaining students' perceptions and attitudes towards M-learning

4.1 Chapter overview

The purpose of Phase 1 was to develop a research model based on the attitudes and perceptions of students regarding M-learning. The chapter begins with a review of the results of the pilot study conducted for Phase 1. Next, the main findings of the Phase 1 survey are presented and explained. After that, the development (refinement) of the research model based on the findings of the survey is explained. The research and data analysis in this phase form the basis for a conference paper already accepted for the 2018 International Conference on e-Commerce, e-Administration, e-Society, e-Education, and e-Technology to be held in Japan in April (Alkhalifah, & de Vries, 2018).

4.2 Pilot study results

A pilot study is a research technique that uses a small sample to test the efficacy of a questionnaire survey, as well as other types of research approaches. Ticehurst and Veal (2000) argue that it is always appropriate to conduct at least one pilot survey prior to beginning the exercise of collecting data as part of a larger research project.

A pilot study was conducted from 1 August 2015 to 15 August 2015, in two public high schools in Saudi Arabia with students studying at level three in order to detect any weaknesses in the design and instrumentation of the proposed survey questionnaire. From an approximate population of 600-800 students, 30 surveys were completed. The pilot study tested the reliability of the survey, that is, did the survey measure what it was intended to measure? And was the survey reliable? That is, can the survey instrument produce reproducible results, thus indicating internal consistency and correlation between survey items?

Cronbach's alpha was used to measure internal consistency. Cronbach's alpha should have a value in the 0.7 range to be acceptable and to indicate adequate internal consistency. For the 13 items in question 11, it was 0.872. The results of the pilot study allowed to proceed to conduct Phase 1.

4.3 Data analysis (main study for Phase 1)

The *Statistical Package for Social Science* (*SPSS*) software version 22.0 was used to analyse the data obtained for this phase.

4.3.1 Results obtained from closed format questions

Question 3 in the survey investigated the type of mobile technologies the students own or use. Figure 4.1 shows that 95.4% of the 218 participants have smartphones; 3.7% of total respondents owned basic mobile phone for calls and texts; 33% of total responses owned a tablet PC; 42.7% of total respondents owned a laptop.

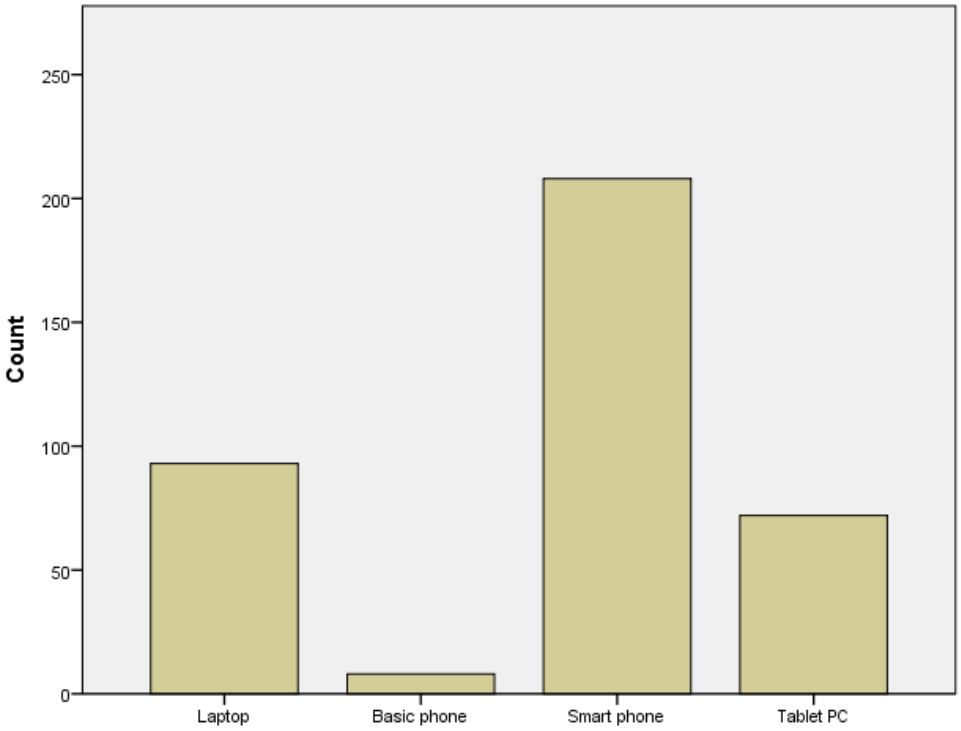

Figure 4.1 Availability of devices

Question 4 in the survey investigated whether the students had access to the Internet in their homes. Table 4.1 shows that 100% of the participants had access to the Internet in their home.

Table 4.1 Internet availability at home

Answer	Frequency	Percent
Yes	218	100.0
No	0	0

The survey explored the question of how frequently students access the Internet in order to examine how Internet access habits might impact the M-learning implementation (question 5) (Table 4.2; Figure 4.2).

Table 4.2 How often do you use the Internet from your mobile device per day?

Access	Frequency	Percent
Lower than 1 hour	4	1.8
1-2 hours a day	16	7.3
2-3 hours a day	28	12.8
More than 3 hours	170	78.1

About 98.1% of respondents had continuous access to the Internet on their mobile gadgets every day, while 78% of the students accessed the Internet from their mobile devices for more than three hours a day; 12.8% accessed the Internet from their mobile devices for 2-3 hours a day; 7.3% accessed it for 1-2 hours a day and 1.8% accessed it less than an hour a day.

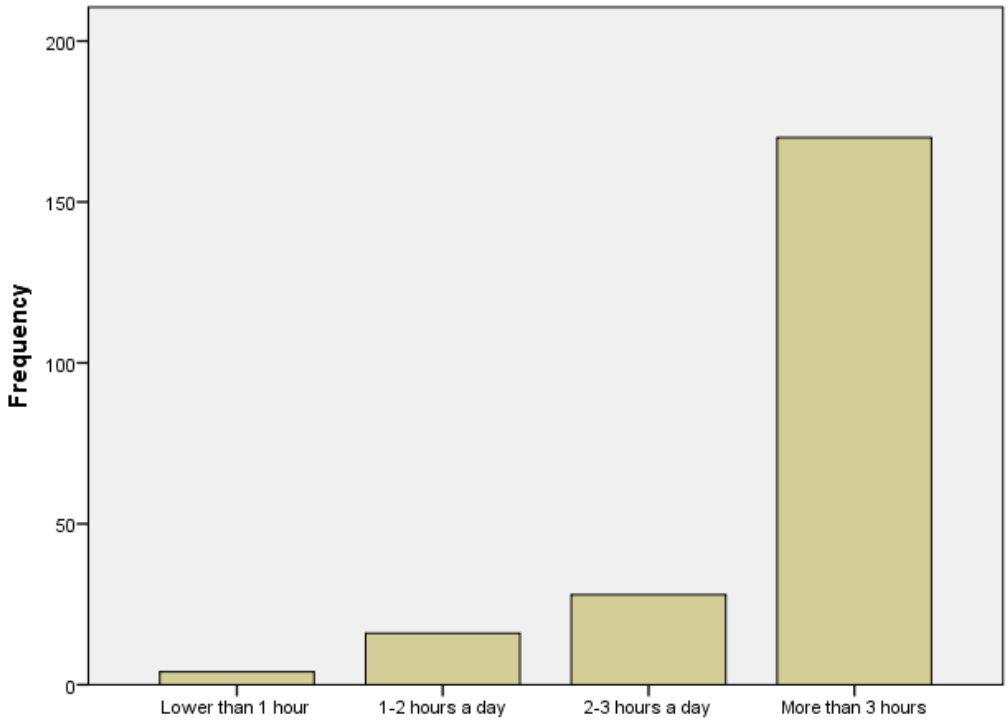

Figure 4.2 How often do you use the Internet from your mobile device per day?

Question 6 in the survey asked whether the participants had used any educational application on their mobile device before. The results indicated that 72.5% of the participants had used an educational application before whereas 27.5% had not used any educational application before. See Table 4.3 and Figure 4.3.

Table 4.3 Have you used any educational application on your mobile device?

Answer	Frequency	Percent
Yes	158	72.5
No	60	27.5

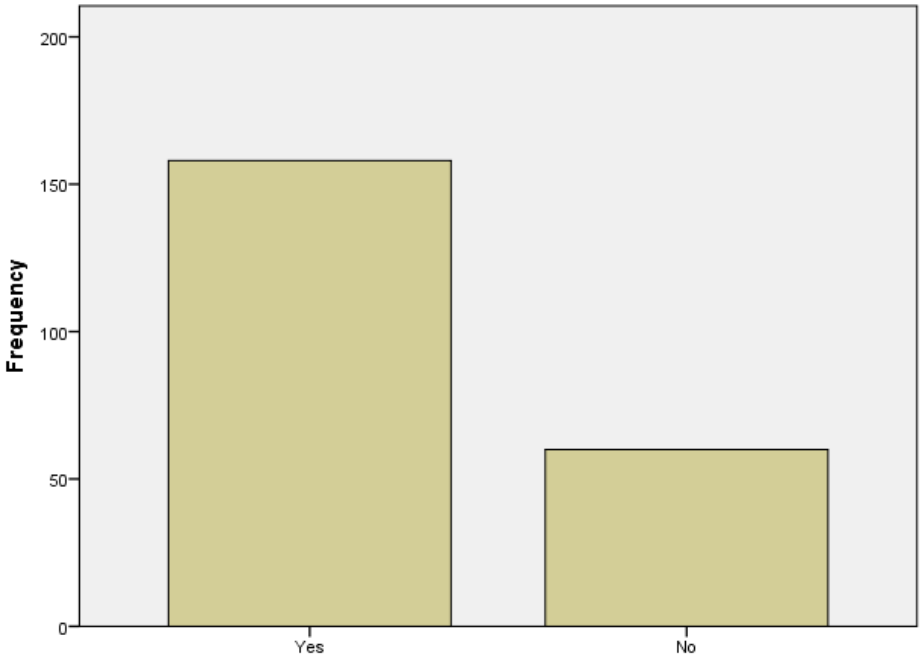

Figure 4.3 Have you used any educational application on your mobile device?

Questions 7 and 8 in the survey asked whether the participants felt that they had benefited from using educational apps and whether they had heard of M-learning. As can be seen from Figure 4.4 and Table 4.4, the majority of participants (84.4%) indicated that it was useful to use the educational apps, while 15.6% did not think it was useful.

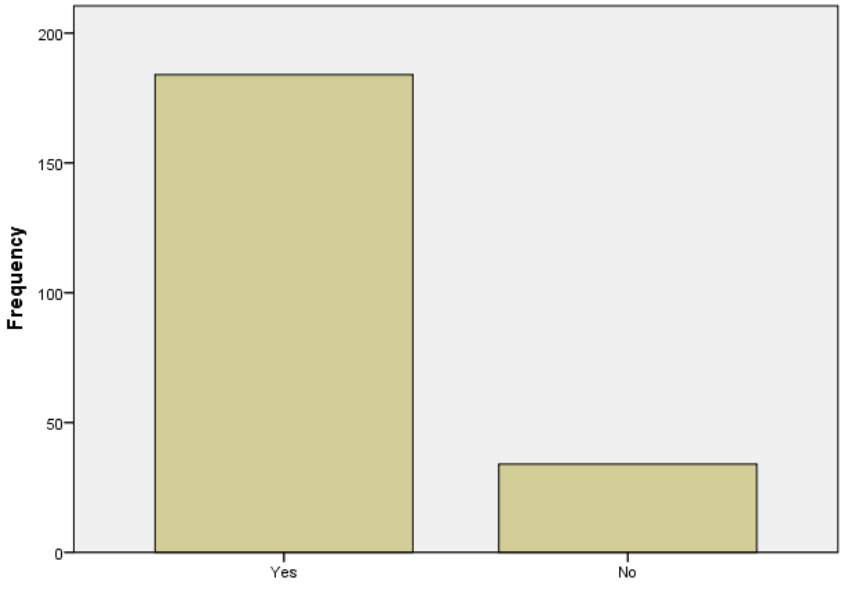

Figure 4.4 Do you think it is useful to use educational apps?

Table 4.4 Do you think it is useful to use educational apps?

Answer	Frequency	Percent
Yes	184	84.4
No	34	15.6

As for Question 8, the results showed that 76.1% of the participants had heard about the concept of M-learning before, whereas 23.9% had not. See Table 4.5 and Figure 4.5.

Table 4.5 Have you heard about (M-Learning) before?

Answer	Frequency	Percent
Yes	166	76.1
No	52	23.9

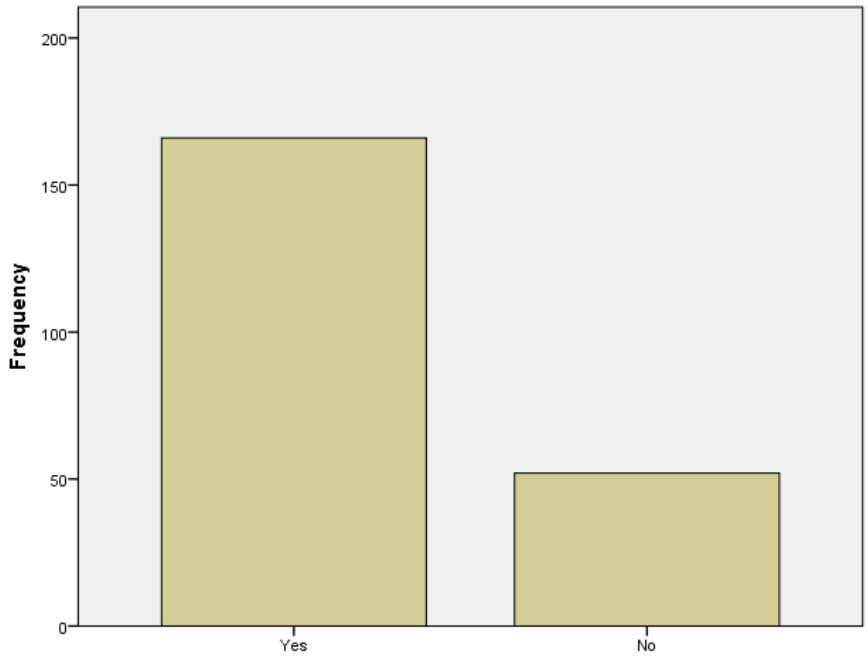

Figure 4.5 Have you heard of M-learning?

Question 9 in the survey sought the participants' views, opinion and impression about M-learning. The students could choose from four different answers:

- *M-learning is a good initiative and want to utilize it.*
- *M-learning is a good initiative but do not want to utilize it.*
- *M-leaning is not a good initiative.*
- *The students have their own opinion about M-leaning that they would like to record.*

As can be seen from Table 4.6, 66.1% of participants thought it was a good initiative and they would like to utilize it; 21.1% of participants indicated it was a good initiative but they would not like to utilize it; whereas 8.7% believed that M-learning is not a good idea and 4.1% have other opinions about M-learning (including positive and negative ones), such as '*eye damage from looking at the device*', '*makes learning less serious*' and '*a student can collaborate with his fellow peers and teachers*'. Figure 4.6 shows the answers for the same question but records gender differences.

Table 4.6 What is your impression about M-Learning?

	Frequency	Percent
Good initiative (want to utilize)	144	66.1
Good initiative (do not want to utilize)	46	21.1
Not a good initiative	19	8.7
Other	9	4.1

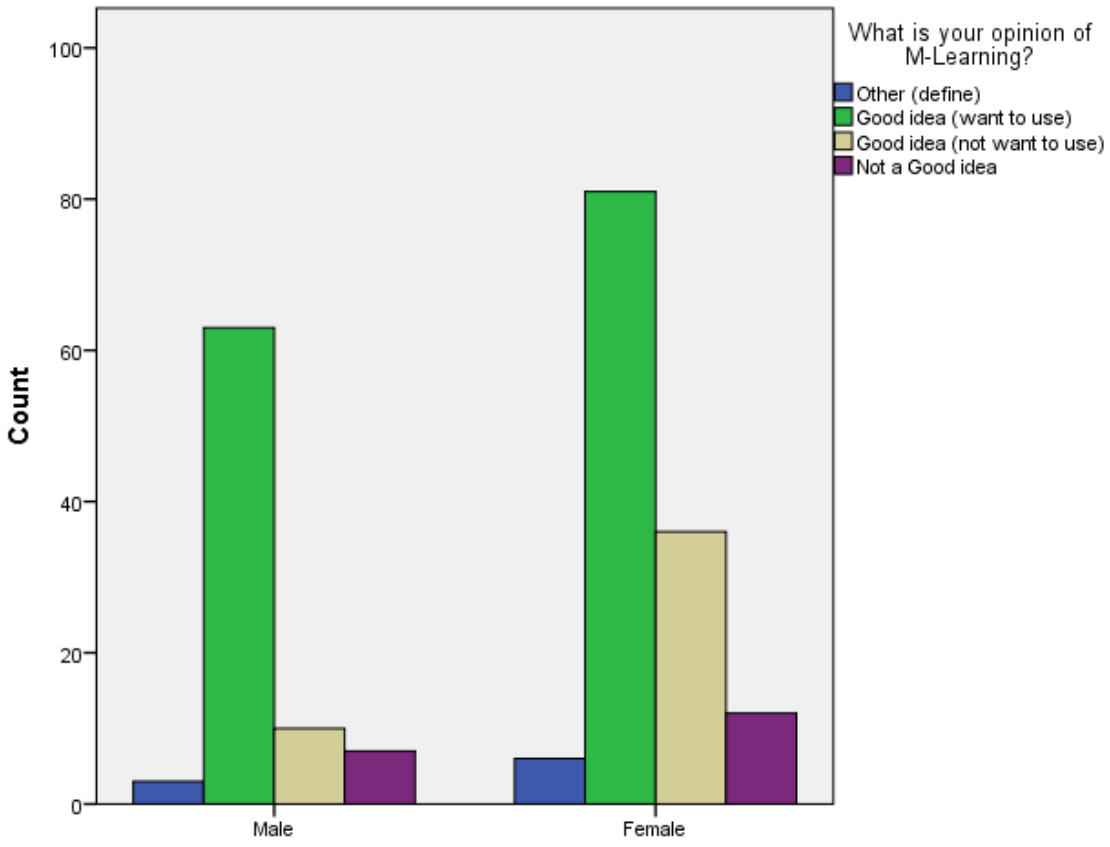

Figure 4.6 What is your opinion of M-learning

4.3.2 Results from Likert scale question

Table 4.7 shows the mean responses for each gender for 13 statements that related to M-learning (question 10). *Participants* provided answers on the *five-point scale*, from 1 (strongly disagree) to 5 (strongly agree).

The standard deviation (SD) of the data is also shown in Table 4.7. The SD enables the person carrying out research to get the spread of the data around the mean of all the variables studied. The greater the standard deviation, the larger the spread of the data. This leads to greater variance in the data and better results. On the other hand, a small standard deviation shows a smaller spread of data and thus the results obtained are not conclusive. When a standard deviation of 0 is obtained, it means that all the responses to a given question are the same (Fielding & Gilbert, 2006). The range of the standard deviation in the table is between 0.78 and 1.26, implying that the students' answers were similar.

The first two statements focused on trying to understand the students' ability to use the M-learning platforms in their day-to-day activities.

Table 4.7 Mean and standard deviation for each Item for both males and females (question 10)

	Statements	Total mean	Mean for males	Mean for females	SD males	SD females
1	I find it easy to use mobile applications.	3.84	3.69	3.93	1.20	1.07
2	Training is needed to be familiar with an M-learning system.	2.00	1.98	2.02	0.95	0.97
3	Using M-learning will enhance the flexibility of learning (anytime and anywhere).	4.04	4.09	4.01	1.10	1.19
4	Using M-learning will enhance efficiency of learning make the educational process easier and more enjoyable	4.17	4.13	4.20	1.04	1.07
5	I am confident when using my mobile device for learning.	4.16	4.09	4.20	0.98	1.10
6	M-learning will bring new methods and opportunities to learn	4.12	4.15	4.11	0.83	1.13
7	I like to use my own mobile device for my learning.	4.06	4.01	4.09	1.10	1.18
8	I think that using M-learning will help me to get good grades.	3.80	3.78	3.82	1.09	1.15
9	M-learning will enhance and boost contacts between students and teachers	4.05	3.98	4.10	1.16	1.03
10	M-learning will support personalized learning	3.97	4.08	3.90	0.78	1.07
11	M-learning will enhance the quality of the curriculum	3.94	4.00	3.91	0.94	1.16
12	There is adequate technical support to implement M-learning	2.81	2.15	2.20	1.07	1.21
13	It is hard to implement M-learning	2.80	2.62	2.91	1.14	1.26

Observations

1 In the first statement, students were required to state whether they found it easy to use M-learning. The student responses recorded on the Likert scale had a mean of 3.84, close to the ‘neutral’ and ‘agree’.

2 The next statement required the students to say whether they would embrace any training necessary for them to be able to use mobile learning services effectively. The mean for the Likert scale responses was 2.00, which is positioned around the ‘disagree’ option. The conclusion to be drawn from the analysis of the first two statements is that the students believe that they could comfortably make use of the M-learning services without any need for assistance or training.

The statements that followed (i.e., 3-10) were designed to ascertain the students’ attitudes towards the advantages that result from the use of M-learning platforms.

3 Statement 3 asked the students whether the use of M-learning would increase the flexibility of the learning process. A mean of 4.04 indicates that the students largely agreed with the assertion that the use of mobile learning services would increase the flexibility of the learning process.

4 The students strongly agreed that M-learning services made the learning process easier, as well as more enjoyable, with a mean of 4.17 supporting that suggestion.

5 Statement 5 measured the students’ levels of confidence in using M-learning services. A mean of 4.16, between the ‘agree’ and ‘strongly agree’ options, indicates that the participants were confident about using M-learning services.

6 Statement 6 was designed to assess whether the students felt that M-learning services could provide new opportunities and methods for learning. Many students agreed that M-learning would bring new opportunities and the mean was 4.12.

7 Statement 7 asked whether the students regularly carried technologies with them that they could use for learning. The mean for this question was 4.06, indicating that many students strongly agreed.

8 Statement 8 asked whether M-learning could influence the grades that students' got. Many students were neutral on this question, while others agreed that the use of M-learning helped to improve their grades. The mean score for this particular question was 3.80.

9 Statement 9 asked whether the students' felt that M-learning could improve the communication between teachers and students. The mean for this question was 4.05, which showed that the students felt that M-learning would increase the communication between students and teachers.

10 Statement 10 sought to find out whether students felt that M-learning allowed them to have a more individual learning experience and greater independence. The response rate had a mean of 3.97, which showed that students felt that by using M-learning services, they could be independent and their study personalised.

11 The students were also asked to express their views on the effects of M-learning on the growth and development of the curriculum (Statement 11). A mean of 3.94 indicates that the students believed that the use of the M-learning services would impact positively on the development of the curriculum through improved quality of the services.

12 Students' perceptions of the difficulties of implementing M-learning were focused on in the last two statements. Statement 12 sought to establish whether there was the existence of a reliable source of help or support to ensure that the process of implementing the mobile learning services was successful for all those involved, including the students. The mean score for this was 2.81, which is in the area of 'disagree' and 'neutral'. The mean is an indication of the feeling among the students that there would not be enough technical support to ensure a smooth implementation of M-learning services.

13 Statement 13 sought to determine whether the students believed it would be difficult to implement a system of M-learning services in their school. The mean score for this question was 2.80, indicating that many students felt that implementation would be easy.

Students' preference for M-learning services. To arrive at the preferences showing the efficacy of M-learning services, students were provided with some types of services that were to be performed through the mobile learning platform. The students were then asked to make a

decision regarding the level of satisfaction of a given service in their learning process. As shown in Table 4.8, a large proportion of students expected that an M-learning facility could prove very useful for obtaining information online (92.2%). 91.3% of the students expected the mobile learning platform to be more useful in obtaining information offline.

Very few students supported the idea that M-learning could aid the flow of information and knowledge through short messaging applications such as SMS and MMS, with only 30.3% of the students agreeing to the idea. 47.2% of the students remained neutral, and did not provide their views on the subject. And 22% of students indicated that it was useful to receive information via SMS/MMS. Furthermore, the majority of students pointed out that it would be useful to collaborate with other students (94%) and teachers (91.1%).

Table 4.8 Preference of M-learning services

Type of M-learning service	Not useful %	Neutral %	Useful %
To access educational content online	5	2.8	92.2
To access educational contents offline	2.8	6.0	91.3
To receive supporting educational information via SMS/MMS.	30.3	47.2	22.5
To collaborate with others students	1.4	4.6	94.0
To collaborate with the teachers	1.4	5.5	93.1

4.3.3 Results obtained from the open-ended question

Students were requested to provide their views about M-learning in schools or its application in any other environment. They wrote their opinions at the end of the questionnaire. This strategy facilitated the collection of much data which was investigated and analysed using thematic analysis. The method involved stages of familiarizing with the sets of data, creating preliminary codes, searching, revising and refining themes (Patton, 1990). The responses were as follows:

1 **Distraction tool.** An interesting comment was received from a female student in level three. She stated *I personally like the idea of using my iPhone to learn. However, some people (especially parents) perceive mobile technologies as (entertainment tools) and not as learning tools. And therefore they will not take learning seriously.*

2 **M-learning should be supervised by the Ministry of Education**. A female student in level one stated *I like using mobile apps to learn but I think they should be supervised by the Ministry of Education. We need different apps for different courses.*

3 **Health implications.** A female student in level three expressed her concerns about using the mobile technologies to learn as it may have some health implications. However, she also believed it would be fun to use her phone to learn as a change in routine (from learning via textbook). She stated *I prefer to learn via the original textbook rather than using my Galaxy tab because if I spend hours using my device, my eyes start to hurt. But I think using mobile technologies for a short duration or for a lesson is something I would like to experience because it changes the routine way of using textbooks and fun and different way of learning.*

4 **Easy to use apps.** A comment was received from a female student in level one indicating the need to develop easy to use M-learning apps. She stated *As you know there are many kind of apps for different purposes. I had to quit using some apps because I found them really difficult to understand and to use. I only keep the ones that I am comfortable using.*

5 **Importance of using high quality M-learning systems.** A comment received from a male student in level three indicated the need to develop high quality M-learning systems (mobile apps) so that students will continuously use them. He stated *For me, the quality of the mobile app is important. I believe a badly designed educational app will affect student engagement and usage of it. However, a good user interface not only increases usability of the app but also leads to the smooth completion of any task at hand thereby making everything enjoyable and flexible for every student.*

6 **Special tools.** A female student in level three thought that there was a need for special mobile tools in order to provide efficient learning. She stated *I like the idea of using M-learning in schools only if there are special mobile tools or programs that are able to control or limit the usage of these technologies for only educational purposes.*

7 **M-learning and time management.** A comment from a male student in level three indicated that using technology, such as mobile devices, would help to manage learning time more effectively. He stated *Because everything will be in one device (e.g. iPad), I think we are able to manage our learning more effectively and efficiently by using*

different sets of tools to help us manage different courses. My sister is in her final year doing a university degree and she used to tell me that she was using an online interactive tool in her device to help her manage her time while learning.

8 **Lack the experience.** A female student in level three believed that some students lack the experience of using mobile device and it would take a while for them to learn know how to use the technology. She stated *I have a friend that does not know how to use her mobile phone, I believe it is difficult to implement M-learning in schools because not every student knows how to properly use the device.*

9 **Adding fun to learning**. A female student in level three said that introducing M-learning to the curriculum would add fun to the learning process which will make students more motivated as it offers different way to learn. She stated *I think students will be more enjoyed and eager to learn when they use their mobile devices. Because these devices offer different ways to learn.*

10 **Collaboration with students and teachers.** A male student in level two believed that M-learning would increase the collaboration between students and teachers. He stated *I am using different apps to learn and to socialise with friends. With the availability of different apps, such as WhatsApp, students will be able to communicate with each other and also to communicate with teachers by creating group chat.*

11 **M-learning is easy to use and a new method of learning**. A female student in level three believed that M-learning was easy to use and would provide different and new opportunities to learn. She stated *I think it is a good idea to implement M-learning because it is to use and currently we are addicted to mobile devices all the time for different purposes.*

12 **Reduce the burden of carrying heavy school bags.** A comment was received by a female student in level two saying that M-learning would reduce the burden of carrying heavy school bags. She stated *My doctor says that my back and neck pain is due to the heavy schoolbag I am carrying every day to school. That's why I think learning via mobile devices is healthier and convenient.*

4.4 Model development

This section explains the development of a conceptual model for the study of key factors affecting M-learning acceptance among high school students in public schools in Saudi Arabia. The model was based upon the critical review and analysis of information collected from previous studies outlined in the literature review chapter and found in the results of Phase 1.

Turner (2016) and Clarke and Svanaes (2014) assert the need for M-learning to be explored through more extensive research in the context of K-12 education. As a result, the conceptual model was developed in order to determine the key factors involved in users' acceptance of M-learning. The model was based on the points outlined in the findings from Phase 1 and the identification of the gaps in the literature. At present, no Saudi Arabian studies have focused on students' acceptance of M-learning in the K-12 context, and so the conceptual model provided a framework for the collection and analysis of empirical evidence on this topic in order to provide greater insight into the acceptance of M-learning in high schools in the Saudi Arabian public education sector.

The proposed hypotheses and main constructs of the model that were tested in a later phase of the study are explained in this section. The research has been limited to students' perspectives of M-learning, and acceptance by teachers lies outside its scope. It is expected that the proposed conceptual model will be attractive to the Ministry of Education, schools, and educators who are interested in implementing the technology in public schools.

4.4.1 The proposed research model

This research explored the factors influencing students' acceptance of M-learning. No research has attempted to address and identify the factors affecting M-learning acceptance among students in the K-12 context in Saudi Arabia until now. Therefore, a conceptual model was devised to fill this gap.

This conceptual model applies only to students' acceptance of M-learning within a high school context. It was based upon a critical review and analysis of the literature and the findings from Phase 1. The model was validated by students participating in an actual M-learning project (Phase 3). It consisted of six constructs there were identified from the literature and Phase 1 results.

The research model was based on the unified theory of acceptance and use of technology (UTAUT) which was used as a theoretical driver for this research. UTAUT was developed by (Venkatesh et al., 2003) who demonstrated that the UTAUT is well suited to explain IT use behaviour. The researchers found that the UTAUT model would allow them to explain how and why new technologies found acceptance. Furthermore, they pointed out that testing the model allowed them to discover new constructs, to which prediction of *intention to use* and *behaviour* could be added. Since the M-learning system is a type of technology (involving software and devices), it was considered highly probable that its acceptance by students could be investigated within a technology acceptance model such as UTAUT.

The original UTAUT model was formulated by theorising four constructs to play an important role as direct determinates of user acceptance and usage behaviour:

- *performance expectancy*
- *effort expectancy*
- *social influence*
- *facilitating conditions.*

For the purpose of this study, *facilitating conditions* and *user behaviour* were omitted from the study because the researcher was interested in measuring students' *behavioural intention* rather than their *actual usage* of M-learning.

The findings of Phase 1 revealed several factors that could potentially influence students' acceptance of M-learning, which led to the inclusion of three additional constructs in the research model:

- *system quality*
- *hedonic motivation*
- *self-management of learning.*

The research model contained seven latent constructs. A latent construct cannot be measured directly; however, it can be measured or represented by one or more variables. The variables in this instance were specific items or questions obtained from the participants in the questionnaire. Observed variables are used as indicators of latent constructs and these indicators are associated with each latent construct and are specified by the researcher (Bollen, 2002).

Based on the literature, the items were assigned to their latent constructs. The minimum number of items in each construct was three and the maximum four. For example, the *system quality* construct contained four observed variables, including SQ1, SQ2, SQ3 and SQ4, while the *self-management of learning* construct contained three observed variables, including SMoL1, SMoL2 and SMoL3. The research model (i.e., the theoretical framework) consisted of six important independent variables, one independent variable and one moderator (Figure 4.7).

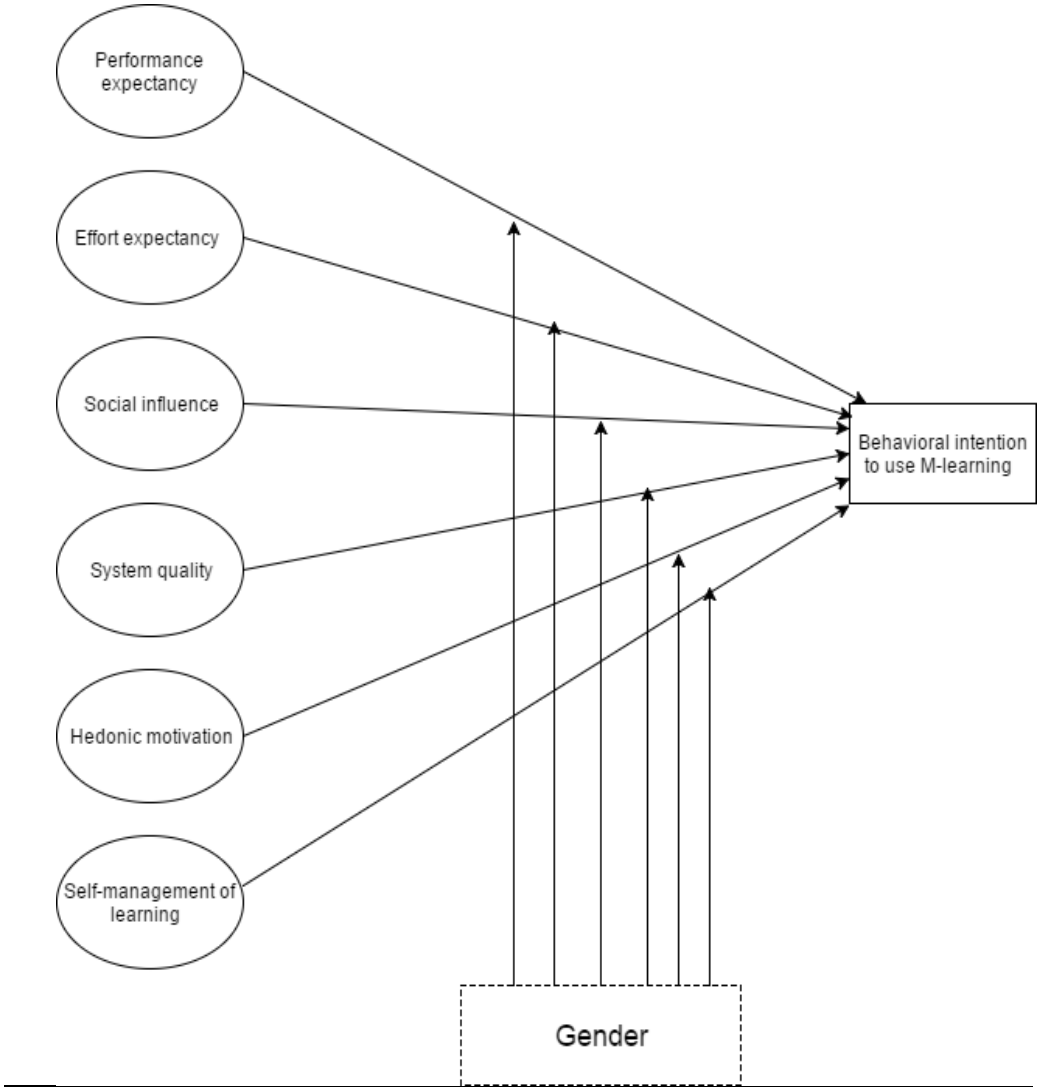

Figure 4.7 Proposed research model

- Six core constructs (independent variables)
  - *performance expectance*
  - *effort expectancy*
  - *social influence*
  - *hedonic motivation*
  - *system quality*
  - *self-management of learning*

These core constructs were expected to influence students' *behaviour intention* to use M-learning.

- One dependent variable
  - *behaviour intention.* The six independent variables were expected to influence the *behaviour intention* of students to use M-learning.
- One moderating variable
  - *gender*. The moderator was expected to impact on the influence of the six core constructs towards *behaviour intention*.

4.4.2 Model constructs and hypothesis development

Based on the research model, several hypotheses associated with the constructs were developed and tested.

Performance expectancy. *Performance expectancy* refers to the extent to which a particular system is perceived to be able to improve employees' performance in the workplace (Venkatesh et al., 2003). It is also associated with other acceptance model constructs, such as *outcome expectations* (as per SCT), *relative advantage* (as per IDT), *job-fit* (as per MPCU), *extrinsic motivation* (as per MM) and *perceived usefulness* (as per TAM/TAM2 and C-TAM-TPB).

In the case of tablet computer usage, *performance expectancy* has been found to be the key determinant in user acceptance (Anderson, Schwager, & Kerns, 2006), as well as the most common influencer of the degree of adoption (Davis, 1989). In the current research, *performance expectancy* was measured in terms of the usefulness, the ability to enhance productivity and learning outcomes of using M-learning systems. It was also predicted that *performance expectancy* would impact the *behavioural intention* of users to adopt M-learning.

> ***H1*** *Performance expectancy will have a positive effect on students' behavioural intention to use M-learning.*

Effort expectancy. *Effort expectancy* refers to the degree to which a particular system is believed to be convenient and requires little effort to use (Venkatesh et al., 2003). It has been acknowledged in other models, such as TAM and MPCU, with regards to perceived ease-of-use and complexity, respectively. *Effort expectancy* has been found to be a major determinant

of IT system acceptance. Wang et al. (2009), with numerous other researchers, also demonstrated that effort expectancy has a more significant impact on *behavioural intention* amongst female users than male users, older females than younger females, and females with less experience than those with more experience (Venkatesh & Morris, 2000; Venkatesh, Morris, & Ackerman, 2000; Venkatesh et al., 2003).

It has been suggested that the degree of acceptance users demonstrate towards a certain technology is determined by both ease-of-use, which relates to *effort expectancy*, and usefulness, which relates to *performance expectancy* (that is, the degree to which the technology is perceived to be able to help improve their job performance) (Davis, 1989; Venkatesh & Davis, 1996). In this research, *effort expectancy* was measured by the perceptions of the use of M-learning services. The following hypothesis was tested:

> ***H2*** *Effort expectancy will have a positive effect on students' behavioural intention to use M-learning.*

Social influence. *Social influence* was first presented as part of Ajzen (1985) TRA model, wherein it was referred to as 'normative beliefs'. *Social influence* refers to the way in which behaviour is perceived, as shaped by peer or societal opinions of the behaviour or, in other words, the extent to which other people influence users' acceptance of a system (Venkatesh et al., 2003). *Social influence* was also mentioned in the C-TAM-TPB, TAM2, TPB and other models, where it is referred to in the form of the term 'subjective norm' (Venkatesh et al., 2003). *Social influence* has been found to be a direct influencer of *behavioural intention* with regards to technology adoption, as demonstrated by several researchers (Harrison, Mykytyn Jr, & Riemenschneider, 1997; Mathieson, 1991; Moore & Benbasat, 1991; Thompson et al., 1991; Venkatesh & Davis, 2000) .

Normative beliefs have been broken down into two sub-forms: *peer influence* and *superior influence* (Taylor & Todd, 1995c). Both of these forms of normative beliefs were taken into account as part of *social influence* in the current study, as per the UTAUT model, wherein *social influence* was first presented as a single construct. In the current study, *social influence* was measured by the degree to which the perceptions of teachers, peers and parents influence the *behavioural intention* to adopt M-learning. Therefore, it was hypothesized that:

H3 *Social influence will have a positive effect on students' behavioural intention to use M-learning.*

Hedonic motivation. The engagement of users in activities using mobile technology can be better understood through an exploration of the factors that motivate them. This is an important consideration for businesses, since this can help to drive sales through being more in tune with the ways in which users are motivated to engage more with smartphones and other mobile technologies for entertainment, academic and other purposes. As Wachter, Kim, and Kim (2012) point out, it is likely that long-term engagement and use is positively associated with user satisfaction and perceived value, each of which is linked to motivation. The value mobile device users obtain from using their smartphones and other technologies increases as their level of engagement increases, with such devices allowing them to build and maintain rich, interactive social networks. Users then begin to demonstrate loyalty to their chosen device, which increases their motivation to use the technology whilst also enhancing their satisfaction as a result of greater value. This, in turn, provides users with even more motivation to engage with their mobile devices.

Motivation can be subcategorised into social, hedonic and functional aspects. Functional motivation is achieved through factors such as how convenient and easy to use the technology is. Hedonic motivation is derived from how pleasurable the user finds the technology to use. Finally, social motivation stems from the user's inclination to share content and interact with other people. Companies are able to build long-term relationships with users through greater engagement, which is achieved when users are motivated to use their devices. This then causes a decrease in disengagement and switching behaviour.

Activities that offer variety, enjoyment and relaxation engage users in pleasurable pursuits that are hedonically motivated (Venkatesh & Brown, 2001). This is related to the fulfilment of humans' intrinsic needs. Higgins (2006) further explains that 'hedonic' is rooted in Greek, with the term being related to pleasure. Therefore, as Holbrook and Batra (1987) assert, users perceive mobile device use as an intrinsically pleasurable activity that provides hedonic value through fun, entertainment and pleasure. A number of researchers, including Kim and Han (2011) and Sheth, Newman, and Gross (1991) have found that *hedonic motivation* promotes greater engagement, whilst others have demonstrated that mobile device engagement increases

in line with the enjoyment obtained through usage, as a result of intrinsic motivation (Lee & Jun, 2005). Additionally, Turel, Serenko, and Bontis (2007), along with Venkatesh and Brown (2001), have found empirical evidence to support the argument that users are more likely to engage with technologies when they experience *hedonic motivation*. Therefore, it is argued that users perceive technologies to deliver greater value the more *hedonic motivation* the technology arouses.

Venkatesh et al. (2012) modified the UTAUT model, developing the UTAUT2, to incorporate the construct of *hedonic motivation*, which was defined as the fun or pleasure associated with using a technology (Venkatesh et al., 2012). As Venkatesh and Speier (1999) and Davis et al. (1992) explain, initial models asserted that *hedonic motivation* refers to the perceived enjoyment of a particular system. Researchers such as (Childers, Carr, Peck, & Carson, 2002), Van der Heijden (2004), Ono, Nakamura, Okuno, and Sumikawa (2012) and Venkatesh et al. (2012) have all found that *hedonic motivation* is a key factor in the acceptance of new technology whilst also being a reliable indicator of how likely it is for a system to be accepted by users. Additionally, (Wang et al., 2009), (Wang & Wang, 2010), and (Suki & Suki, 2011) found that *hedonic motivation* has a significant impact on the acceptance of M-learning.

The current research incorporated hedonic motivation as a key factor in the behavioural intention of students to adopt M-learning. The following hypothesis was tested:

H4 *Hedonic motivation has a positive effect on behavioural intention to use M-learning.*

System quality. Swanson (1997) applied Reeves and Bednar's quality framework to the *quality of information systems,* asserting that strong performance, software standards and the use of the latest technology all contribute to superior IS quality. Users obtain value through ease-of-use and usefulness, and developers must also ensure that the software can be updated and maintained easily in order to avoid user dissatisfaction. The goal of any system must be to both meet the standards set in the industry in which it will be used, as well as to fulfil the needs of the end user.

Systems that take users' feedback into account, that meet stakeholder requirements and that offer an attractive, easily-to-navigate interface offer the greatest IS quality. System quality can be broken down into IS value, which is derived from easy maintenance, a short learning curve

and user-friendliness, and IS excellence, which is derived from the provision of major features and functions. Essentially, a high-quality system is deemed as such based on the quality of information processing offered by the system.

System quality and *information quality* have been found to be the two core requirements for the adoption of IS according to previous research (Delone & McLean, 2003). In the current research, system quality is taken to refer to how clear, accurate, and reliable the overall M-learning system and the services provided by the system are. *System quality* has been found to influence users' *behavioural intention* to adopt the IS, as well as users' satisfaction with the IS (DeLone & McLean, 1992, 2003), and is widely accepted as an influencer of technology acceptance.

The latter point is supported by Xin (2004), who states that users' acceptance of new technology is influenced by service quality. In the learning context, it has been suggested that students' behavioural intention to accept E-learning is impacted by the quality of the online support offered (Lee, 2010), with other researchers also finding that users' behavioural intention to study online courses is directly impacted by system quality (Chang & Tung, 2008).

It has been suggested in other research that service quality, user satisfaction, ease-of-use, security, information quality and a number of other dimensions should be incorporated into system quality (Aladwani & Palvia, 2002). Additionally, Schaupp et al. (2006) analysed survey data and found that users' satisfaction with online websites was significantly determined by information and system quality, whilst Lin and Lu (2000) found that user acceptance and customer satisfaction are both highly driven by website quality (system quality).

Various other researchers, including Barnes and Vidgen (2002), Nelson, Todd, and Wixom (2005), Wixom and Todd (2005), Ahn, Ryu, and Han (2007) and Collier and Bienstock (2009), have demonstrated that technology acceptance is greatly impacted by system quality, with service and website quality also being noted as important factors. Al-Hajraf and Al-Sharhan (2012) assert that the implementation of technology in the education field (e.g., E-learning) is greatly impacted by quality assurance. As Gafni (2009) explains, system quality is an important consideration when studying M-learning as an element of mobile system technology. Moreover, Huang (2014) has demonstrated that users' intention to engage with M-learning is

positively related to M-learning system quality, as is the case with E-learning also.Therefore, *system quality* was included in the research model. It was expected that the overall *system quality* would have a positive influence on the behavioural intention to use M-learning. The following hypothesis was tested:

H5 *System quality has a positive effect on behavioural intention to use M-learning.*

Self-management of learning. *Self-management of learning* is a type of learning in which learners are allowed to work on authentic problems and tasks of their own choice, and are still provided learning support in the context of their problems. Self-directed learning is an essential skill required in 21st century education. This learning approach increases the motivation of students to learn. Since they are the makers of their own knowledge, they experience a sense of independence while learning. This process keeps them engaged, since now they have to acquire knowledge on their own, and apply it along with their skills to find solutions to their problems, evolve their learning and be encouraged for life-long learning (Ni, 2013).

Today, technology supports practically every aspect of learning and teaching. As Ni (2013) notes, the effective use of technology is beneficial to learners in that it skill with ICT can help them to access the tools needed to learn independently for the rest of their lives. Kukulska-Hulme (2009) points out that learners are now able to access new sources of information, tailored learning experiences and more technologies as a result of mobile devices, which foster self-management of learning.

Smith et al. (2003) consider that *self-management of learning* is how individuals perceive themselves and their ability to self-motivate their own learning, and Sharples (2002) argues that in order to be a successful student, the individual needs to feel in control of the learning activity. Control comes through autonomous experimentation, asking questions, explorations and through collaborative argument. Distance learning requires self-control, motivation and self-management, a fact evidenced by much of the literature concerning this and resource-based flexible learning in general (Evans, 2000; Smith et al., 2003). Successfully engaging with M-learning requires positive and effective self-management of learning.

Various researchers, including Abar and Loken (2010), Lounsbury, Levy, Park, Gibson, and Smith (2009) and Chen (2002), have highlighted the fact that *the self-management of learnin*g

is a guide to greater academic attainment (Chen, 2002), and that higher GPAs have been found amongst students who are more proficient in self-managed learning (Lounsbury et al., 2009). Furthermore, *self-management of learning* has been argued to be a major factor in language learning outcomes for L2 learners (Wu, 2009), with Huang et al. (2012) finding that English-language learners demonstrate higher proficiency when their *self-management of learning* is more developed.

Students engaging in M-learning are often isolated from their peers, their teachers and the support of their educational establishment. For this reason students need to be good at critical thought. They need to be able to identify what they need as far as learning materials go, and they need to be able to submit feedback and evaluate resources (Li, 2010; McFarlane, Roche, & Triggs, 2007; Wang et al., 2009). It was anticipated that, with regards to M-learning, behavioural intention would increase in line with the user's capacity to self-manage. Successful M-learning demands self-directed and independent behaviour since students spend significant time working independently of their teachers.

Interestingly, Beck (1991) found that compared to women, men tend to demonstrate more autonomy in their nature, which could suggest that male learners may be more likely to engage in the *self-management of learning* through mobile technology. Additionally, it has also been suggested that older individuals are more likely to be skilled in self-management compared to younger learners. It is therefore useful that the *self-management of learning* is included in this study due to its direct impact on the acceptance of M-learning.

H6 *Self-management of learning has a positive effect on behavioural intention to use M-learning.*

4.5 Summary

Phase 1 was only a single aspect of this research study, and designed to develop the conceptual model for this research after producing a scenario revealing the overall views of the students when they consider using M-learning in their studies. Phase 1 also attempted to explain the research constructs of the proposed model.

As it can be observed from the findings of Phase 1, M-learning helps teachers and students enjoy the learning process more by enhancing their level of interaction. Similarly, the results

indicated that most students endorse the implementation and use of M-learning. Additionally, M-learning enhances the accessibility of learning materials by facilitating real time and remote access of these materials. This flexibility encourages students to utilize their free time interacting more with their teachers and fellow students.

The results showed that students had positive attitudes towards M-learning and believed that it could be readily implemented. Furthermore, they perceived many services and benefits flowing from M-learning that could help them in their studies. The results of this phase demonstrate for the Ministry of Education the readiness of students to use M-learning. The Ministry of Education in Saudi Arabia should take this opportunity to devise mechanisms to ensure that the implementation of the M-learning services is successful as it is of potential benefit to both teachers and students. It's implementation would require better infrastructure in schools for the management and maintenance of technology and its effective use.

The results and views obtained from the students helped to formulate the final research model. The next chapter describes Phase 2 of the present research in which the proposed research model was tested using structural equation modelling (SEM) techniques.

Chapter 5

Phase 2. Model validation

5.1 Chapter overview

The results of Phase 1 indicated that students accept the idea of introducing mobile technologies into their learning activities and they are willing to use them. The majority of students believed that M-learning would be an exciting and interesting process that would boost their level of confidence and enhance teaching and learning.

This chapter describes the ways in which the research model proposed in Phase 1 was investigated. In addition, the chapter explains how the influence of gender as a moderator of M-learning uptake was measured, and the results.

The chapter begins with a review of the results of the pilot study conducted for Phase 2. Next, the main findings of the Phase 2 survey are presented and explained, including the details and results of the analysis of the measurement and structural models that were utilized to test the constructs proposed in the conceptual model.

5.2 Pilot study results

The duration of the pilot study was from 1 October 2015 to 15 October 2015. From an approximate population of 600-800 students, 33 surveys were completed. Three of the received online responses were exempted from the analysis due to many unanswered questions. Therefore, 30 questionnaires were used in the analysis. The completion time for the survey was estimated to be around 10-15 minutes. At the end of the questionnaire, respondents were requested to comment and provide feedback on the instrument, particularly in relation to any unclear wording or ambiguity.

5.2.1 Instrument reliability

Reliability refers to the degree to which an instrument is consistent in measuring what it has been designed to measure, with Sekaran and Bougie (2010) also explaining that it refers to the extent to which random errors are absent from the research instrument. Reliability is tested in the current study using Cronbach's alpha, wherein a value of 0.7 or higher demonstrates good reliability (Hair et al., 2010).

Any items below a value of 0.7 must be excluded from the instrument in order to ensure overall reliability. The demographic characteristics of the pilot study respondents are illustrated in Table 5.1. The internal consistency of the measure for each construct was tested using the *SPSS* v. 22 reliability function.

Table 5.1 Demographic characteristics of the pilot study

Variable		Frequency	Percentage
Gender	male	10	33.3
	female	20	66.7
Educational level	first	0	0
	second	7	23.3
	third	23	76.7
E-learning knowledge	very poor	0	0
	poor	1	3.3
	moderate	6	20
	good	7	23.3
	very good	16	53.3
Mobile devices	mobile phone	0	0
	smart phone	30	100
	tablet pc	8	26.7
	laptop	7	23.3
Mobile educational apps	yes	15	50
	no	15	50
M-technologies knowledge	very poor	0	0
	poor	0	0
	moderate	2	6.7
	good	9	30
	very good	19	63.3

Table 5.2 Reliability coefficients of scales

Construct	Original # of items	# of deleted items	Final # of items	Cronbach's alpha
Performance expectancy (PE)	4		4	.755
Effort expectancy (EE)	4		4	.739
Social influence (SI)	4	1	3	.765
Hedonic motivation (HM)	4	1	3	.866
System quality (SQ)	4		4	.910
Self-management of learning (SMoL)	3		3	.830
Behavioural intention (BI)	4		4	.820

Table 5.2 shows that some items were removed to increase the values of alpha. One statement item was removed from the scales of social influence, *hedonic motivation*, which increased the value of alpha to 0.756 and 0.866, respectively.

As can be seen from Table 5.2, the findings of the pilot study confirmed an acceptable Cronbach's alpha for all six constructs (after removed items). The Cronbach's alpha coefficients of all scales were high and well above the 0.70 threshold, ranging from 0.739 to 0.910, demonstrating internal consistency. The results confirmed that these variables were reliable and valid for further analysis.

5.3 Data analysis (main study for Phase 2)

One of the main challenges for researchers is analysis of the data using any of a variety of statistical methods. The techniques used to collect the statistics in this specific field can be categorised in two ways – descriptive and inferential statistics. Descriptive statistics draw on the basic features of sample data and describe them; while inferential statistics are used to test hypotheses from the data in order to extrapolate theories about the larger population (Hair, Money et al. 2007).

Analysis of the quantitative data in this phase involved two steps. Firstly, descriptive statistics were used to outline the demography of the male and female respondents followed by testing the assumptions of data; secondly, advanced statistical analysis was conducted using structural equation modelling (SEM). Structural equation modelling is a general modelling framework that integrates a number of different multivariate techniques into one model fitting framework (Hair et al., 2010). Analysis of the descriptive statistics was conducted, along with SEM to test the assumptions of the data analysis. SEM was used to validate the proposed model in order to provide answers about the constructs and present the outcomes of the hypotheses to answer the research questions.

5.4 Descriptive statistics

Descriptive statistics provide information about the sample population's fundamental characteristics (Janssens, Wijnen, De Pelsmacker, & Van Kenhove, 2008). The main questionnaire findings will be presented in this section, with descriptive statistics selected as the data analysis method. Each variable is expressed in terms of frequencies and percentages.

As indicated in Chapter 3 (methodology), the online survey (main survey for Phase 2) was distributed to students at all levels of high school education, with 295 questionnaires returned. Of the 295 responses, 23 were excluded due to incompleteness. Therefore, the total number of valid responses was 272, with 139 responses from male students and 133 responses from female students.

Gender. As can be seen from Figure 5.1, there were more male students in the sample population than female students, with 51.10% males and 48.90% females in the total population. This indicates that both males and females students in Saudi Arabia are highly interested in M-learning.

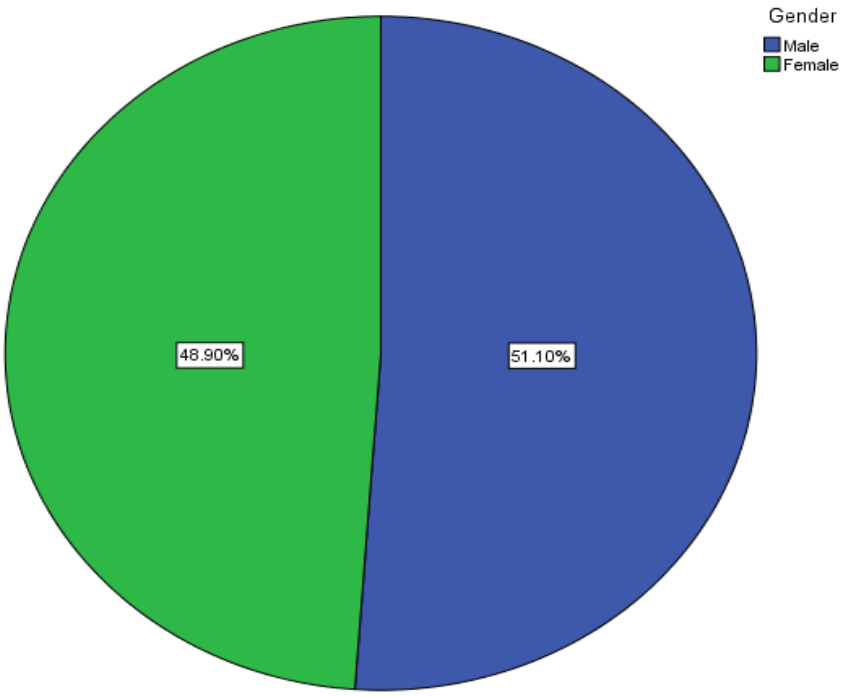

Figure 5.1 Gender distribution

Educational level. Figure 5.2 shows that the majority of the 272 students who responded to the questionnaire (121 students) were in the third level of study (equivalent to year 12 in the K-12 range), and at that level there were more female respondents than males (63 females; 58 males). From the 66 level two respondents, females again outnumbered males (36 females; 30 males). However, of the 85 students from level one who responded, males outnumbered females (51 males; 34 females). This indicates that students in higher levels are more excited about M-learning than those in the lower levels.

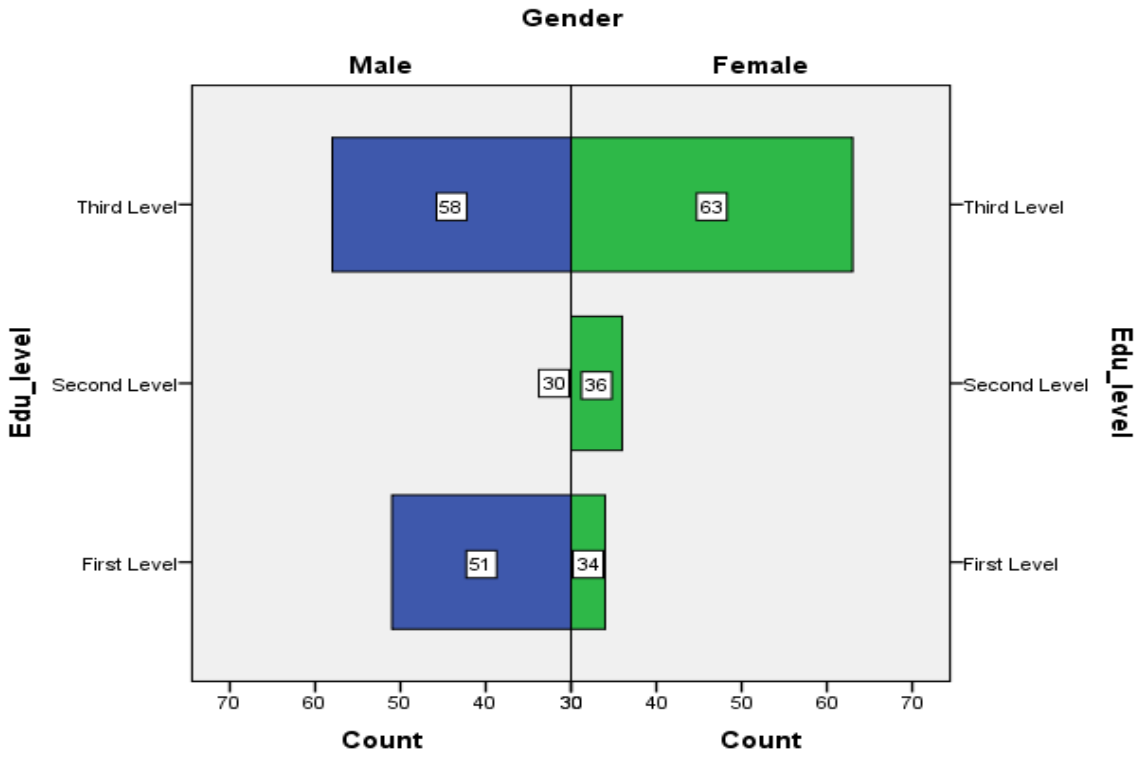

Figure 5.2 Educational level distribution

Access to mobile devices. Figure 5.3 shows that the majority of the 272 respondents of both genders had access to a smart phone. As can be seen in Figure 5.3, a tablet PC was the second most popular device recorded by the students, with 99 students having access to one, followed by laptops (46 students). Only four students reported having access to a basic type phone (no Internet access or built-in camera). This indicates that the majority of students have access to different kinds of mobile technologies which will ease the implementation of M-learning if schools decides to integrate M-learning in their curriculum.

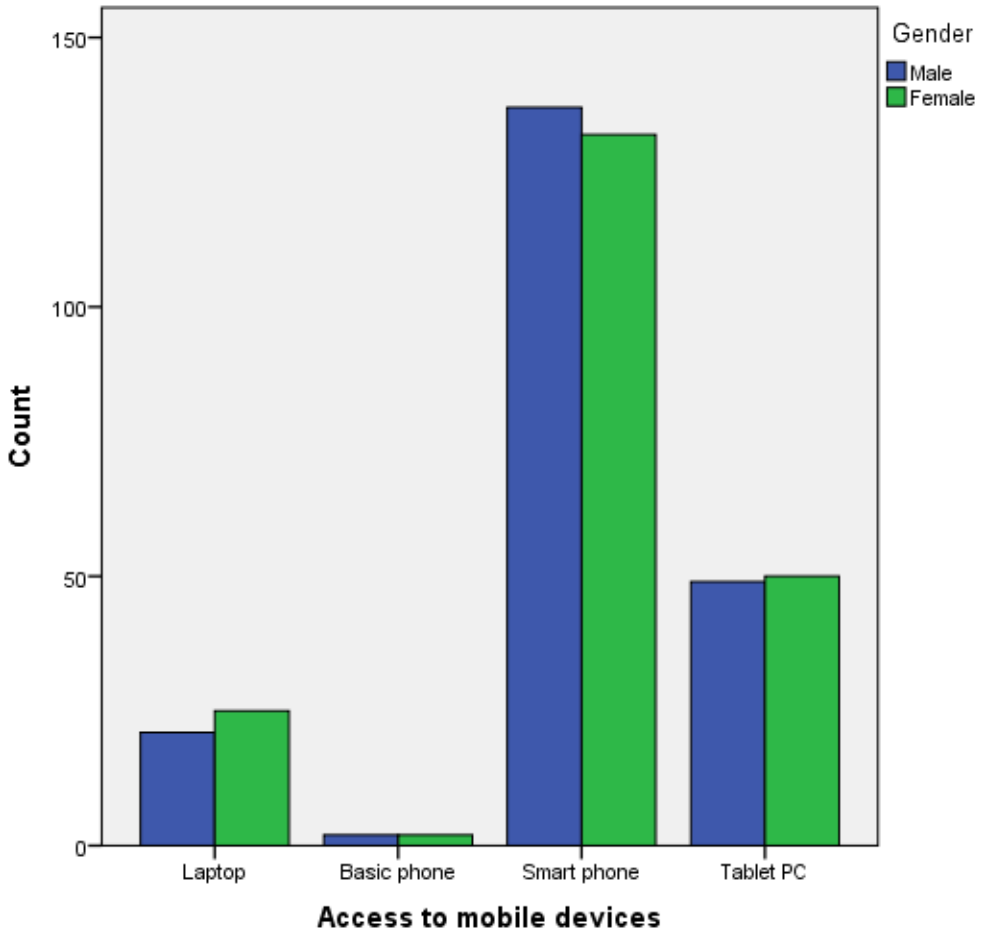

Figure 5.3 Access to different mobile devices

Educational applications via mobile technologies. The question *Are you using any educational applications on your mobile device or have you used any before?* was asked to check whether students were using or had used any educational software application (or app). The results showed that both genders were using or had used an educational application. As can be seen in Figure 5.4, almost half of the female respondents (65 respondents) indicated that they had used or were still using an educational application. On the other hand, 95 out of 139 male respondents indicated that they had not used any educational application before.

Respondents who answered yes to the question were asked to define the educational application. A variety of applications had been used by the respondents. The majority of them used English language learning applications on their smartphones, such as dictionary applications and translation. Other educational applications included learning mathematics by using *Khan Academy* app.

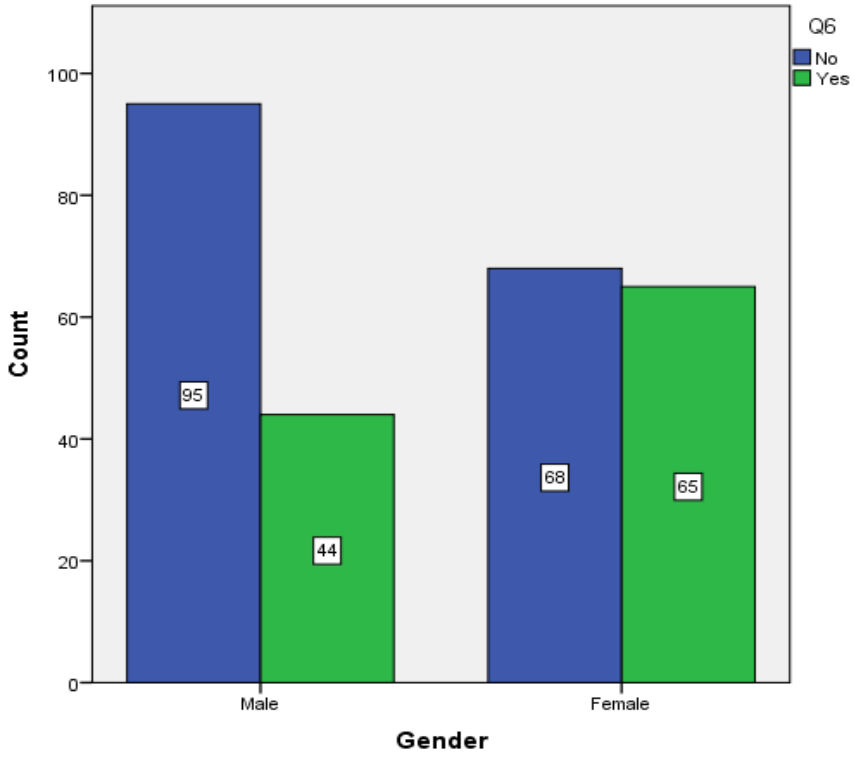

Figure 5.4 The use of educational applications via mobile apps (by gender)

Knowledge of using M-technologies. As shown in Figure 5.5, 200 students (including males and females) indicated that they had a *very good knowledge* of M-technologies. 52 of the respondents stated they had a *good knowledge* of using M-technologies, 18 students indicated a *moderate knowledge*, two students stated they had a poor knowledge, and no students reported *very poor* knowledge of using M-technologies. This indicates that the majority of students are familiar with using different M-learning tools and, therefore, schools may be less concerned about conducting training sessions for their students to use mobile technologies.

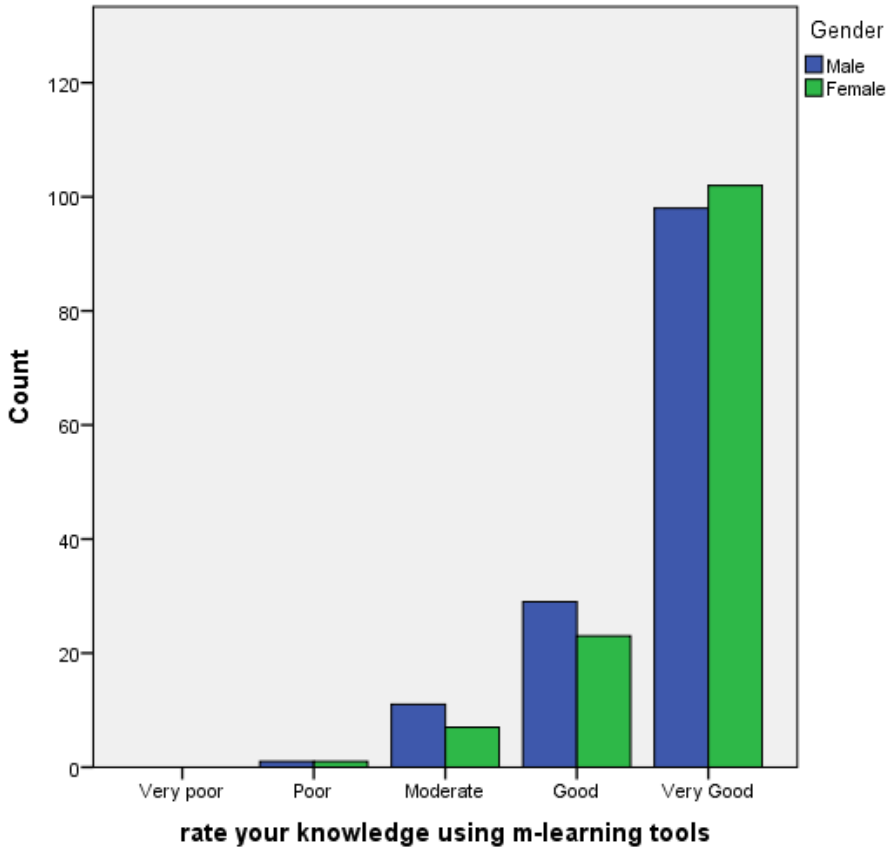

Figure 5.5 Knowledge of using M-learning tools

5.5 Testing the assumptions of data analysis

Before proceeding to conduct the main and advanced statistical analysis, two assumption tests were performed to meet the requirements of data analysis. The first assumption was *outliers testing*. Outliers are numbers which are either much larger, or much smaller than the rest of the data in a dataset (Hair, Anderson et al. 2010). Moore and McCabe (1989) point out that outliers are data values that are positioned outside of the overall pattern of the distribution. Outliers can skew or change the shape of the data and can artificially inflate or deflate estimates. The process of eliminating outliers is important to make the data eligible for proceeding to the main analysis.

The second assumption was *normality testing*. Multivariate normality is the key assumption in multivariate analysis. Hair et al. (2010) explain that normality is associated with the baseline standard for all statistical methods (normal distribution), with most statistical methods assuming a normal distribution of scores on the dependent variable. Gravetter and Wallnau

(2016) add that a normal distribution is representative of a symmetrical bell-shaped curve, where lower frequencies are at either side and higher frequencies are around the middle. This present research tested the variables' normality using skewness and kurtosis tests to determine whether the variables were normal for using statistical techniques like SEM. These techniques are used both commonly and widely to test variables' normality (Hair et al., 2010).

The appearance of skewness and kurtosis threatens a SEM analysis (Byrne, 2016; Hair et al., 2010). The skewness of a data set seriously affects the algorithms that are used to test the mean (Byrne, 2016). Kurtosis is used to calculate the variance and covariance (Byrne, 2016). Therefore, it is necessary to conduct these data set tests prior to SEM analysis.

According to Byrne (2016), skewness values greater than 3.0 and kurtosis values greater than 7.0 should be considered problematic. As can be seen in Table 5.3, the values of skewness and kurtosis in this research were not larger than 1.4 and 1.9 respectively. The results demonstrates moderate skewness and moderate non-normality. Although the scores presented both positive and negative skewness and kurtosis, neither of them was extreme. Pallant (2013) has pointed out that many other research findings in social sciences have obtained different negative and positive values for skewness and kurtosis.

Table 5.3 Values of skewness and kurtosis

Variable	Skewness	Kurtosis
Performance expectancy		
PE1	-0.301	-0.281
PE2	-0.355	-0.265
PE3	-0.490	0.049
PE4	-0.589	0.405
Effort expectancy		
EE1	-0.680	0.699
EE2	-0.678	0.894
EE3	-0.508	0.554
EE4	-0.800	0.204
Social Influence		
SI1	0.887	-0.176
SI2	0.820	-0.458
SI3	0.905	-0.221

Variable	Skewness	Kurtosis
System quality		
SQ1	0.239	-0.605
SQ2	0.027	-0.683
SQ3	-0.089	-0.895
SQ4	0.272	-0.445
Self-management of learning		
SMoL1	-1.256	1.373
SMoL 2	-1.417	1.98
SMoL 3	-1.113	1.147
Hedonic Motivation		
HM1	-0.538	0.677
HM2	-0.583	0.864
HM3	-0.273	-0.261
Behavioural Intention		
BI1	-0.763	1.663
BI2	-0.601	0.843
BI3	-0.743	1.830
BI4	-0.520	0.786

5.6 Overview of structural equation modelling

Structural equation modelling (SEM) is a general statistical modelling technique used to establish relationships among variables (Hair et al., 2010). SEM is a popular statistic technique in social science research (Mueller, 1997). Byrne (2016) defined SEM as a statistical technique for testing causal relationships based on non-experimental data. SEM is not a single technique, but a family of integrated procedures and techniques, such as measurement theory (psychology), factor analysis (psychology and statistics), path analysis (epidemiology and biology), regression (statistics) and simultaneous equations (econometrics) (Holmes-Smith, Coote, & Cunningham, 2006). According to Gefen, Straub, and Boudreau (2000), SEM is considered an excellent tool with which to investigate and validate theoretical models. It provides a basis for hypothesis testing by estimating the path coefficients of the fundamental links of the linear relationships among observed and unobserved variables (Byrne, 2016).

According to Hair et al. (2010), SEM is used to test theoretical models. A SEM model consists of:

1 The measurement model (CFA)

The measurement model (CFA; i.e., confirmatory factor analysis), also referred to as 'the restricted factor model', is a statistical technique used to verify the factor structure of a set of observed variables (Hair et al., 2010). It provides a stricter interpretation than those methods employed during exploratory analysis (Anderson & Gerbing, 1988). According to Kline (2015), CFA allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exits. CFA validates the hypothesised theoretical constructs (or factors).

2 The structural model

Hair et al. (2010) explain that the structural model focuses on the nature and magnitude of the relationships between the constructs in the model, whilst the measurement model focuses on the associations between the selected variables within their specified constructs.

In this study, a two-step approach was followed. Firstly, the whole measurement model was assessed to test its validity and whether the model could be considered a good fit with the data collected. Secondly, the structural model was assessed to test the relationships between the constructs (hypotheses testing) (Anderson & Gerbing, 1988). In both steps, *AMOS* (Arbuckle, 2014), a software package for the analysis of SEM, was used because it is compatible with the *SPSS* program that was used for the previous analysis.

Prior to conducting the measurement model (CFA), an exploratory factor analysis (EFA) was performed on the data. The selection of factor extraction and proper rotation methods for extracting the factors are always important (Tabchnick & Fidell, 2006). In this study, principal components analysis (PCA) was selected as the factor extraction method and varimax variation was the rotation method.

Principal components analysis (PCA) was selected to produce the initial solutions for the EFA, because this extraction process recognises the fundamental evaluative dimensional arrangements and decreases a big number of factors into a smaller number of constituents by

converting a set of interconnected variables into a fresh set of unconnected linear complex variables (Cooper, Schindler, & Sun, 2003; Hair et al., 2010). Each constituent interpretation looks for a decreasing quantity of total difference in the original variables, and processes what the variables had in common (Churchill & Iacobucci, 2006; Cooper et al., 2003).

The examining orthogonal influence enquiry model with varimax variation in *SPSS* v.23 was used in this review because conclusions produced from orthogonal variation have a greater replicability and generalisability control when likened with leaning variation. Secondly, interpretation of orthogonal rotation factors is easier because the factors do not correlate with one another. Lastly, orthogonal rotation, particularly with varimax rotation, is the preferred choice of the majority of researchers in similar circumstances (Beavers et al., 2013; Osborne & Costello, 2009; Rennie, 1997).

In selecting the items, only items with a loading value over 0.4 were extracted as factor loadings, as those below 0.4 are considered too low to be included (Field, 2013; Stevens, 2012). The initial EFA showed that two items (SQ3 and EE4) were loading on a single factor alone with SQ3 having a negative loading. Therefore, the two items were removed from the study. The data in Table 5.4 illustrate that the item loadings of 23 variables were significant and well above the 0.40 threshold without having any cross or negative loadings among the seven extracted factors. In addition, the factor analysis explained 68.289% (cumulative percentage) of the variance criterion.

The results confirmed that the developed instrument consisted of reliable and valid items, which sufficiently captured the meaning of the model constructs and their associated factors. The final result of the exploratory factor analyses are presented in Table 5.4.

Table 5.4 Exploratory factor analysis results

Constructs	Item loadings	Loadings						
Performance expectancy	PE1	.722						
	PE2	.825						
	PE3	.769						
	PE4	.764						
Effort expectancy	EE1		.798					
	EE2		.815					
	EE3		.730					
Social influence	SI1			.842				
	SI2			.854				
	SI3			.737				
Hedonic motivation	HM1				.678			
	HM2				.804			
	HM3				.830			
System quality	SQ1					.799		
	SQ2					.805		
	SQ4					.760		
Self-management of learning	SMoL1						.845	
	SMoL2						.774	
	SMoL3						.715	
Behavioural intention	BI1							.807
	BI2							.750
	BI3							.694
	BI4							.566

5.7 Goodness-of-fit metrics

The overall fit of the measurement and structural models must be determined following the evaluation of SEM criteria. To decide whether the theoretical model fits the data, there are several fit measures that can be used such as the goodness-of-fit (GOF) metrics. The model is evaluated from numerous angles by each specific GOF grouping (Hair et al., 2010). In this research, three types of fit indices were selected for assessing model fit:

Absolute fit indices. Absolute fit indices determine the congruence between a model's fit and the invariance–covariance matrix of the sample data without comparing the model's fit to other models (Kline, 2015). These actions deliver the most important signal of how well the planned concepts fit the information. There are several indices that fall into the category of absolute

indices that are computed in *AMOS* software, including the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), Chi-squared test, χ^2/df ratio and the root mean square error of approximation (RMSEA) (Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999; Suhr, 2006).

The Chi-square (χ^2) statistic is the most general and common absolute fit index. Nonetheless, from the literature, it was understood that Chi-square is sensitive to a big sample size (Hair et al., 2010). An alternative solution is to consider using the normed χ^2 (CMIN/DF), which mitigates the result of a model size by distributing the Chi-square by the gradations of liberty χ^2/df, where a value less than 3.0 is evidence of a healthier fit, and occasionally even values less than 5.0 are permissible (Hair et al., 2010).

RMSEA is frequently applied in the applications of SEM that provide a good indication of an absolute fit index. Values of RMSEA equal to zero show an exact fit of the model, while a RMSEA value between 0 and 0.05 is considered acceptable and provides a good fit. Whereas a value between the range 0.05-0.10 is considered a moderate fit, and a value over 0.10 shows a poor fit (Fan & Sivo, 2007; Hooper et al., 2008).

Jöreskog and Sörbom (1993) developed the goodness-of-fit index (GFI) test as an alternative for the Chi-square test. The GFI estimates the quantity of modification that is accounted for by the projected covariance. Furthermore, they developed the adjusted goodness-of-fit index (AGFI) to adjust for a bias resulting from model complexity. Several researchers have attempted to define the recommended values for both GFI and AGFI. The recommended value for GFI is > .95. Moreover, values above .90 are also considered acceptable. As for AGFI, the recommended value for AGFI is > .90 and values above .85 provide acceptable fit (Marsh & Grayson, 1995; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Schumacker & Lomax, 1996).

Incremental fit indices. Also known as the comparative or relative fit indices (McDonald & Ho, 2002), the incremental fit indices compare a Chi-square for the model tested to one from a so-called null mode (baseline model). In this case, the null proposition is that the all flexibles are un-correlated in the models. Common incremental fit indices computed in *AMOS* software includes the incremental fit index (IFI), Tucker-Lewis index (TLI), comparative fit index (CFI) and the normed fit index (NFI).

Among all incremental fit indices, CFI tends to be the mostly commonly reported in the literature, as CFI can deal with smaller samples and overcome the effect of sample size. For CFI, the cut-off value is usually accepted as CFI ≥ 0.90 (Hu & Bentler, 1999; Suhr, 2006). However, some recent studies suggest that a cut-off of CFI ≥ 0.95 is more appropriate to guarantee that mis-specified models are not recognised (Hooper et al., 2008).

Parsimonious fit indices. By taking into account the complexity (i.e., number of estimated parameters), parsimony fit indices check whether a model fits the sample data (Mulaik et al., 1989). In other words, it is common to add parameters to the estimated models until they fit the data. It is important to ensure that the large number of parameters of the model and its complexity are not the reason behind the high level of fit of the model. This type of index includes the parsimony goodness-of-fit index (PGFI), the parsimonious normed fit index (PNFI) and the parsimony ratio (PRATIO).

Summary of indices used in the study. Table 5.5 summarises the goodness-of-fit indices used in this study.

Table 5.5 Summary of indices used in the study

Category	Fit index	Acceptable Level	References
Absolute fit index	Chi-square χ^2	χ^2 < df	(Hair et al., 2010) (Byrne, 2016) (Kline, 2015) (Hu & Bentler, 1999) (Hooper et al., 2008) (Marsh & Grayson, 1995) (Schumacker & Lomax, 1996) (Schermelleh-Engel et al., 2003)
	CMIN/DF (χ^2/df)	< 3 good; < 5 sometimes permissible	
	RMSEA	< 0.05 good 0.05 to 0.10 moderate > .10 bad	
	GFI	> 0.90	
	AGFI	> 0.85	
Incremental fit indices	CFI	> 0.90	
Parsimonious fit indices	PRATIO	> = 0.5 closer to 1 better	

5.8 The measurement model

Once the SEM requirements are assessed, the next step is to assess and validate the overall fit for the measurement model using the criteria defined in the previous section. Seven latent factors were entered into the model (Figure 5.6).

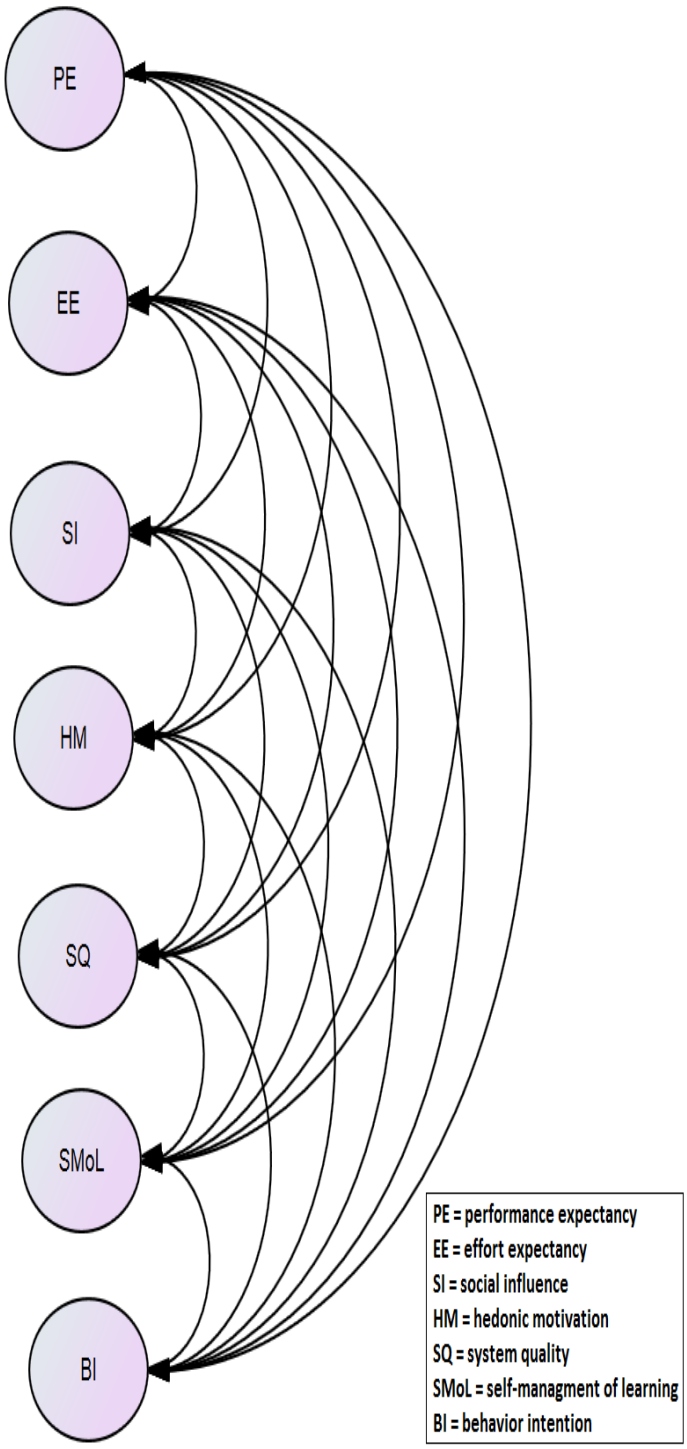

Figure 5.6 The measurement model

5.8.1 Results of the measurement model

The results for the measurement model are shown in Table 5.6. The measurement model was drawn using *AMOS* software version 22 which presents more than 20 different goodness-of-fit measures. As can be seen in Table 5.6, the goodness-of-fit indices achieved acceptable results. A significant Chi-square implies that the model does not account for the data, whereas a non-significant Chi-square (i.e., p value > 0.05) provides model support. Furthermore, the Chi-square statistic was supplemented by other varied tests (identified in section 5.6) of fit in order to gain a consensus on the applicability of the model. Table 5.6 presents the main fit statistics applied and their acceptable levels.

Table 5.6 Results of the measurement model

Chi-sq.	P-VALUE	CMIN/DF	RMSEA	GFI	AGFI	CFI	PRATIO
236.795	0.091	1.133	0.022	0.933	0.911	0.988	0.826

5.8.2 Validity analysis

Before applying the independent and dependent constructs to the structural model and testing the hypotheses, the validity of these constructs needed to be finally checked. Construct validity involves the degree to which measured variables actually reflect the construct. Typically, it involves two subdivisions: convergent and discriminant validity (Hair et al., 2010) to be calculated. A few measures are necessary to calculate the discriminant and convergent legitimacy of the constructs. These are maximum shared variance (MSV), average variance extracted (AVE), and average shared variance (ASV).

Hair et al. (2010) explain that convergent validity refers to the assertion that all items associated with a construct should have a common degree of variance. Straub, Boudreau, and Gefen (2004) also explain that convergent validity represents the degree to which items are representative of a single construct, with (Wiederman, 2002) defining convergent validity as the degree of correlation between a research instrument and theoretically relevant constructs and scales. Poor correlation between the chosen variables is indicated by convergent validity problems, meaning that the variables do not offer a good level of insight into the latent factor associated with them.

According to Fornell and Larcker (1981), there are some measures that are useful for assessing convergent validity: composite reliability (CR) and average variance extracted (AVE).

Composite reliability (CR). CR is a less biased estimate of reliability than Cronbach's alpha. The acceptable cut-off value is 0.7. It can be calculated according to the formula (Hair et al., 2010):

$$\textbf{Composite reliability} = \frac{\left(\sum_{i=1}^{n} \lambda_i\right)^2}{\left(\sum_{i=1}^{n} \lambda_i\right)^2 + \left(\sum_{i=1}^{n} \delta_i\right)}$$

Where: *n* = total number of items; = standardized factor loadings; and λ_i = error variance term.

Average variance extracted (AVE). Measures the level of variance captured by a construct versus the level due to measurement error. The average variance extracted (AVE) value is set at a benchmark of 0.5 (Bagozzi and Yi, 1988), with Fornell and Larcker (1981) asserting that good convergent validity is demonstrated at an AVE value of above this figure. In this study, the Hair et al. (2010) equation was used to assess convergent validity.

$$\textbf{Average variance extracted (AVE)} = \frac{\sum_{i=1}^{n} \lambda^2{}_i}{n}$$

Where: *n* = total number of items; and λ_i = standardized factor loadings

Discriminant validity refers to the degree to which an instrument can accurately distinguish the groups it is designed to distinguish (that is, the degree to which a particular construct differs from others in the model) (Hersen, 2004). Holmes-Smith et al. (2006) assert that poor discriminant validity is found at correlational values of 0.8 or higher between latent constructs. On the other hand, good discriminant validity is shown when the AVE value exceeds the construct's squared correlations between the scales (Hair et al., 2010). Fornell and Larcker (1981) further note that the square roots of the AVE values are compared to the correlations

between factors within constructs in order to evaluate discriminant validity. The threshold criteria for all these validity tests are presented in Table 5.7.

Table 5.7 Recommended measures for model validity (Hair et al., 2010)

Analysis test	Recommended criteria
convergent validity	AVE > 0.5
discriminant validity	MSV < AVE, ASV < AVE

The CR, MSV, AVE, and ASV as well as composite reliability are presented in Table 5.8.

Table 5.8 Validity results (CR, MSV, AVE, and ASV)

	CR	AVE	MSV	ASV
HM	0.808	0.684	0.508	0.195
PE	0.849	0.585	0.329	0.193
EE	0.795	0.565	0.345	0.175
SQ	0.776	0.537	0.329	0.132
SI	0.757	0.517	0.007	0.004
SMoL	0.705	0.454	0.051	0.017
BI	0.807	0.512	0.508	0.242

As can be seen in Table 5.8, all composite reliabilities for each factor exceeded the criterion of 0.70. Furthermore, all factors demonstrated discernment validity, which indicates that no constructs of a factor in the model had any effect on other constructs of other factors in the same model.

However, as seen in Table 5.8, there is a convergent validity issue with one factor (*self-management of learning*) as the AVE was below the recommended threshold value of 0.50. Therefore, the researcher had to further investigate this problem as both CR and the discriminant validity of *self-management of learning* were accepted. The researcher found that the question that was asked to determine the *self-management of learning* factor was sometimes misinterpreted by the students. The variables for *self-management of learning* have mixed responses, which somewhat contradict the qualitative responses. Because the students misinterpreted and mixed these variables, the convergent validity for these constructs was below the threshold. As a result, one item (SMoL3) was dropped from the study and no validity issues were found after eliminating the item (SMoL3).

Table 5.9 shows that the square correlation between any two constructs was less than their respective AVE. All the validity and reliability checks indicated that the CFA model was verified (after removing SMoL3 from the study), and these constructs could be safely entered into the structural model analysis.

Table 5.9 Factor correlation matrix with square root of the AVE on the diagonal for the exogenous and endogenous constructs

	SMoL	PE	EE	SQ	HM	SI	BI
SMoL	0.742						
PE	0.120	0.765					
EE	0.082	0.523	0.752				
SQ	0.062	0.574	0.335	0.733			
HM	0.152	0.471	0.557	0.322	0.764		
SI	0.044	0.061	0.071	0.086	0.039	0.719	
BI	0.227	0.558	0.587	0.488	0.713	0.036	0.715

5.8.3 Invariance testing

It is important to consider and reduce any bias that may have resulted from the data collection and/or respondents' characteristics, when conducting research that spans across groups (e.g., gender) (Cohen, Manion, & Morrison, 2013). To reduce such bias, there is a need to assess the measurement invariance across different groups (i.e., gender). This was also important as the researcher planned to study moderation effects at a later stage. Hair et al. (2010) recommend checking metric-invariance prior to examining path estimates in the structural model.

Following these recommendations, the researcher investigated the measurement model invariance to ensure that the factor structure was equivalent across different groups or values of multi-group moderators. For instance, it was necessary to find out whether the factor structure for both males and females was the same. If good levels of goodness-of-fit (GOF) were achieved across the groups, this would indicate that configural invariance had been achieved and the two groups were probably going to be equivalent, indicating that the model could be used across different groups.

One approach to test that the model is invariant is to look at the GOF parameters for the calculated model after defining a number of groups within *AMOS*. If the GOF parameters were good, this would indicate that the model was equivalent across different groups. By using *AMOS*, according to the proposed model, two groups were created (males and females). Table 5.10 presents the model fit indices for both groups.

Table 5.10 Model fit indices for both groups

Chi-sq.	P-value	CMIN/DF	RMSEA	GFI	AGFI	CFI	PRATIO
461.749	0.002	1.228	0.029	0.876	0.833	0.962	0.829

As can be seen in Table 5.10, an acceptable level of parameters was achieved. Therefore, it was assumed that the model was the same across genders.

To confirm these findings and to achieve metric invariance, a Chi-square test of difference was performed using *AMOS*, which helps in comparing Chi-square and degree of freedom values for both models (i.e., unconstrained and fully constrained). In order to constrain the model to be equal across the groups, the variances for factors were restricted to one and the regression values were removed from the lines.

The researcher ran the Chi-square difference test using the gender group to ensure that the model was equivalent across different groups at the model level. Table 5.11 presents the output obtained from comparing both the constrained and unconstrained model.

Table 5.11 Invariance testing of the fully constrained and unconstrained model

	Chi-square	df	p-value	Invariant?
Overall model				
Unconstrained	461.7	376		
Fully constrained	491.4	398		yes
Number of groups	2	2		
Difference	29.7	22	0.126	

As can be seen in Table 5.11, the p-value is not significant and is greater than Byrne (2016) threshold value of 0.05. This confirmed that there were no significant differences between the two groups at the model level and metric invariance was achieved. Differences at the path level within moderators was explored at a later stage as part of the structural model moderation testing.

5.9 The structural model

After the successful development of the measurement model, the next step was to develop a structural model with all seven factors. Hayduk (1987) explains that a structural model represents the associations that exist between different chosen variables. According to Byrne (2016), structural models are statistical methods that are designed with hypothesis testing in mind when assessing a structural theory relevant to a particular research topic or object.

Hair et al. (2010) explain that the purpose of hypothesis testing is to determine a meaningful contribution to the explanation of the dependent variables. Generally, the model specified *performance expectancy*, *effort expectancy*, *social influence*, *self-management of learning*, *system quality* and *hedonic motivation* as *exogenous (independent) constructs*, whereas *behavioural intention* was specified as an endogenous (dependent) construct, as revealed in Figure 5.7.

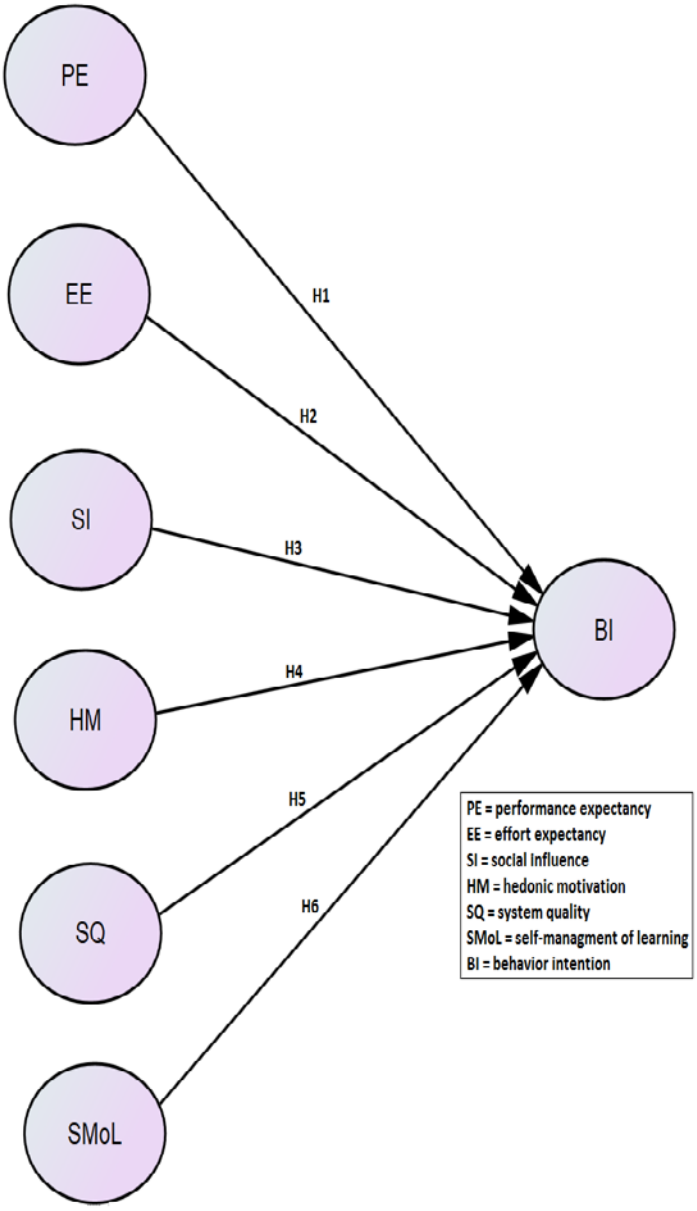

Figure 5.7 The structural model

The assessment of the structural model included an inspection of model fit indices (similar to those used in the measurement model). Furthermore, in the structural model, the standardized path coefficients and critical ratio (t-values) were checked to explore which hypothesized

relationships were supported or not. In order to determine whether the hypothesised relationship could be considered significant, the critical ratio should exceed ±1.96 (significant at alpha (α) level 0.05) or ±2.56 (significant at alpha (α) level 0.01) (Gefen et al., 2000).

5.9.1 Results of the structural model

The fit indices are summarized in Table 5.12. As can be seen, the model showed a poor level of fit which indicates that there is room for improvement. The values of GFI, AGFI and CFI were below the recommended threshold. However, CMIN/DF, RMSEA and PRATIO showed an acceptable level of fit.

Table 5.12 Structural model results

Chi-sq.	P-value	CMIN/DF	RMSEA	GFI	AGFI	CFI	PRATIO
440.817	.000	2.172	0.066	0.864	0.831	0.891	0.879

In modifying the research model, this study initially specified error covariances and direct paths between constructs based on large modification index (MI). After adding the positive correlations (between PE and SQ), the overall goodness-of-fit were checked again and provided the following results (Table 5.13). All model-fit indices, except GFI, were above the recommended threshold value.

Table 5.13 Results of refined structural model

Chi-sq.	P-value	CMIN/DF	RMSEA	GFI	AGFI	CFI	PRATIO
440.817	.000	1.849	0.056	0.889	0.861	0.921	0.874

In SEM, the structural model tested the estimated path coefficients, t-values (critical ratio) and standard errors, in order to evaluate the relationships and make a decision regarding the hypotheses. Figure 5.8 presents the SEM outputs and depicts a graphic representation of the structural model with the results of the hypothesis testing. However, for better understanding, the results are also presented in Table 5.14.

As can be seen from Table 5.14, the findings showed that the *performance expectancy* (PE) construct positively predicted the *behavioural intention* (BI) construct ($\beta = 0.172$, $p < 0.05$), thus supporting H1. Secondly, *effort expectancy* (PE) positively predicted *behavioural intention* (BI) ($\beta = 0.267$, $p < 0.05$); therefore, H2 was supported. Thirdly, *social influence* (SI) did not significantly predict *behavioural intention* ($\beta = -0.022$ $p > 0.05$); therefore, H3 was not

supported. Fourthly, *hedonic motivation* (HM) positively predicted *behavioural intent* (β = 0.533 $p < 0.05$); therefore, H4 was supported. Fifthly, *system quality* (SQ) positively predicted *behavioural intention* (β = 0.245 $p < 0.05$); therefore, H5 was supported; and finally, *self-management of learning* (SMoL) positively predicted *behavioural intent* (β = 0.146 $p < 0.05$), thus providing support for H6. *Hedonic motivation* was found to be the most influential predictor of M-learning acceptance (β=0.533), and *self-management of learning* was found to be the lowest influential predictor of M-learning (β=0.146). The model accounts for 52% of the variance in *behavioural intention* to use M-learning.

Table 5.14 Results of research model based on SEM analysis

Hypothesis	Standardised path coefficient	Critical ratio (t-value)	P value	Empirical support
H1: PE→BI	0.172	2.043	.041	Accepted
H2: EE→BI	0.267	3.879	***	Accepted
H3: SI→BI	-0.022	-0.345	0.730	Rejected
H4: HM→BI	0.533	6.603	***	Accepted
H5: SQ→BI	0.245	2.752	0.006	Accepted
H6: SMoL→BI	0.146	2.066	0.039	Accepted

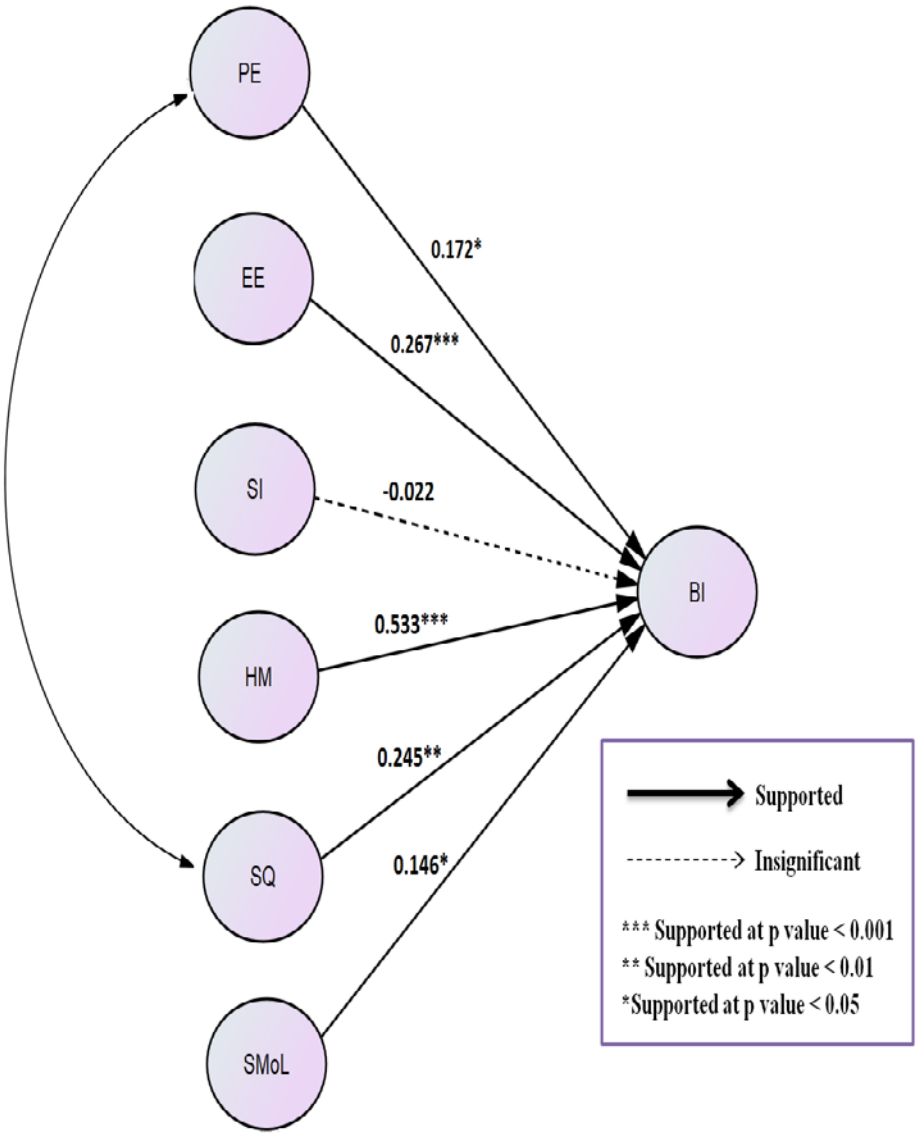

Figure 5.8 Refined structural model results

5.9.2 Moderator effect

The impact of the gender moderator on the proposed model is discussed in this section. As Serenko, Turel, and Yol (2006) explain, a moderator is a variable that can impact the significance of correlations between the model's independent and dependent constructs. The effect of a moderating variable provides an explanation for a moderated relationship (Hair et al., 2010). In this study, *AMOS* multiple-group analysis was used to test two sets of hypotheses for the purpose of exploring the effect of the gender moderator on the ways in which different factors impact *behavioural intention* with regards to M-learning. The purpose of the between/among-group comparison was to ascertain the extent of variance that exists, if any. If there is no significant variance between the two groups (male and female students), this indicates that the factors associated with behavioural intention are not impacted by the gender moderator.

Using *AMOS* (version 23), multiple-group covariance structure analysis to assess measurement invariance produced five levels of invariant output (by default): unconstrained model, structural weights (constrained model), structural covariances, structural residuals and measurement residuals. For the purpose of this research, only the unconstrained model and structural weights (constrained model) were checked.

The investigation of whether the influence of determinants (PE, EE, HM, SQ and SMoL) toward behaviour intention (BI) was moderated by gender was performed by testing the following moderating hypothesis which stated that: *The influence of determinants (PE, EE, HM, SQ and SMoL) toward behavioural intention (BI) is moderated by gender.* In other words, the direct paths between determinants and *behavioural intention* differed between males (139 cases) and females (133 cases).

Checking the fit indices simultaneously (for both groups) resulted in the following fit statistics: Chi-sq =630.297; P-value= .000; CMIN/df ratio = 1.560; CFI = .899; RMSEA = .046; GFI = 0.835; AGFI = 0.793; PRATIO = 0.874. The results demonstrated acceptable fit indices for CMIN/df, RMSEA and PRATIO. However the values of GFI, AGFI and CFI were below the recommended value.

Testing for moderation influence included constraining each path separately while the other paths were estimated freely (Byrne, 2016). For example, to test the path PE→BI, the path was constrained to be equal across males and females while all other paths were estimated freely. Five paths were tested separately.

First Path PE→BI. Performing a Chi-square difference test, freely estimating the two models except for constraining the path PE→BI to be equal across males and females showed that the p-value was not significant. This indicated that the path was not different between males and females. Even if the path PE→BI were forced to be equal, there was no difference when it was estimated freely. Table 5.15 shows the result of the Chi-square test in *AMOS*.

Table 5.15 Moderation result (path PE→BI)

Model	DF	CMIN	p-value
Structural weights	1	0.017	0.896

Second Path EE→BI. Performing a Chi-square difference test, freely estimating the two models except for constraining the path EE→BI to be equal across groups (males and females) showed that the p-value was not significant, indicating that the path was not different between males and females. Even if the path EE→BI were forced to be equal there was no difference when it was estimated freely. Table 5.16 shows the result of the Chi-square test in *AMOS*.

Table 5.16 Moderation result (path EE→BI)

Model	DF	CMIN	p-value
Structural weights	1	0.044	0.833

Third Path HM→BI. Performing a Chi-square difference test, freely estimating the two models except for constraining the path HM→BI to be equal across groups (males and females) showed that the p-value was not significant, indicating that the path was not different between males and females. Even if the path HM→BI were forced to be equal there was no difference when it was estimated freely. Table 5.17 shows the result of the Chi-square test in *AMOS*.

Table 5.17 Moderation result (path HM→BI)

Model	DF	CMIN	p-value
Structural weights	1	0.088	0.767

Fourth Path SQ→BI. Performing a Chi-square difference test, freely estimating the two models except for constraining the path SQ→BI to be equal across groups (males and females) showed that the p-value was not significant, indicating that the path was not different between males and females. Even if the path SQ→BI were forced to be equal there was no difference when it was estimated freely. Table 5.18 shows the result of the Chi-square test in *AMOS*.

Table 5.18 Moderation result (path SQ→BI)

Model	DF	CMIN	p-value
Structural weights	1	0.782	0.376

Fifth Path SMoL →BI. Performing a Chi-square difference test, freely estimating the two models except for constraining the path SMoL →BI to be equal across groups (males and females) showed that the p-value was not significant, indicating that the path was not different between males and females. Even if the path SMoL →BI were forced to be equal, there was no

difference when it was estimated freely. Table 5.19 shows the result of the Chi-square test in *AMOS*.

Table 5.19 Moderation result (path SMoL→BI)

Model	DF	CMIN	p-value
Structural weights	1	0.666	0.415

The multi-group analysis results showed that gender had no significant effect on the relationships among constructs in the proposed model. Thus it could be concluded that the moderator hypotheses is rejected. Consequently, the direct paths from determinants (PE, EE, HM, SQ and SMoL) toward *behavioural intention* (BI) do not differ in magnitude and /or direction for males and females.

5.10 Summary

This chapter statistically tested the research model proposed in Phase 1. The chapter began by presenting the results of the pilot test before proceeding to describe the main study where detailed analyses were performed. After that, structural equation modelling (SEM) techniques were used to evaluate the theoretically modified model. The analysis involved an evaluation of the core elements of SEM along with the measurement and structural models. The measurement and structural models (with the hypotheses) were evaluated using SEM techniques.

The study investigated six factors and their impact on the behavioural intention to use M-learning, *performance expectancy*, *effort expectancy* and *social influence* were the original constructs in the UTAUT model, whereas *hedonic motivation, system quality* and *self-management of learning* emerged from Phase 1 and were added to the research model. Apart from the *social influence* construct, all constructs were found to have a direct influence on the behaviour intention to use M-learning.

Furthermore, the inclusion of a moderator (gender) demonstrated that gender did not have any role in the relationship between the independent factors and *behavioural intention*. The results show that 52% of the intention to accept M-learning in high schools in Saudi Arabia was explained by the proposed model. The results provide insight into the importance of developing mobile resources that students perceive to be easy to use and useful.

Considering that M-learning is still in its early stages of development, it is important that the Ministry of Education in Saudi Arabia and educators understand what factors might affect students' acceptance of M-learning. M-learning offers the opportunity, like any other educational technology, to enhance students' learning experience and outcomes by offering a unique experience. In order to make this happen, an M-learning educational application needs to be useful in content, easy to use, simply and clearly designed. Furthermore, it needs to increase students' motivation for their work.

The next chapter describes a software project used to practically test and validate the findings of Phase 2. The analysis of the descriptive data showed that learning English was the most favourable type of learning applications among students. Therefore, an M-learning tool designed and developed by the researcher to learn English was provided to the students and the influence of the factors *performance expectancy, effort expectancy, social influence, hedonic motivation, system quality* and *self-management of learning* on *behavioural intention* to use M-learning in high schools in Saudi Arabia was investigated.

Chapter 6

Phase 3. Model in practice: App implementation

6.1 Chapter overview

This chapter presents the results of the implementation of an M-learning project for English language learning in high schools in Saudi Arabia. The aim of this project was to confirm and validate the findings of the UTAUT model presented in Chapter 5. The project also sought to discover any potential factors that affect students' acceptance of M-learning which were not covered by the UTAUT model. Furthermore, this project explored the challenges facing teachers and government educational officials trying to implement M-learning in schools in Saudi Arabia.

The chapter begins with an introduction, then explains the technologies used to develop the app and the technical details. After that, the main findings of the questionnaire are presented. The methods used to collect and analyse data for Phase 3 were explained earlier in the research methodology chapter.

6.2 Introduction

We have unprecedented access to information and communication whenever or wherever we need it thanks to a variety of digital devices and software applications to run on them. Conventional and unconventional learning networks based on these devices, such as computers, laptops or mobile phones, are being transformed by the use of new and evolving educational apps delivered on mobile devices. In the future, M-learning will be a component part of the digital landscape, increasingly cost-effective and open to all. The implications for learning worldwide have resulted in a large amount of published research reporting on the pros and cons of using software applications and mobile devices for education.

An application (app) for a mobile device, such as a mobile phone or tablet, is designed for working on the device and for a specific purpose. Software programs, such as Microsoft *Office* or Adobe *Creative Cloud*, are collections of integrated applications designed to run on relatively large computers, whereas mobile apps tend to be stand-alone bits of computer code designed to achieve a single goal for the end user while operating within the design constraints of small devices, such as phones or tablets (Nickerson, Varshney, Muntermann, & Isaac,

2007). Apps have proliferated online (although an app does not necessarily have to be connected to the Internet to be useful) to the point that there are now 'app stores' where they can be purchased for a small fee, then downloaded to a hand held device, although many are supplied free. The number of apps now runs into the millions and they are constantly being written for specific purposes and audiences.

6.3 Theory into practice

A mobile learning app was written by the researcher for the present study for the specific purpose of investigating student interaction with a mobile learning device loaded with a learning app (see section 6.4). Students' and teachers' experiences of using the app were recorded and analysed, increasing the richness and depth of the quantitative data collection and statistical analysis.

An online survey was conducted after the M-learning app had been used for a month. The survey aimed to confirm and validate the findings of the analysis of the UTAUT model completed in Phase 2. Furthermore, the survey questions were designed to identify and discover any other factors affecting students' acceptance and use of mobile learning which had not been identified by the extended UTAUT model. Survey respondents were encouraged to express their views, opinions, and make suggestions.

The second part of this chapter discusses and explores the challenges and obstacles that face the implementation of M-learning by conducting another online survey for teachers and educational officials in the government. This step was designed to discover obstacles to M-learning implementation from the perspectives of teachers and education officials in order to present a comprehensive view and discover the common obstacles which need to be considered

6.4 The English language app

The mobile app for learning English was developed to help students use some of their free time studying with the aid of their mobile phones or tablets. It was specifically designed for high school students in Saudi Arabia and used the current textbook *KSA- Edition Traveller 6* as a reference for all the exercises available in the app. It was developed on the Apple platform for iPhone devices using the iOS operating system.

6.4.1 Developing the app

There were several technologies and tools used for the development of the English app. These tools and technologies included: Proto.io, Apple Xcode, Objective-C programming language, PHP, MySQL, JSON, phpMyAdmin and an iPhone mobile phone.

Proto.io. Proto.io (https://proto.io/) is an online platform for developing application prototypes for iPads and iPhones. It allows users to create wireframes that can be used for prototyping and testing (Allen & Chudley, 2012). It was used in this study to develop a simple iOS prototype (a simple English app) and to receive feedback and comments from academics and teachers. An initial prototype was designed and sent to different academics and teachers for their assessment. Two important suggestions were received from teachers after their evaluation. Firstly, they wanted an extra sub-category for grammar tasks (such as reported speech). Secondly, the teachers suggested the addition of a web administration panel so that teachers would have the opportunity to add, edit and delete questions and answers.

Xcode. Developed by Apple, Xcode is an integrated development environment (IDE) that contains tools for writing, building and testing applications for a range of Apple products (such as the Apple iPhone). It supports many programming languages such as C, C++, and Objective-C. Furthermore, it includes tools to design, edit, analyse, debug, test, package and distribute the project (Bucanek, 2006).

Objective-C. The Objective-C programming language is based on C programming language, but provides object-oriented capabilities and a dynamic runtime. Objective-C programming language is considered one of the languages to use when writing applications for Apple's iOS (Kochan, 2011).

JSON. JavaScript Object Notation or JSON is an open-source computer language that uses human readable text for scripting. It is associated with JavaScript, but can be used with many programming languages, and is basically a syntax for storing and exchanging data. JSON was developed at the beginning of the 21st century by Douglas Crockford (Crockford, 2006) to overcome issues related to converting JavaScript objects into text for the exchange of data between the browser and the server. Using JSON, one can readily work with data as a JavaScript object with no complicated parsing or translations.

PHP. PHP was originally known as *Personal Home Page.* It is a scripting language used primarily for web development, although it is also a useful general purpose programming language. It was developed in the middle of the 1990s by Rasmus Lerdorf who wrote it so that he could maintain his personal home page, and was somewhat taken aback when it simply grew from there with the input of other programmers. Now called *PHP: Hypertext Preprocessor*, PHP can be embedded in HTML and readily used in combination with a variety of web tools.

PHP scripts are executed on the server and returned to the browser as plain HTML. For this research, PHP was used to connect to the external database and execute various queries to retrieve data from and save data to the database (grammar and vocabulary tasks).

MySQL. Created by Michael Widenius, MySQL is a cross-platform open-source relational database management system (RDBMS) based on Structured Query Language (SQL) and was initially released in May 1995 under the GNU General Public License (Welling & Thomson, 2003). MySQL has been used in this project for storing questions, answer options and correct answers for the grammar and vocabulary tasks.

Client-side web development (web admin panel). Different from server-side development, client-side development is the process of producing HTML, CSS and JavaScript for a web application which a user can use to interact directly with the web. In this study, the following client-side technologies were used to develop the admin panel:

- HTML
- CSS
- JavaScript (JQuery).

phpMyAdmin. phpMyAdmin is a free and open source MySQL database administration tool written in PHP. phpMyAdmin is a very popular administration tool with a wide range of users and contributors and was first released in 1998 under the GNU General Public License. It has cross-platform support for the major operating systems and supports administration of multiple servers (Delisle, 2009).

6.4.2 Using the app

Technical details. The English language app requires an Internet connection to operate due to the fact that there are lots of data exchanges between the server side of the application and the client side. For instance, an Internet connection is needed to retrieve the questions and the answers from the external database (MySQL) for the vocabulary and grammar tasks. The deployment diagram for the application is as shown in Figure 6.1.

Figure 6.1 shows both the client and the server side of the application. As a student, the client side communicates with the server side by sending an HTTP request. On the server side of the application, there are PHP scripts to process every request. These PHP scripts communicate with the database to retrieve the questions and answers. After processing every request, a JSON response is sent back to the client side from the server side. Similarly, teachers login to the web admin panel and update the questions and answers. However, JSON is not required (as an administrator) because there is no data request. Data (grammar and vocabulary questions) are only uploaded and added to the database.

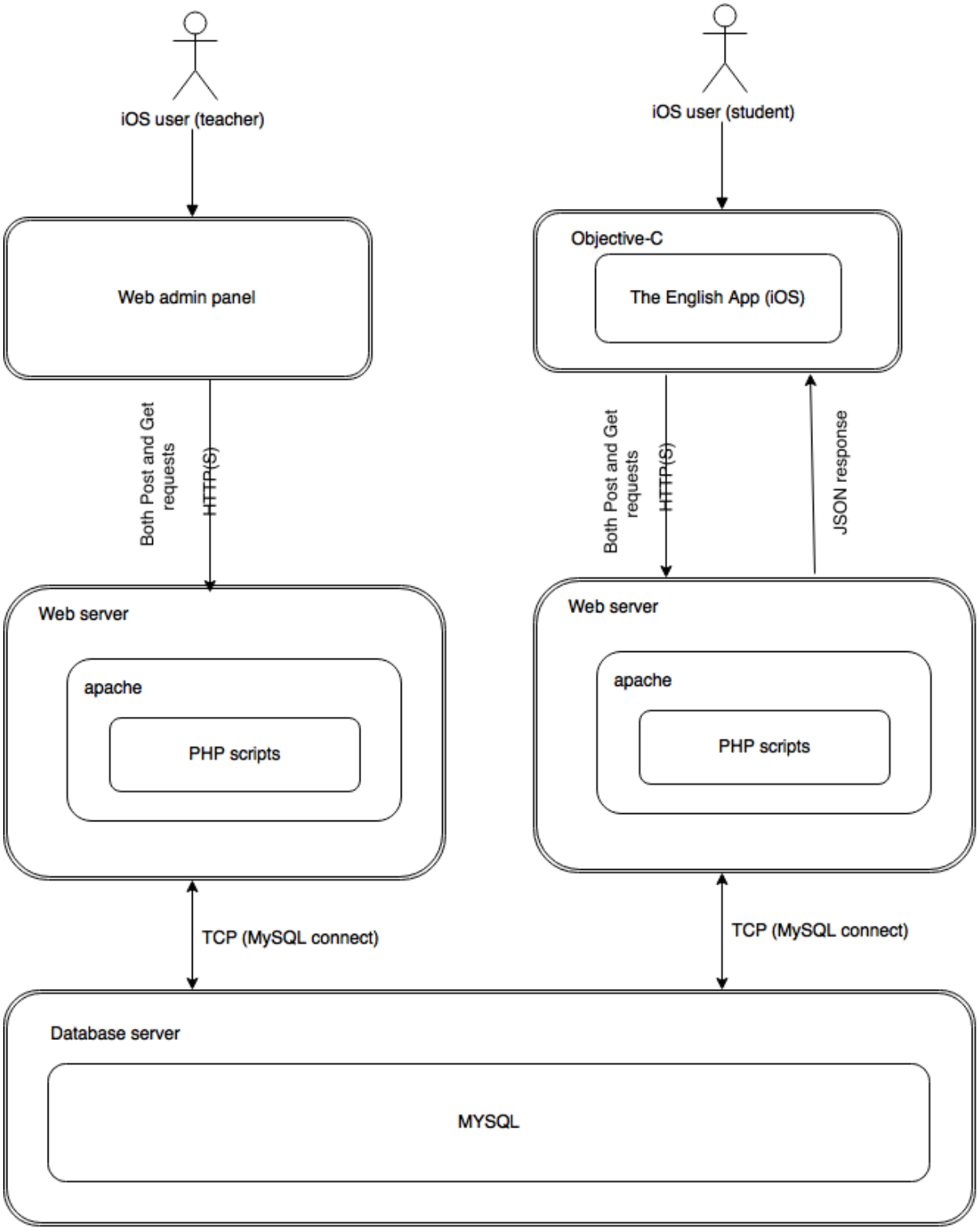

Figure 6.1 The deployment diagram for the application

For the user. As is the way with computer apps, the users generally do not know the technical details that drive their interactions with the device. The app for the students' smartphones contained three sections:

- vocabulary tasks
- grammar tasks
- video tutorials.

The grammar and vocabulary tasks share the same structure. Each tab contains ten multiple choice questions with four options from which to pick. The grammar task contains three sub categories (i.e. passive voice, reported speech and comparisons). Examples of the app interface are shown in Figure 6.2.

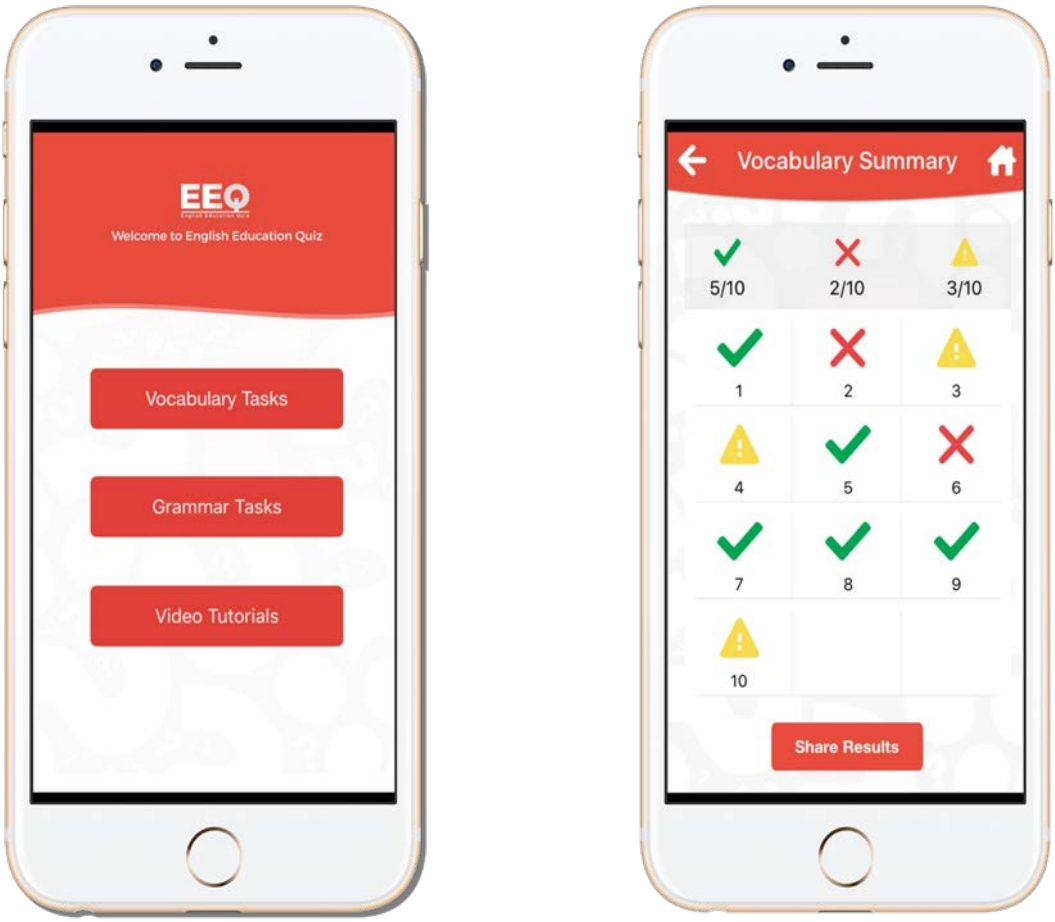

Figure 6.2 The English app interface and results page

The web-based administration panel allows teachers to add more questions and answers and upload correct answers to the database. While using the app, students can go back to reselect an answer or can skip a question to proceed to the next one. At the end of the task a summary report is shown to students. Depending on their answers, students can see a  'correct' or  'wrong' or 'ignored' symbol corresponding to the question number. Students can tap the symbol to transfer them to the question page where they will find the correct answer.

Following online instructions, students who elected to participate accessed the app from the Apple Store, just as they would a commercial app. No particular instructions separate from the app were needed due to its intuitive design. Once the participants had the app on their smartphones, they could use it and submit their results to their teacher by email via their phones. They could also share their results with their friends via social media sites such as *Twitter* or *Facebook*.

Video tutorials were added to help students answer the grammar questions. More screenshots of the app and the web panel are available in Appendix C5.

6.5 Results of app experience survey 1 (students and teachers)

A survey was administered online for the students and teachers in order to assess how closely their experiences with the app matched the UTAUT model, and to ascertain whether there was new information to be analysed. Items in the survey related to the following constructs:

- *performance expectation*
- *effort expectation*
- *social influence*
- *hedonic motivation*
- *system quality*
- *self-management of learning.*

6.5.1 Performance expectancy

In this study, *performance expectancy* was used as the degree to which students and teachers believed that using the English language app would be useful and would help them achieve gains in performance (Venkatesh et al., 2003), which would make them consider using M-learning in the future. The following comments capture the thoughts of the respondents.

Four responses were received from students. Three were positive, although one would have preferred some changes in the app. A fourth student disagreed that the app would be helpful.

Student S3 said,

> *I found the app really useful. I liked the idea of using an English app to do my homework and solve extra exercises and share them with my friends. I spend too much time on social media using my iPhone and I will be honest with you that I prefer to use the app to do my homework than using the textbook as it is more time consuming. I would love to use such apps in the near future.*

Student S2 stated,

> *From my point of view, the app is useful. Due to health reasons sometimes I skip school. The only way to review the course and catch up with my friends is by watching the tutorials in the app. I feel more confident when studying as I am able to repeat the video multiple times. I wish more apps would be available soon for different subjects.*

Student S6 believed the functionality of the app could have been improved but stated it was a good experience,

> *In terms of functionality I think the app could have been improved. But the app is useful, especially the extra grammar exercises that were not available in the textbook. I think the existence of these educational apps will make students engage more actively to learn.*

Only one student, S9, did not like the English app experience, and pointed out that it was a bad experience because,

> *It was a bad experience for me. The app is terrible and I feel more confident in using the original textbook than using a software app.*

All teachers who participated in the study and used the English language app to teach stated that it was a good experience in general and students were challenged and involved when using the app. Teacher T1 stated,

> *The use of educational apps can help students to independently enhance their learning capabilities which will create a much more positive mentality towards education overall. My students are challenged, engaged, and more independent when using the English app.*

Teacher T4 commented,

> *Students can learn at home or anywhere. Along with many different apps, the English app provides the opportunity for students to develop strong foundations in group work.*

6.5.2 Effort expectancy

According to Venkatesh et al. (2003), the *effort expectancy* variable is the degree of ease that is related to the use of a specific system. In this study, it was defined as the ease of use of the English language app and its importance to the promotion of M-learning in the future. The following viewpoints were drawn from the respondents' discussion.

Similar to the *performance expectancy* construct, four responses were received which confirmed that the English app was easy to use and they did not report any difficulties when using it. Student S5 stated,

> *Personally, I believe anyone with basic understanding of using a smartphone, won't find any problems in using the English app. For me the app was easy to use. I believe if any educational app is easy to use, my friends and I will not hesitate to use it.*

Student S4 believed that previous experience using smartphones was associated with the ease of use of using any mobile educational software,

> *I've had a smart phone for more than four years. I used different types of educational apps, so it was really easy for me to use the English app.*

Another student, S6, believed that the main interface could be improved by adding more colours, but stated it was easy to use and operate,

> *The app interface could have been better by improving the colours. But overall my experience with the app was good. It was easy to navigate between sections. I think it is logical that the more the app is easy to use for everyone the more they will consider using it in the future.*

A similar comment received from Student S1, indicated that it was easy to use the English app. Only one teacher commented, and was positive. Teacher T2 stated,

> *I see the English app along with other social media apps like YouTube or WhatsApp, as an important tool to help the education process and to maximize students' potential in learning. This app is easy to use, and I think students are more willing to use such apps if they were user-friendly.*

6.5.3 Social influence

Venkatesh et al. (2003) defined *social influence* as the degree to which peers influence the use of a system, whether positive or negative. In this study, *social influence* was defined as the degree to which peers, teachers and parents have influenced (or may influence) the use of the English app.

Contrary to the findings for *performance* and *effort expectancy*, the majority of responses received from students for the *social influence* construct pointed out that they had not been influenced by their peers, teachers or parents to use the English app and stated that they depended on their own experience to evaluate and use the app. Four responses were received from students. Student S7 thought that her parents and teachers had negative opinions of the use of smartphones. She stated,

> *My parents and most of my teachers have negative views on using smartphones. They believe that such devices do waste time and they are only for playing games. But the fact is different for me, I believe current devices can offer more. There are many educational apps out there that have many benefits. I immediately volunteered to participate using this app without the influence of others.*

Student S1 observed that because his parents use old type phones, they do not realise the potential of current smartphones. He commented,

> *Honestly, if I find this app or any other technology useful in my studies and very easy to use, I will not hesitate to use it. My parents use old phones, so they do not realise the capabilities of these high tech gadgets and I do not expect them to support the usage of them.*

A similar comment was received from Student S2, who indicated that her parents and teachers lacked the experience in using recent smartphones and therefore did not expect them to support the usage of mobile technologies in education. She stated,

> *My parents and some teachers lack the experience in using current mobile technologies. That's why I personally depend on my own experience to use the mobile technologies and their educational apps and not on other's beliefs and opinions.*

However, Student S3 stated that she sometimes met with her friends in a café to chat and discuss recent smartphones and apps and thought that her friends might influence each other to use different phones and apps. She stated,

On the contrary, my parents have always believed that such technologies have some negative impacts and they do not support them. So I don't think that they play an important role in influencing me. However, sometimes I sit with my closest friends in a cafe and talk about recent developments in devices and apps and we may influence each other a bit, but it was my decision to use this English app.

Teachers, on the other hand, were asked about how important they considered their role in influencing students to use educational apps, like the English app, or M-learning. Only one comment was received from teachers. Teacher T5 believed that the current generation of students were using mobile technologies at a very young age and were confident enough to make their own decisions without the influence of others. The teacher stated,

Mobile technologies play an important role in this century and give many benefits to society. Mobile technologies are accessible to everyone, such as teenagers. I know that most, if not all, of my students own smartphones and they use them for different purposes, including games, social media apps, such as SnapChat and in education. I use my smart phone pretty much in many different aspects like them. And I understand their educational potential and what they can offer. I think that the education of the future will use mobile technologies to deliver information. Students have been using mobile technologies at a very young age and that's why I believe that they are more confident and have the ability and resources to find out what really suits their needs without the influence of others.

6.5.4 Hedonic motivation

Venkatesh et al. (2012) defined *hedonic motivation* as the fun or pleasure associated with using a technology. In this study, it was defined as the fun or pleasure associated with using the English app.

Similar to the findings obtained from Chapter 5, the comments received from students indicated that they enjoyed the English app experience and confirmed that fun and enjoyment are important to the acceptance of M-learning. Two comments were received from students for the *hedonic motivation* construct. Student S7 enjoyed the experience of using the app but believed it could be improved. She suggested 'gamifying' the English app would make it more interesting and pleasurable to use. She stated,

I enjoyed the new experience. Maybe I would consider gamifying the app to add more fun? But it was fun to use it. I think the more enjoyable the app is the more students will be engaged in using the software applications.

Similarly, Student S8 stated,

> *It was interesting to experience a different way of doing the homework tasks. It was fun to electronically view and answer the questions and instantly receive the solutions for the tasks.*

Three comments were received from teachers, all of which indicated that it was fun and interesting to use the English app to teach. Teacher T6 pointed to the importance of motivational software, such as the English app, as a positive influence on students' engagement in learning. She stated,

> *Yes, it was interesting to experience such apps. From my point of view, I think motivational software is important in education because it could positively impact students' mental and physical reactions, which will increase the willingness to get the task done more efficiently and effectively, resulting in higher productivity.*

A similar comment was received from Teacher T3. Furthermore, the comment by Teacher T5 emphasised the importance of designing apps that motivate students to study and be more willing to do their homework. He said,

> *Sitting down to play with a smartphone or tablet has become an inventive part of life for many people. Therefore, we should see these portable devices as precious tools to be used for educational purposes. Designing apps like this one motivates students to study or do their homework, as well as to have fun; contrary to the traditional way in the textbook. So I would answer yes to this question and I will seriously consider designing apps for learning English for my students.*

6.5.5 System quality

Delone and McLean (2003) argue that information and *system quality* are the key initial antecedents for information system success. In this study, *system quality* was defined as how clear, accurate, and reliable the English language app was, the quality of its overall design and the usefulness of the services provided.

The responses received for the *system quality* construct confirmed that the overall design of the English app was clear, which made it easy to answer the grammar and vocabulary tasks and to navigate through objects. Furthermore, the comments indicated that the quality of the system was an important factor in the acceptance of M-learning. Two comments were received from students. Student S6 thought that the design of the English app could have been better, but it was clear and provided logical interactions. He stated,

I have seen better designed apps than this English app, but it was a good experience to use it. It provides logical interactions and behaviour. I believe a poorly designed app reduces the user's loyalty towards it. On the contrary, a good design will increase engagement.

Similarly, Student S7 indicated that the design of the English app was clear and accurate with no problems to report. She stated,

In terms of design the app was clear and accurate. The design of the app was simple and clear with no crashes or bugs to report.'

Two responses were received from teachers, who emphasised the importance of *system quality* in encouraging the acceptance of M-learning. Teacher T2 stated,

For me, the quality and the usefulness of the app come first. Personally, I assume a good quality design will make the app more valuable, easy to use and effective for all students. Poor design quality (like a poorly designed main interface) will lead to confusion and frustration which will make students uninstall or abandon the app.

Similarly, Teacher T6 addressed the importance of the quality attribute in educational software and the value it adds to student experience. She stated,

I think the quality of any educational app, including this English app, is a pivotal attribute in the ever progressing world of learning, teaching and education and it can add a great deal of value to the student educational experience.

6.5.6 Self-management of learning

Smith et al. (2003) define *self-management of learning* in terms of how well an individual is able to manage their learning experience. It is clear from the literature about flexible learning, distance learning and resource based learning, that *self-management of learning* is a recurrent and important theme when students are studying without direct supervision (Evans, 2000; Smith et al., 2003; Warner, Christie, & Choy, 1998). It is expected that M-learning will require similar discipline from the student due to its similarity with E-learning. As such, *self-management of learning* will be necessary for a large number of students.

Similar to the findings obtained from Chapter 5, the comments received from students regarding *self-management of learning* make it clear that this is an important factor in the acceptance of M-learning. Two comments were received from students relating to this factor. Student S3 stated,

Because I work in a café on weekends, it is very difficult for me to bring my textbook with me and do my English homework assignment in my spare time. However, I can do my homework and answer the tasks using the app quickly and efficiently. Using the English app helps me in managing study time and schedules effectively and completing assignments on time.

Student S8 concurred,

*Along with other English apps, such as **Learn English Grammar**, this app helped me to manage my time more effectively while learning English. Because I can learn anytime and anywhere using the app, I have more flexibility in controlling my learning process.*

Only one comment was received from teachers. Teacher T2 believed that educational apps, such as the English app, would help students manage their time more effectively. She stated,

Since introducing the English app to my students in the class, they have become more motivated to learn English and get involved. Out of 23 students in my class, 21 of them have submitted their grammar homework using the English app. I believe educational apps have the power to help students to manage their time more effectively while they learn and assist them to become self-disciplined learners.

6.6 Additional factors

At the end of the survey, an open-ended question was asked about any issues the study participants thought might hinder the acceptance of M-learning apps like the English language app. No responses were received from the students. However, three teachers responded, each considering 'affordability' as a factor in the acceptance of M-learning.

Affordability. Teacher T1 said,

I think the ability to purchase mobile technologies is a very important factor towards the acceptance of M-learning. Unfortunately, one student in my class could not afford to buy a new smartphone, which would affect the implementation and the acceptance of M-learning in the future.

Furthermore, Teacher T4 believed that the recent spending cuts by the government would affect parents' ability to provide mobile devices for their children, which, in turn, would prevent the implementation of M-learning in high schools. He stated,

The cost of buying or upgrading new gadgets is very high in the market. Considering the recent spending cuts from the Saudi Arabian government, I think parents will find it difficult to cope financially and it may affect their ability to provide the devices to their children which in turn will affect their acceptance and desire for using M-learning.

Teacher T5 believed that this issue would be even more complicated for those living in rural areas. He stated,

> *I think affordability is a very important issue for students. Not all of them can buy mobile technologies. I assume it is even harder for those in rural areas where family income is considerably lower than the ones in city.*

6.7 Results of survey 2 (teachers and education officials)

This section of the chapter explores the challenges and obstacles that face the implementation of M-learning in high schools from the perspectives of teachers and education officials in order to present a comprehensive view and discover the common obstacles which need to be considered. Based on the responses received from teachers and educational officials from the open-ended question in survey 2, the following describes the main challenges that face the implementation of M-learning in high schools in the Kingdom of Saudi Arabia. Thirteen different responses were received from survey 2.

Resistance to change. Previous research has shown that resistance to change among people is a common problem and significantly reduces the success of any venture (Gonçalves & da Silva Gonçalves, 2012). Two comments were received from teachers (T10 and T11) who identified resistance to change as the main challenge to the implementation of M-learning. Teacher T10 indicated that it would be harder for older teachers to accept and use a new technology than younger ones. He stated,

> *Teachers' resistance to change, especially those who are old, will be one of the critical issues when applying M-learning or any new technology in our country. Younger teachers who are exposed to recent hi-tech gadgets are more interested in using technology in learning and find a way to productively integrate technology, such as M-learning, into teaching and learning practices.*

Similarly, Teacher T11 pointed out that some teachers feel stressed and anxious about using new technologies for teaching. He stated,

> *I know a friend of mine who is a teacher and lives in Riyadh, he recently submitted a request to transfer from his school because he found it difficult and hard to cope with the school decision to provide laptops to some of the students. Many teachers are reluctant to embrace new technologies such as M-learning as they are very stressed out by the idea of using them because they are not familiar with mobile technologies. They perceive smartphones as a way to communicate only (making calls).*

Technical standards. The competition between the major device manufacturers and software companies had led to developing different kinds of smartphones and tablets running different operating systems, with browsers that support different file formats and web features. Two comments were received from teachers who identified 'technical standards' as a challenge. Teacher T8 stated,

> *I am not an expert when it comes to mobile technologies. But I have been using mobile phones for over 17 years and I have used different type of phones. As you know, currently there are thousands of models that exist with different operating systems (iOS, Android, window, etc.) with different browsers and each support its own file format. I'm sure students own different types of smartphones, so it is hard to develop M-learning apps for such a wide variety of platform configurations and this presents a barrier to the growth of M-learning.*

Similarly, Teacher T2 said that her students wanted to participate in the study and use the English app but they were using an Android operating system. She stated,

> *Ensuring compatibility between solutions for Android, iOS, Windows is considered an issue in implementing M-learning. Other students wanted to join the study and download the app but they were using Android.*

A distraction tool. Previous research has shown that distraction is considered one of the major challenges to the implementation of M-learning in schools (Chou et al., 2012; Kearney, Schuck, Burden, & Aubusson, 2012). Two comments were received that identified distraction as a challenge to the implementation of M-learning. An educational official in the government, E3, stated,

> *From my point of view, I think there are many challenges for the implementation of M-learning in schools. Some policy-makers, teachers and parents have the perception that mobile devices are distracting and disruptive tools that have a negative impact on students. They believe that it is not possible for a student to resist the temptation of navigating between different apps, browsing the web, listening to music while he/she learns or does his/her homework.*

Teacher T7 expressed her concerns about distraction, writing,

> *M-learning tools have a great educational potential. Such devices can give greater passion to study and learning and even teaching. Because these tools offer more than just learning (like texting and browsing the web) I am afraid that it may distract students from learning.*

Infrastructure. The cost of smartphones and the limited ICT infrastructure, coupled with limited networking capacity, still hamper developing countries, such as Saudi Arabia. To support connectivity and enable learning, a strong and scalable network based on robust telecommunications should be established. It is important that high-speed fixed line networks are available to provide a strong foundation for mobile networks. Research has made it clear that technological infrastructure is required for technological success (Ngwenyama & Morawczynski, 2009; Weiss & Birnbaum, 1989). Regarding this issue, five comments were received that identified infrastructure as a challenge to the introduction of M-learning in schools. An education official, E2, stated,

> *I think infrastructure is one of the main concerns regarding the implementation of M-learning. However, improving infrastructure and connectivity is one of our government's priorities. It is investing millions of riyals in its technological infrastructure. As you can see, there are many projects in our city to install optical fibre cables. It is important to improve the infrastructure to provide high Internet speeds and a reliable, high quality service that covers as much of the population possible, as this will play an essential part of implementing M-learning.*

Similarly, another education official, E1, believed that the possibility of M-learning is even harder to achieve in rural areas where there is a lack of access to the Internet. He stated,

> *It is not easy to implement M-learning in our schools. Unfortunately, only few of them are connected to the Internet (via fixed-line) and many are not. The situation is even harder in rural areas where some villages lack access to the Internet.*

Furthermore, a comment received from a teacher expressed her concerns about implementing M-learning due to complaints received from students about their Internet connection speed at home. Teacher T9 stated,

> *Some of my students in the class are complaining about how slow their Internet connection at home is. I think this might affect the implementation of M-learning.*

In their paper, Kukulska-Hulme and Shield (2008) indicated that cost is considered an issue and a barrier for using M-learning for the three groups of young people who participated in their study. An education official believed that cost is the main challenge for the implementation process. E3 observed,

> *From my point of view, because there are many things associated with the implementation of M-learning, I believe cost is the main challenge. For example, the cost of improving the existing infrastructure for schools (such as wireless connection). Furthermore, not every student is*

capable of providing the hardware and software resources for running M-learning, so are they going to receive any kind of financial support from the government for this? There are other costs associated with hardware and technical maintenance, teacher training programs, developing software courses and many more. If the school is located in a rural area the cost will be even higher.

Similarly, another education official (E4) commented,

Costs associated with the deployment were the first thing that came to my mind when you asked me about the challenges of introducing M-learning in our schools, as it will require a significant amount of resources.

Evaluating the impact of M-learning. Several studies have investigated the effectiveness of M-learning. Wang, Novak, and Shen (2008) proposed a method to evaluate the effectiveness of M-learning on a large hybrid/blended computer science classroom of 562 students. Williams (2009) conducted a PhD to measure the effectiveness and the acceptance of M-learning. Two comments from teachers were received in this survey about evaluating M-learning effectiveness and outcomes and measuring their impact on teaching and learning. Teacher T10 stated,

It is true that integrating technology will gain many different opportunities for learning and teaching. It changes the way students learn and how teachers teach. But how do we know that introducing such mobile technologies will be educationally effective?

Teacher T9 expressed the same reservations and suggested introducing M-learning to a group of students first. She wondered,

As teachers, how are we going to measure the effectiveness of M-learning? Will it significantly improve students' performance and engagement in their studies? My suggestion is that we need to test the technology first on some groups and evaluate the outcomes and compare the results with groups that did not use the technology.

Meeting students' needs (personalised learning). The self-directed nature of M-learning allows app designers to be flexible and to meet the diversity needs of all users, given the appropriate resources. Apps can cater for different cultural backgrounds, educational levels and skills. Students with disabilities can be included in the learning experience at their level of capability (Basham, Meyer and Perry, 2010). At a university level, both students' and lecturers' needs can be considered when apps are scripted (Marshall & Mitchell 2002). And in every instance pedagogical or technical support should be provided. Teacher T9 explained,

I teach around 70 students in my school; different students have different needs. The English app is a good idea. However it does not provide personalisation. I think there is a need to develop an M-learning environment which suits different kinds of students (including those with special needs).

6.8 Summary

This chapter presented the results of the implementation of an M-learning project for English language learning in high schools in Saudi Arabia. The aim of this project was to confirm and validate the findings of the UTAUT model presented in Chapter 5. The project also sought to discover factors that affect students' acceptance of M-learning which was not covered by the UTAUT model. Furthermore, this project explored the challenges facing teachers and government educational officials trying to implement M-learning in schools in Saudi Arabia.

The chapter began with an overview of the M-learning app that was developed for high school students as part of the research study described in this thesis. It included a general description of the structure of the app, the technologies used to implement the project and the deployment process. Two surveys were administered in this phase. The first was administered after the students and teachers had used the M-learning app for English language learning. And the second survey was sent to the government officials and teachers in order to discuss and explore the challenges and obstacles that faced the implementation of M-learning.

Analysis of the data generated by the first survey demonstrated that the findings of the M-learning experiment have practically confirmed and validated the hypotheses testing in Phase 2 (the extended UTAUT model). According to the findings of this phase, performance expectancy, effort expectancy, hedonic motivation, system quality and self-management of learning significantly influenced students' acceptance of M-learning. Social influence, on the other hand, did not influence the students to use the app. In addition, the findings of the practical experiment revealed a potential factor, affordability, to be significant in the acceptance of M-learning.

Furthermore, analysis of the data provided in the second survey identified several challenges to the implementation of M-learning in high schools in Saudi Arabia. Challenges highlighted by education officials and teachers included: resistance to change, technical standards, the distraction posed by technology, the cost of infrastructure, the capacity to evaluate the impact *of M-learning and the ability to meet students' needs (personalised learning).*

In the next chapter, the findings of the three phases are discussed in more detail and with reference to previous studies, and in the light of the objectives and purposes of the study.

Chapter 7

Discussion

7.1 Chapter overview

The research sought to understand the factors that influence high school students' acceptance of M-learning in K-12 education in Saudi Arabia. It aimed to accomplish several objectives:

- to comprehensively review the literature in the area of M-learning in the K-12 context in general and more specifically in Saudi Arabia
- to understand and measure the perceptions and attitudes that exist among high school students in K-12 education in relation to M-learning in Saudi Arabia in order to develop and formulate the research model
- to identify the factors that affect high school students' acceptance of M-learning in the K-12 context in public high schools in Saudi Arabia by testing and validating the research model
- to propose, design and implement an M-learning application (app) for students and teachers to validate and confirm the findings of the quantitative study
- to determine potential barriers that might affect the use of mobile technologies for learning (from the perspective of government officials and teachers).

In this chapter, the results of the data analyses of the three phases of this thesis are discussed. Prior research in the field of M-learning is re-examined as it relates to the outcomes of the study, and the results of the three phases of the study are integrated to compile a list of the main factors that affect students' acceptance of M-learning. The chapter begins by discussing the findings of each phase separately. After that, it integrates the results of the study to present a list of the main factors that affect high school students' acceptance of M-learning in K-12 education.

7.2 Overview of the study

The purpose of this study was to understand and to develop an acceptance model for high school students in K-12 education. The first step in this study was to identify the gap in the literature in the field of M-learning acceptance by conducting a literature review. Research into M-learning acceptance globally was collected and evaluated, particularly as it pertained to Saudi Arabia.

The literature review was divided into two main sections, the first concerned with ICT integration in schools, M-learning definitions, mobile technologies and M-learning in the K-12 setting. The second section was focussed on technology acceptance theories and studies investigating M-learning acceptance internationally and in Saudi Arabia.

The research was conducted in three different phases in order to discover and confirm high school students' perceptions of and attitudes towards M-learning. The research methods used were designed to:

- Help discover the factors that influence their acceptance of M-learning (Phase 1).
- Statistically test (using SEM techniques) and validate the research model by deploying the extended UTAUT model (Phase 2).
- Practically confirm and validate the findings of the UTAUT by proposing, designing, implementing and evaluating an M-learning app for high school students (Phase 3).

In Phase 1, a questionnaire survey of 218 high school students in Saudi Arabia was used to investigate their awareness of M-learning, and their understanding of the concept and process, while identifying any factors that might affect their acceptance.

In Phase 2, a questionnaire survey of 272 high school students in Saudi Arabia was used to investigate the factors that influence high school students' acceptance of M-learning by testing the extended UTAUT model proposed in Phase 1. The proposed model included six independent constructs: *performance expectancy, effort expectancy, social influence, system quality, hedonic motivation, self-management of learning* and one dependent variable, *behavioural intention* to use M-learning.

In Phase 3, an M-learning application (app) was developed and provided to the participants for use on their smartphones in order to supplement the findings of Phase 2. The app was designed specifically for high school students, who, at this age, would have been learning English (from their school textbook). It included grammar and vocabulary and videos which could be uploaded by their teachers. In addition, Phase 3 sought to ascertain what sorts of issues hindered or prevented the acceptance of M-learning technologies according to education officials and teachers.

The next sections discuss the results in this research for each of the three phases.

7.3 Findings of the three phases

7.3.1 Findings of Phase 1 (exploratory phase)

This section discusses the main findings obtained from the analysis of the data generated during Phase 1. The findings from the student surveys showed that most of the students embraced smartphones and had a smartphone (95.4%). Students without smartphones had ordinary mobile phones; 33% of them had a tablet PC; and 42.7% of them had a laptop. All students reported that they had access to the Internet in their homes. The findings demonstrated therefore that the students had the necessary tools to activate and use M-learning in their homes.

Students recruited in Phase 1 also had some first person experience of M-learning. The data showed that they were already using educational applications via their mobile devices (72.5%). They were familiar with 'app stores', such as those operated by Apple and Samsung, where apps for different purposes, including educational apps, could be accessed. Apps for English, mathematics, chemistry or history, for example, are available. They encourage interaction with online educational content and motivate students to learn and pursue different kinds of information. The student participants in the study were interested in the M-learning concept and willing to indicate what they thought of the idea.

The results obtained from Likert scale items showed that the students had the skills to interact with a wide range of software applications. Furthermore, the results showed that the students had positive perceptions of M-learning in general. They expected that they would get better grades, increased communication between themselves and their teachers, the increased flexibility of learning anytime and anywhere, a more enjoyable learning experience, independent and personalized learning, and an improved curriculum.

The majority of the students preferred to access and use M-learning services online (via a mobile device browser) or offline (to use apps). They did not find educational content via SMS/MMS useful. They perceived both positives and negatives in relation to M-learning, as evidenced in Table 7.1.

Table 7.1 Positive and negatives regarding the use M-learning

Positive	Negative
• new method of learning that will add fun to learning	• student lack of experience
• increase collaboration between students and teachers	• health implications of using devices
• help to manage learning time	• potential of the devices to distract
• reduce the burden of carrying heavy school bags	

Other general comments were received about using M-learning in schools. It was largely agreed that M-learning integration in schools should be supervised by the Ministry of Education, that there was a need to design high quality M-learning systems, and that special M-learning tools should be designed to limit their use to only educational purposes.

The findings of Phase 1 in the context of this and previous studies in M-learning were as follows:

1 The results clearly demonstrated enthusiasm about the potential of M-learning and focused on students' perceptions of and attitudes towards M-learning, as was found during a study by (Ozdamli & Uzunboylu, 2015).

2 Smartphones were the mobile device of choice by the students. Students reported using several M-learning applications. The most popular M-learning applications were for learning English and mathematics. A similar result has been found in the higher education context (Abu-Al-Aish & Love, 2013).

3 The advantages and benefits of using M-learning educational applications (apps) should be explained to students as a significant number of them (15.6%) did not think they were useful. In fact, 23.9% of the participants had never heard of the concept of M-learning. The benefits of an M-learning system should be demonstrated to the students in order to encourage them to use it as suggested and recommend by (Asiimwe, Grönlund, & Hatakka, 2017; Chang, Liu, & Huang, 2017).

4 Most students felt they were capable of using M-learning. Most, in fact, felt that they might not even need training, although one respondent specifically suggested the necessity for training. Previous research in the field of M-learning involved training

sessions to familiarise students with the hardware and software of M-learning (Corlett, Sharples, Bull, & Chan, 2005). In her mixed method study, Mao (2014) reported that 'lack of training' could affect both students and teachers using social media apps in the classroom.

5 The majority of students shared the idea that M-learning usually makes the process of learning more interesting and enjoyable, as well as making the study process more flexible for learners. Additionally, the use of mobile devices makes the flow of information between the students and the teachers easier because of its immediacy. Feedback can be provided quickly both from and to the students. These observations had been noted before by researchers such as (Al-Fahad, 2009; Oyelere, Suhonen, & Sutinen, 2016; Sabah, 2016).

6 Several factors were reported in this study that could affect students' acceptance of M-learning. For example, most students reported that their schools were not prepared yet to deploy M-learning because they lacked the technical infrastructure and individual expertise among the students. Other factors that would influence students included the quality of the M-learning system (applications), their experience of self-management of learning while using M-learning, the use of motivational software to increase engagement, and the ease of use of the system. This finding agrees with several other studies that have reported similar factors that influence the acceptance of M-learning, including (Huang, 2014; Venkatesh et al., 2012; Wang et al., 2009).

7.3.2 Findings of Phase 2 (hypotheses testing)

The purpose of Phase 2 was to investigate factors affecting the acceptance of M-learning in high schools in Saudi Arabia (validating the research model). Phase 2 was motivated by the findings of Phase 1, which indicated the need to investigate the factors that influence students' acceptance of M-learning. Furthermore, there is a notable lack of research into the acceptance of M-learning in the K-12 context based on a validated model. The key factors that influence students' intention to use M-learning have not been clarified.

This phase used a theoretical model grounded in the UTAUT, which was amended to exclude *facilitating conditions* and *use behaviour*, while including three additional factors (i.e., *hedonic motivation, system quality* and *self-management of learning*) that had emerged from the

responses received from students in Phase 1. The UTAUT model in this research was closely examined to identify the effect of its constructs on the acceptance and use of M-learning in high schools in Saudi Arabia. Each factor is discussed separately in an attempt to explain the results of hypothesis testing. The final results of the relationship between the UTAUT model and the hypotheses are discussed below.

Performance expectancy. In this research, *performance expectancy* was defined as the degree to which students believe that using M-learning will facilitate their learning in terms of: usefulness, saving time, improving results, increasing productivity, collaboration and efficiency. The hypothesis related to *performance expectancy* was:

> ***H1: Performance expectancy will have a positive effect on behavioural intention to use M-learning.***

Many previous studies have found performance expectancy to be a significant predictor of *behavioural intention*. In their review of a number of studies, Sun and Zhang (2006) found that in 71 out of 72 studies, *performance expectancy* had a significant effect on *behavioural intention*. Furthermore, other studies (Al Qeisi & Al-Abdallah, 2014; El-Gayar & Moran, 2006; Esteva-Armida & Rubio-Sanchez, 2012; Jong & Wang, 2009; Lakhal, Khechine, & Pascot, 2013; Louho, Kallioja, & Oittinen, 2006; Martins & Kellermanns, 2004; Shafi & Weerakkody, 2009; Sun & Zhang, 2006; Weerakkody, El-Haddadeh, Al-Sobhi, Shareef, & Dwivedi, 2013; Yamin & Lee, 2010) have also found that *performance expectancy* or *perceived usefulness* (older models) had a significant effect on *behavioural intention*. Recent studies have also shown the positive impact of *performance expectancy* on *behavioural intention* (Hashim, Yunus, & Embi, 2016; Maruping, Bala, Venkatesh, & Brown, 2016; Moon & Hwang, 2016).

According to the results of the present research, *performance expectancy* has a positive effect on *behavioural intention* ($b^* = 0.172$, $p < 0.05$). The finding is also supported by some empirical studies that investigated M-learning (Badwelan et al., 2016; Chaka & Govender, 2017; Thomas, Singh, & Gaffar, 2013; Wang et al., 2009). This indicates that the higher the perception of usefulness for M-learning, the higher will be the intention to adopt it. In other words, it appears that students with higher *performance expectancy* (i.e., who trust that adopting M-learning will be helpful and enhance their learning performance) tend to

acknowledge M-learning more than those with lower expectancy. If the advantages and benefits of using M-learning were demonstrated to the students in an interactive manner, the acceptance and use of M-learning would most likely increase.

Therefore, the hypothesis (H1) is accepted.

Effort expectancy. In the context of the current study, *effort expectancy* relates to the extent to which an M-learning system is perceived to have good ease-of-use. This was measured in terms of the degree to which respondents believed they were equipped to use a particular M-learning system effectively. The hypothesis related to *effort expectancy* was:

> ***H2: Effort expectancy will have a positive effect on behavioural intention to use M-learning.***

Similar to *performance expectancy*, different studies had shown a positive effect for *effort expectancy* on *behavioural intention* (AlAwadhi & Morris, 2008; Birch & Irvine, 2009; Garfield, 2005; Louho et al., 2006; Rosen, 2005; Venkatesh et al., 2003). Recent studies had also shown this positive relationship (Abu-Al-Aish, 2014; AlMarwani, 2016; AlMuhanna, Hall, & Millard, 2016; Alshehri, 2012; An, Han, & Tong, 2016; Boontarig et al., 2012; Cimperman, Brenčič, & Trkman, 2016), including M-learning acceptance research (Abu-Al-Aish & Love, 2013; Han & Shin, 2016; Sarrab, Al Shibli, & Badursha, 2016; Shorfuzzaman & Alhussein, 2016).

In this present research, the relationship between *effort expectancy* and *behavioural intention* was significant and confirmed that students are more likely to develop a positive attitude towards M-learning when they believe it will require little effort or time to learn and use ($b^* = 0.267$, $p < 0.001$). Furthermore, this positive relationship could be supported by designing and implementing simple, easy to use M-learning apps in order to attract students to use such technologies (Wang et al., 2009).

This statistically significant influence suggests that students are apt to use M-learning services when they are easy to use, which includes providing quality services and the procedures and instructions needed to use M-learning tools. Moreover, more technical considerations are needed to provide intuitive and comparable applications for different types of mobile devices

for use by different students (including students with special needs) to enhance their M-learning experience.

Therefore, the hypothesis (H2) is accepted.

Social influence. In this research, the *social influence* construct was defined as the degree to which a student perceives that is it important in the opinion of others to use M-learning in their studies. It was measured by the extent to which the perception of *social influence* affects students' *behavioural intention* to use M-learning, in other words, the direct influence of peers and teachers, as well as the school administration towards accepting M-learning. The hypothesis related to *social influence* was:

> ***H3: Social influence will have a positive effect on behavioural intention to use M-learning.***

Venkatesh et al. (2003) have stated that *social influence* is one of the key factors encouraging the acceptance and adoption of a technology. A number of studies in the Saudi Arabian context have previously investigated the impact of *social influence* on the acceptance of different technologies. Alwahaishi and Snásel (2013) used the UTAUT model to determine factors that affect the acceptance and use of mobile Internet. They found that *social influence* is among major variables affecting the intention to use. In terms of M-learning, Al-Hujran et al. (2014) found that *social influence* had a significant relationship with *behavioural intention* in a study conducted in a college in Saudi Arabia. This was consistent with the outcome of a study by (Badwelan et al., 2016). Similar findings by Wang et al. (2009), Abu-Al-Aish and Love (2013), and Feng et al., (2015) found *social influence* significantly supported *behavioural intention* towards the acceptance of M-learning in different countries.

In the present research, however, social influence was found to be an insignificant predictor of behavioural intention to use M-learning ($b^* = -0.022$, $p > 0.05$). The findings from the present study suggest that students are not socially influenced by their peers or teachers to use M-learning, which comes as no surprise considering the administrative constraints in the Saudi Arabian context. The teaching process in Saudi Arabia is centralised and controlled by the Ministry of Education, and teachers at each grade are given an identical syllabus, with guidelines and deadlines that they are required to apply and follow (Shah, Hussain, & Nassef,

2013). This finding concurs with previous studies undertaken in the Saudi Arabian context, which had shown the insignificance of *social influence* when it came to technology acceptance.

For example, Alkhunaizan and Love (2012) deployed the UTAUT model to investigate the factors that influence the use of M-commerce. Their findings showed that *social influence* was not relevant to users' *behavioural intention* to use M-commerce. Similarly, along with other factors, Alshehri et al. (2012) investigated the impact of *social influence* on the adoption of E-government in Saudi Arabia. They found that *social influence* was the only insignificant factor, indicating that the use of E-government systems is a personal and individual issue and not affected by social influence, consistent with (Al-Sobhi & Weerakkody, 2010).

Another study, but with different factors, by Ng, Ibrahim, Ahmad, and Ng (2015) investigated six factors, including *social influence*, that influence the acceptance of M-learning in Malaysia. Four hundred students from four technical universities participated in the study. The findings indicated that *social influence* was not a significant influence on *behavioural intention* to use M-learning. Furthermore, Iqbal and Qureshi (2012) found that *social influence* was an insignificant factor in M-learning acceptance and adoption by students in Pakistan. Lee, Kim, and Choi (2012) studied the factors that affect smartphone application acceptance by using the UTAUT model. Similar to the findings of this research, the hypothesis that *social influence* would affect intention significantly was rejected.

The findings of the present research indicate that the acceptance of M-learning in high schools in the Kingdom of Saudi Arabia depends on the student's confidence, ability and self-esteem, which all affect their ability to deal with a technological system, rather than the opinions and beliefs of others. The evidence strongly suggests that the use of M-learning among students is considered a personal and individual issue, and not significantly affected by the influence of others. It can be concluded that in Saudi Arabia, where the use of M-learning is still considered in its early stages, the use of M-learning among high school students is not affected by peers, teachers or school.

Therefore, the hypothesis (H3) is rejected.

Hedonic motivation. *Hedonic motivation* is defined as the fun or pleasure associated with using an M-learning system. It was measured by the perception of enjoyment by a student when they use the M-learning tools. A student will be more motivated to do or repeat an enjoyable activity than the same activity if it is not enjoyable (e.g., learning the traditional way). The hypothesis related to *hedonic motivation* was:

> ***H4: Hedonic motivation will have a positive effect on behavioural intention to use M-learning.***

Previous studies have shown that *hedonic motivation* influences *behavioural intention* (Kim, Chan, & Gupta, 2007; Liaw, Huang, & Chen, 2007). Van der Heijden (2004) incorporated *perceived enjoyment* into the original TAM model and found that it had a significant influence on the intention to adopt technology. More recently, Ohtonen and Karjaluoto (2016) found that hedonic motivation is the most important driver of a consumer's intention to continue using *Instagram* (a social network service).

Similarly, Moon, Hwang, and Cho (2016) found *hedonic motivation* had a positive influence on *behavioural intention*, and they recommended that the manufacturers of smart wearable devices design their products in a way that was pleasant, beneficial and fun. Furthermore, Alazzam, Basari, Ibrahim, Raziff, and Hariz (2016) investigated the role of *hedonic motivation* and other constructs in the acceptance by medical staff of the use of an electronic health record (EHR) system in hospitals. Their findings showed that *hedonic motivation* had a significant influence on using the electronic health record.

According to the findings of the current research, *hedonic motivation* did play an important role for students in their acceptance of M-learning ($b^* = 0.533$, $p < 0.001$). The results indicated that students in high schools are willing to use such technologies if fun and pleasure are associated with them. M-learning tools often provide many entertaining and interactive functions that offer enjoyment and a sense of satisfaction.

An English language app should be designed to include a range of motivational and pleasurable features that will enhance a student's engagement in the process of learning English. This finding is consistent with other M-learning studies that included perceived enjoyment,

playfulness or *hedonic motivation* in their research models, such as (Bere, 2014; Kang, Liew, Lim, Jang, & Lee, 2015; Poong, Yamaguchi, & Takada, 2016; Wang et al., 2009).

Therefore, the hypothesis (H4) is accepted.

System quality. In this research, *system quality* is a term used to describe the quality of the content of an M-learning system, which includes: security of use, speed of browsing and the ability to obtain information quickly, and provide communication and feedback between students and teachers. In other words: usability, accessibility, reliability and stability. *System quality* was integrated into the UTAUT as an independent construct to study its impact on students' *behavioural intention* to adopt M-learning. The hypothesis related to *system quality* was:

H5: System quality will have a positive effect on behavioural intention to use M-learning.

System quality is recognised as a key influencer of *behavioural intention* and user satisfaction under the IS success model. Davis (1989) explains that *system quality* can be perceived as an external variable that impacts users' behavioural beliefs, according to the assumptions of TAM. Delone and Mclean (2004) further point out that the specific variables associated with system quality can change based on the technology in question, with Lee, Shin, and Lee (2009) suggesting that online systems most commonly relate to variables such as:

- the speed of the network
- system and navigation of the site
- the usability of the site
- accessibility
- reliability
- how complicated it is
- response time
- flexibility of the system
- convenience of access
- the degree to which the system has been integrated.

System quality was reported in several studies as an important factor that directly affects the intention to use e-applications in general (Aladwani & Palvia, 2002; Chang & Tung, 2008; Hoffman & Novak, 2009; Lin & Lu, 2000; Sabherwal, Jeyaraj, & Chowa, 2006; Xin, 2004). Similarly, the findings of this research indicated that there is a positive impact of *system quality* on *behavioural intention* to use M-learning ($b^* = 0.245$, $p < 0.01$). This finding is also supported by some empirical studies that have investigated M-learning (Chin-ChehYi, Huang, & Hwang, 2010; Liu, Han, & Li, 2010). Additionally, research suggests that the perceived usefulness of the mobile Internet is influenced by both perceived system and content quality (Cheong & Park, 2005).

The results of the present research indicate that students can benefit from better communication, shorter response times, greater privacy and greater convenience when the quality of the system used is high. Without a certain standard of system quality, M-learning system efficiency cannot be achieved, since students will not perceive the system to be appealing. For this reason, it is important for systems to be designed with two specific considerations in mind.

Firstly, the system features should be easy to use, with particular emphasis on network speed, navigation speed, response time, integration, flexibility and the interface design. Secondly, feedback and input from students, teachers and researchers must be pursued in order to develop the most useful and successful system possible.

Therefore, the hypothesis (H5) is accepted.

Self-management of learning. Smith et al. (2003) consider the term self-management of learning to mean the way in which an individual feels they are able to learn autonomously, how self-disciplined they are and how likely they are to self-motivate. It has been found that the more successful students engaging in M-learning are those with the greatest degree of self-management. The hypothesis related to *self-management of learning* was:

> ***H6: Self-management of learning will have a positive effect on behavioural intention to use M-learning.***

Consistent with this, *self-management of learning* has been shown to be an indicator as to whether or not an individual is likely to accept M-learning ($b^* = 0.146$, $p < 0.05$). The greater

autonomy a student displays in their engagement with education, the more likely they are to use M-learning (Almatari, Iahad, & Balaid, 2013; Badwelan et al., 2016; Donaldson, 2010; Huang, 2014; Wang et al., 2009). The present research demonstrates the accuracy of the self-management of learning instrument as put forward by Smith et al. (2003), which predicts the intention of an individual to use M-learning.

This test is useful to M-learning practitioners and system developers in giving them the ability to decide how they can motivate students. This may be done by building functions such as time management systems and learning content hierarchy control into the M-learning apps to appeal to those with a good attitude to the self-management of learning. In addition, functions could be built in to develop an individual's capacity for self-motivation. Educators should be encouraging life-long learning and self-betterment which will in turn increase the engagement with M-learning in the future.

Therefore, the hypothesis (H6) is accepted.

Moderator effect (gender). Since the early 1980s, the differences in gender attitude towards computers had interested several computer and social scholars. Previous research had extensively investigated the role of gender in computer-related use of technology. According to previous research, males tended to be more confident about using their computer capabilities than females (Vekiri & Chronaki, 2008). This finding was consistent in different studies that investigated different age groups and cultures (Imhof, Vollmeyer, & Beierlein, 2007), elementary schools (Meelissen & Drent, 2008), high schools (Campbell, 1990) and universities (Cassidy & Eachus, 2002). In their research study, Reinen and Plomp (1997) found that females expressed lower levels of enjoyment in using computers than males, and were more anxious when using them (He & Freeman, 2010).

However, several other findings on gender and technology have shown similar results for both males and females (DeRemer, 1989). For instance, Jennings and Onwuegbuzie (2001) investigated gender differences along with four factors of computer attitude: anxiety, confidence, liking and usefulness. Their findings indicate that the gap between males and females in terms of technology attitude is decreasing. Furthermore, the researchers assumed that because computers (in 2001) were used for a variety of purposes, females were more likely

to be engaged in computer activities with the same level of success or near to as males. A recent study explored the gender effect with regards to social networking site (SNS) usage and motivation to use, finding that *Facebook* is more likely to be used as a source of information on brands, products and other areas of knowledge by female users than by male users (Noguti, Singh, & Waller, 2016).

The findings of the present study are consistent with those of (Dyck & Smither, 1994; Houle, 1996; Jennings & Onwuegbuzie, 2001; Lowenthal, 2010; Popovich, Gullekson, Morris, & Morse, 2008; Teo & Zhou, 2016), observing that there was no significant difference between males and females in terms of using mobile technologies in their learning activities.

Differences between males and females in using technology has been always a topic of research interest. It is important to understand the patterns among genders, including beliefs and *behavioural intention* toward ICT as such awareness would provide a better grounding for design and implementation, which would offer greater opportunities to support ICT success in education and other contexts. Gender differences in beliefs would likely make a corresponding impact on the intention to use a technology in the future.

Mobile technologies have become increasingly popular in recent years. With the smartphones features and capabilities, they have gained a huge popularity with teenagers in different places around the world. In Saudi Arabia, like any other digital nation, teenagers and adults have turned to the virtual terrain to socialise, play games, learn and connect with fellow netizens scattered across the globe.

According to a technical report about mobile devices in the Middle East (eMarketer, 2015a), 79% of Saudi Arabia's population use an advanced handset. Despite collecting the data from three female schools compared to five male schools in this study, the analysis showed that almost half of respondents in the study were females, and all participants (including males and females) possessed a smart mobile device. This indicates that females in Saudi Arabia, like males, are strongly interested in using mobile technologies and confident in using them in their learning and study activities.

7.3.3 Findings of Phase 3 (practical experiment)

For Phase 3, an iOS M-learning educational app was developed in order to test and validate the findings of the UTAUT model used in Phase 2. Activities in Phase 3 would also be able to discover any factors were not covered in the model, but may emerge when students and teachers use the educational app. Phase 3, furthermore, highlighted the challenges facing the implementation of M-learning in high schools in Saudi Arabia from the perspective of teachers and government education officials.

Following the use of the app, the students were surveyed about their experiences and attitudes. The results of this survey confirmed the findings in Phase 2. Using the English app confirmed that five factors (*performance expectancy, effort expectancy, hedonic motivation, system quality* and *self-management of learning*) were significant indicators of the acceptance of M-learning in high school, and one factor (*social influence*) was not.

The comments received from teachers revealed a potential factor, one not covered in the research model that affected students' decision to use the English app. The teachers believed that *affordability* was an important factor in M-learning acceptance.

Previous research has indicated that the cost of M-learning devices can negatively influence their purchase and the uptake of programs that run on them. Furthermore, it is also asserted in the literature that after ease-of-use and perceived usefulness, cost is the third most important consideration in the adoption of new technologies, such as continually improving and changing mobile services (Pagani, 2004).

The costs of phone and service provision have a negative impact on intentions to use the technology (Habboush, Nassuora, & Hussein, 2011). A study conducted by Lu and Viehland (2008) revealed considerable concern among participants related to their ability to use M-learning, given the costs of the devices and the necessary Internet and mobile services required to use them. In their study to investigate the factors influencing M-learning adoption in Omani higher education, Sarrab et al. (2016) added economics (i.e., cost) as an external variable of perceived usefulness and found it was a significant negative factor influencing M-learning acceptance.

Results from the second survey demonstrated the fact that teachers and government education officials recognised multiple challenges to the implementation of M-learning in high schools in Saudi Arabia. The six challenges teachers and officials highlighted were:

- a natural resistance to change
- existing poor technical standards
- the fear of mobile devices being a distraction tool
- lack of appropriate infrastructure
- little understanding of how to evaluate the impact of M-learning
- being unsure that the students' needs were being met.

These issues indicate that there is a clear call for further inquiry and theoretical modelling of M-learning integration in the Saudi Arabian high school setting.

7.4 Generalized M-learning acceptance model for high school education in Saudi Arabia

Based on the research findings from the three phases of the study, a conceptual M-learning acceptance model for high school students in Saudi Arabia was developed. The generalized model (Figure 7.1) shows the final amended model after considering all the results from the three phases.

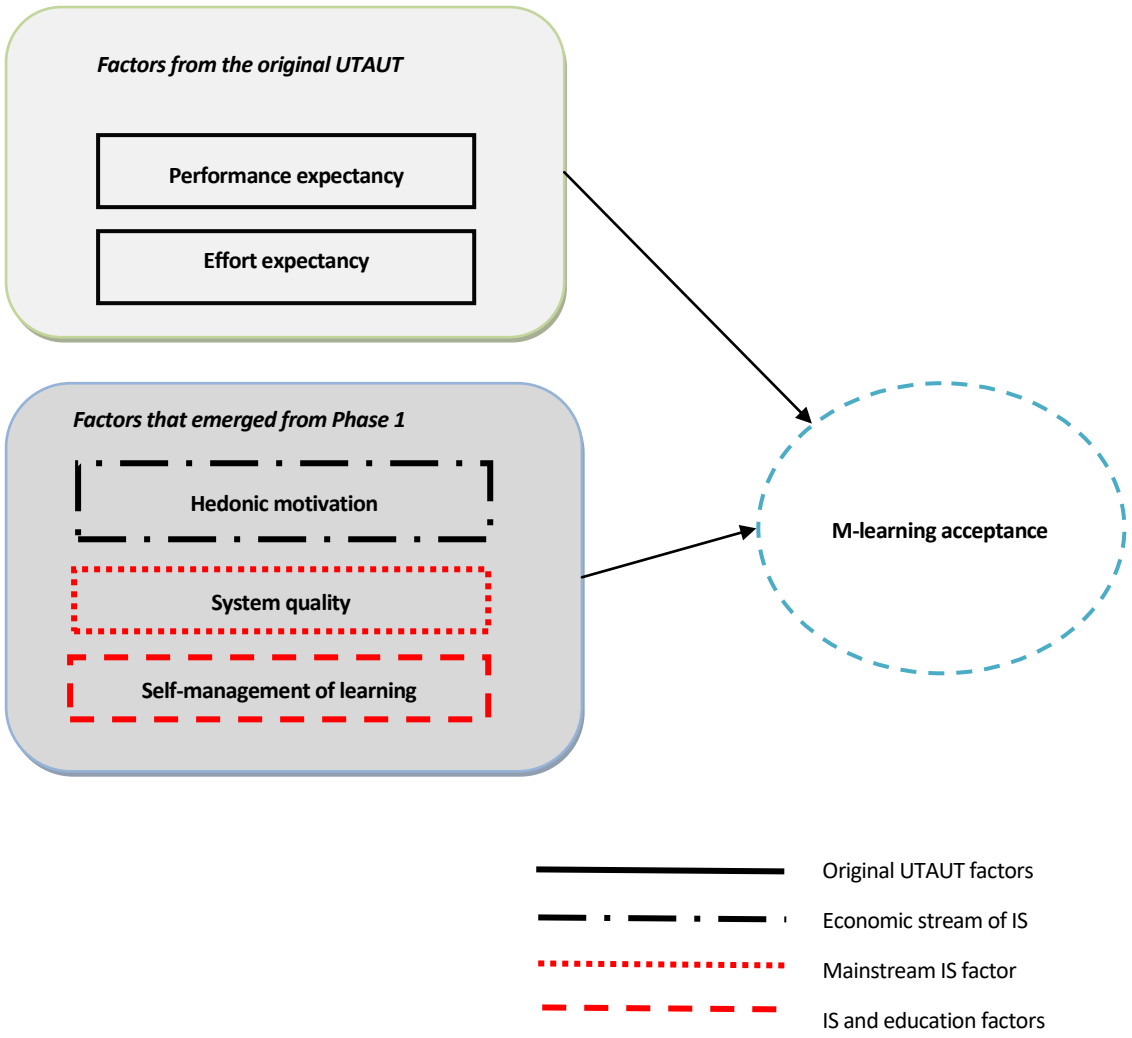

Figure 7.1 Theoretical development of the UTAUT theory integrating other IS factors

Figure 7.1 shows the generalized model consisting of the factors affecting high school students' acceptance of M-learning in Saudi Arabia. The acceptance of M-learning technologies in Saudi Arabia would likely improve if these factors played a positive role.

7.5 Summary

This chapter summarised and discussed the main findings of the three phases of the present study, which involved administering three different surveys for each phase and implementing an M-learning project. A list of the factors that affect high school students' acceptance in Saudi Arabia was tabulated and discussed. In the following chapter, the contributions, implications and limitations of the study, and future research, are all discussed.

Chapter 8

Conclusion

8.1 Chapter overview

This research contributes to the body of knowledge surrounding M-learning by making a significant contribution in the field of K-12 education by measuring the intentions of the use of M-learning by high school students in Saudi Arabia. Acceptance was measured using an extension of the Unified Theory of Acceptance and the Use of Technology (UTAUT) model (Venkatesh et al., 2003).

This chapter presents a summary of the study and the results obtained from the data analysis, starting by addressing the research questions. The contribution of the current study to the existing literature is then discussed along with the implications of the findings, followed by some limitations of the research. The chapter ends with suggestions for future research.

8.2 Answers to the research questions

RQ1: What are the current perceptions and attitudes of high school students towards using M-learning in Saudi Arabian schools?

In Phase 1 (Chapter 4) of the study, an online questionnaire was designed to explore students' perceptions and attitudes towards M-learning. The results of the questionnaire captured the thoughts of the student participants about M-learning and helped, based on student comments, to formulate the research model.

The results of Phase 1 indicated that students were excited and had a positive attitude towards using M-learning. Furthermore, they perceived many services and benefits flowing from M-learning that could help them in their studies. It was also found that M-learning enhances the accessibility of learning materials by facilitating real time and remote access of these materials which encourages students to use their free time interacting more with their teachers and fellow students.

RQ2: What are the factors influencing high school students' acceptance of M-learning?

In Phase 2 (Chapter 5) of the study, six factors were investigated that may influence students' intention to use M-learning using SEM techniques, based on the UTAUT model (and findings of Phase 1). The factors were:

- *performance expectancy* (original UTAUT construct)
- *effort expectancy* (original UTAUT construct)
- *social influence* (original UTAUT construct)
- *hedonic motivation* (additional factor from Phase 1)
- *system quality* (additional factor from Phase 1)
- *self-management of learning*. (additional factor from Phase 1)

Hypothesis testing demonstrated that, with the exception of *social influence,* all of the factors identified in this study have a direct impact on *behavioural intention* with regards to M-learning acceptance. *Social influence* was found to have a non-significant impact, while *hedonic motivation* was found to be the most influential factor. *Effort expectancy* was the second most significant factor influencing M-learning acceptance. (Details are available in Chapter 5).

RQ3: Is there any statistical difference due to gender on the behavioural intention to use M-learning?

A detailed analysis was conducted to determine the influence of the moderator (gender) on the research model constructs (i.e., *performance and effort expectancy, hedonic motivation, system quality* and *self-management of learning*) (discussed in Chapter 5). The analysis involved performing a Chi-square difference test where freely estimating the two models expect constraining each path separately. The findings showed that no affect was found on the moderator variable (gender) between male and female students. (Chapter 5 presents the analysis of the moderator effect while Chapter 7 discusses these findings in detail.)

RQ4: What are the students' opinions about the factors that influence their learning (UTAUT model) after implementing an M-learning project?

Based on the comments and opinions received from students in the online questionnaire delivered in Phase 3, the findings of the UTAUT model were confirmed. However, the

comments from Phase 3 introduced another potential factor not covered in the UTAUT model – *affordability* – which had affected students using the researcher-provided M-learning tool.

> *RQ5: What are the challenges that affect M-learning implementation in public high schools in Saudi Arabia from the perceptive of education officials in the government and teachers?*

Teachers and education officials in the government were asked to complete an online survey about the challenges that affect the implementation of M-leaning in public schools in Saudi Arabia. According to responses received, both teachers and education officials in the government have identified several issues:

- resistance to change
- technical standards
- a distraction tool
- infrastructure,
- evaluating the impact of M-learning
- meeting students' need.

More details about their comments can be found in Chapters 6 and 7.

8.3 Research contribution

As part of the 'Saudi Vision 2030' initiative and the National Transformation Program 2020 (National Transformation Program 2016), the Saudi Arabian government is planning to introduce digital mobile technologies across the Saudi Arabian school system by 2020. However, as identified in the literature review, there is a lack of evidence and little research has been conducted regarding M-learning acceptance in K-12 education about students in Saudi Arabia. Therefore, the outcomes and knowledge introduced by this research are critically important for M-learning diffusion and implementation in K-12 education in Saudi Arabia.

This study has made an important theoretical contribution of an M-learning acceptance model for high school education. Previous studies on M-learning acceptance have predominately focused on developed countries. Research into technology adoption and acceptance does exist in relation to developing countries. However, such studies have been conducted outside the

educational context, in e-government (Alshetewi, 2016; Alzahrani, 2014; Susanto & Goodwin, 2013) and e-commerce (Alqahtani, 2016; Alsharif, 2013). The few that are in the educational context are generally focused on higher education (AlMarwani, 2016; Karim & Rampersad, 2017). This study, therefore, is valuable in offering an M-learning acceptance model in K-12 education, specifically high school levels.

Currently, no studies exist that have examined M-learning acceptance among students in K-12 education in Saudi Arabia. Additionally, the study was critical in the application of an extension to the UTAUT in the context of K-12 education in a developing nation, Saudi Arabia. The UTAUT theory was extended through the integration of several factors that emerged from Phase 1 of this research *(*i.e., *hedonic motivation, system quality and self-management of learning*) and was confirmed by SEM analysis in Phase 2. Furthermore, the software experiment conducted in this research (Phase 3) revealed a potential factor (i.e., *affordability*) that emerged after the testing of the researcher's mobile software application (app) among students and teachers. Therefore, it makes an important theoretical contribution by refining our understanding of M-learning in developing countries by extending the UTAUT through the integration of factors from Internet research (*hedonic motivation*), e-education (*self-management of learning*) and IS (*system quality*).

This research was innovative methodologically. It involved not only exploratory and confirmatory analysis of key factors that influence M-learning acceptance, but the development of a mobile educational app to empirically confirm and validate the findings of the developed M-learning model. To the researcher's best knowledge, no previous research in the technology acceptance field has attempted to transfer their theoretical model into practice to validate their findings in a real-world settings.

8.4 Research implications

Saudi Arabia is embarking on a new phase of its history as a nation (only founded in 1932), and, although wealthy by the standards of many developing nations, lacks the history and experience of the developed world in dealing with digital technologies. M-learning has been shown in this study to be largely acceptable to students from five different high school institutions when the right conditions are met.

The study informs Saudi Arabian decision makers considering the introduction of digital technologies in K-12 education. The findings can help decision makers formulate and devise specific policies and strategies for the effective adoption of M-learning technology by taking account of the different factors investigated in this study and the outcomes. According to Saudi Vision 2030 (National Transformation Program 2016), over the next few years, the Saudi Arabian Ministry of Education is planning to encourage innovation adoption and provide supported resources and efforts to enhance the education sector, and decision makers in the Ministry of Education should consider adopting M-learning due to its potential benefits.

The adoption of M-learning is expected to deliver benefits by increasing productivity and collaboration between students. With a better understanding of the critical factors in the acceptance of M-learning, the Ministry of Education can effectively manage M-learning diffusion and implementation in schools. An educational use for mobile phones has the potential to improve educational outcomes while providing a powerful repository for scholarship activity.

8.4.1 Potential implications for K-12 education

Five out of six constructs in the proposed model were significant influencers of the behavioural intention to use M-learning. With this outcome, this research has demonstrated that the UTAUT technology model is effective in assessing the *behavioural intention* of using mobile devices as learning tools in the K-12 environment. Much of the previous research in the field of M-learning has used the technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT) in a university context rather than K-12. The present research assessed the acceptance of mobile devices using an extended UTAUT model. The current research contributes to the existing literature by providing a new perspective of the UTAUT model by successfully proposing an extension to it.

In this study, the students were positively influenced mainly by their perception about the potential benefits of M-learning and its expected simplicity based on the significant influence of *performance expectancy* on the acceptance of M-learning. Therefore, the Ministry of Education and the policy makers should emphasize the issues that would improve students' performance academically using M-learning applications. An M-learning system, whether it is

mobile apps for learning different subjects or a learning management system (LMS), such as *Mobile Blackboard*, should facilitate student learning. But the system needs to be genuinely useful for learning and teaching, improving students' results, productivity, collaboration and efficiency.

Furthermore, the Ministry of education should focus on features that make M-learning easy to use. All students, including those with special needs, should be able to successfully use the system with minimum effort. Students will be looking for an M-learning system that offers fast implementation, is quick to learn, and provides support and training materials. An M-learning learning system should be easy enough for students to try with success so that they can discover its usefulness as a learning tool and use it with confidence for that purpose.

According to the research findings and previous studies, fun elements added to a learning app have played a pivotal role in user technology acceptance, which indicates that enjoyment derived from usage directly drives continuous engagement with the mobile system (Nguyen, 2015). Given that users' enjoyment of mobile systems directly impacts *behavioural intention*, it is essential that students' enjoyment of M-learning systems is considered a top priority by software developers who design M-learning systems in Saudi Arabia.

Whether it is amusing or not, if the learning app is poorly designed, it will frustrate and anger the students who will eventually abandon the software, often after considerable time and money have been expended. A detailed plan of project specifications, design, frameworks and programming languages to be used, testing and maintenance will help to produce quality apps and reduce the possibility of errors (system bugs). Developing high-quality software apps may not be cheap. However, it is definitely less costly than creating a poor quality one. The issue, of course, for schools that want to introduce M-learning is investing in the best apps.

Even with well-chosen applications and appropriate technology, the results of this study indicate that it will be learners with better *self-management of learning* capabilities who will achieve better mobile learning outcomes. It is probably beneficial to these students that they be encouraged to participate in M-learning so that they can realize more positive learning outcomes since they will be able to pace themselves.

8.4.2 Learning via mobile devices

The results of this research prove that students believe that mobile devices for learning will benefit them by improving their study performance. These results suggest that these devices be included as learning tools in educational facilities. Adhikari, Mathrani, and Parsons (2016) suggest that with the rapid diffusion of digital devices into everyone's daily life, the demand of being digitally literate has also increased. M-learning facilitates personalised learning, contextual learning, learner centred learning, situated learning, collaborative learning, ubiquitous learning, lifelong learning, just-in-time learning, micro-learning, rich media learning, interactive and immersive learning, synchronous learning and asynchronous learning.

Understanding the use of mobile devices as opposed to desktops, will enable educators to better integrate this technology. This study will benefit schools, educational content developers, and government-run educational institutions to understand the educational potential of using mobile devices for learning. The other highly beneficial features of using mobile devices include access to the Internet for research, access to email, taking a picture of the day's homework assignment scribbled on the whiteboard. Mobile devices can be used for taking real-time lesson notes, as student response systems, for recording lessons with voice memos, or for using QR codes to find relevant websites with a simple click. The aforementioned benefits can be used to revolutionise education.

8.4.3 The Saudi Arabian advantage

In 2016, the number of smartphone users reached 2.1 billion worldwide. In short, one in three individuals worldwide owns a smartphone. By 2018, the number of smartphone users in Saudi Arabia is estimated to reach 21.3 million (eMarketer, 2015b).

In March 2017, the Saudi Arabian government announced that it would completely digitalise public schools (replacing textbooks with mobile devices) (Nabbout, 2017). Given this change, the present study is of vital importance, given the expected rise in mobile devices ownership in Saudi Arabia. The findings of this research can aid the understanding of M-learning integration in the context of Saudi Arabian K12 education.

8.4.4 The impact of affordability

In his recent press conference to talk about the digitisation of the Saudi Arabian educational system, the Minister of Education said, 'We have not decided yet whether the tablets would be made available for the students free of charge or for a minimal fee. It will all depend on our capabilities' (Toumi, 2017).

However, the findings of this research (in Phase 3) showed that *affordability* is a major concern that prevented students from joining the software experiment and adopting M-learning. Considering the current economic situation of Saudi Arabia, some students do not have the financial means to obtain mobile devices for the purpose of M-learning, and many Saudi Arabian schools lack the funding to supply devices to all students.

To ensure a successful deployment of the project, the project officials should bear in mind that some students cannot afford to upgrade or buy a mobile device even with a 'minimal fee'. Thus, funding is vital in M-learning implementation and adoption, as a lack of adequate, consistent financial backing (for maintenance) will become a major challenge to successfully implementing the project.

8.5 Limitations of the research

When reviewing the results of this research, certain limitations need to be taken into account:

- This study represents a particular slice of time. It has a cross-sectional design and the results do not demonstrate how views change or the impact of new technology. Considering the likelihood that serious changes may well have occurred over time due to the nature of the ever-developing field, a longitudinal study could well be appropriate for future study to ensure a record of the changes for high school students in relation to M-learning in Saudi Arabia.
- For a longitudinal study, it should be kept in mind that motivators for the use of technology that are reported in the literature or other sources can become obsolete over time. This means that a thorough evaluation of the contexts from which statements are made would be needed during any longitudinal study.
- The participants of this research were taken from a few public high schools in only one city in Saudi Arabia (i.e., Alrass city). Thus the results cannot be generalised to all other high schools in different provinces and cities.

- Even though a few teachers participated in this research, this research was intended to understand the factors that influence students' acceptance of M-learning. More research can be conducted to understand teachers' acceptance of M-learning.
- In Phase 3, several versions of the mobile application (operating systems) could have been designed and developed. However, time constraints meant that only a version for an Apple operating system (iOS) could be written and tested. Students using Android or Microsoft operating systems, therefore, were unable to participate in the study and their views could not be obtained.

8.6 Suggestions for future research

Although there are many fields which have explored technology acceptance, research in the area of acceptance of M-learning in K12 education is relatively unexplored. More research is needed to expand the knowledge in this area. In a wealthy 'developing' nation, like the Kingdom of Saudi Arabia, with such a large population under 30 and one of the highest penetrations of mobile devices in the world, the use of mobile technologies for education is worth further exploration. And with policies being put in place by the government to encourage education through digital media, how M-learning will be accepted and used in the K-12 system needs following and assessing. Recommendations for future research include:

- *replicating the research in other major cities in the kingdom*
  Saudi Arabia is a large and diverse social and cultural educational environment. Replicating the study would help to validate and confirm the findings of this research or add new insights.
- *studying the factors that influence teachers' acceptance of M-learning and teaching*
  Future studies are needed with the teachers who would be expected to deliver education via mobile technologies. Longitudinal studies in different contexts are desirable as the kingdom embarks on its planned economic, educational and social revolution.

  Further research from teachers' perspectives might lead to the exploration of additional factors to address in relation to M-learning. This research focused on students' perspectives and did not include teachers; hence, further studies from teachers' perspectives might lead to the exploration of more factors facing the acceptance of M-learning.

- *investigating social influence on the use of M-learning with a longitudinal study in order to detect any possible changes in social influence from peers, teachers, parents and school administration over time.*

  In this study, the social influence construct of the UTAUT model was defined as the influence by peers, teachers, parents and school administration on the student towards using M-learning, but the research period was restricted. Previous research has argued that social influence diminishes over time with the widespread use of a technology (Margaryan, Littlejohn, & Vojt, 2011); therefore more longitudinal and panel studies are needed to understand the impact of social influence on the uptake and performance of M-learning in Saudi Arabia over time.

- *investigating the effects of gender on the uptake and success of M-teaching and learning.*

  The results of this study indicate that a specific focus on settings that may be moderated by gender and greater gender equality would be very useful in the culture of Saudi Arabia. Whilst gender differences have been a primary focus of existing research into the acceptance of new technologies, the subject of gender as a factor in behavioural intention in other settings requires further investigation due to the increasing use of the Internet both in the workplace and in users' daily lives.

- *developing several other versions of the English app (Android and Windows) to attract as many students and teachers as possible to participate in the M-learning experiment.*

  Several features could be included to improve the app. For example, add login feature for students (personal profile for every student), improving the overall UI of the app, adding several sub categories for the grammar and vocabulary tasks from the English lesson textbook and adding more interactive features (progress bar, exams). Furthermore, explicit usability evaluation should be done on the application to ensure that system quality is achieved.

- *investigating primary students' perceptions towards M-learning.*

  This research has only investigated high school students' perceptions about M-learning acceptance. However, as the government is planning to introduce mobile technologies throughout the K-12 education system, it would be interesting to investigate students at younger ages, who may have different views regarding M-learning that need to be addressed.

- *further research*

  Future researchers should conduct follow-up studies to investigate how the use of mobile learning in K-12 affects college and university education.

8.7 Concluding remarks

This study started with the aim of investigating high school students' perceptions and attitudes towards using M-learning (Phase 1). This included asking students several questions about the type of mobile devices they own, the availability of Internet access, the use of educational apps etc. This phase looked over the current views of M-learning among high school students, and found that students were excited and motivated about the idea of using M-learning in their studies and believed that M-learning would enhance education. In addition to investigating their perceptions and attitudes, Phase 1 aimed to identify, from students' perspectives, the factors that influence their acceptance of M-learning and develop (refine) the research model.

Phase 2 of this study validated the research model proposed in Phase 1. The phase aimed to investigate the factors that influence high school students towards using M-learning. The study developed a statistical model to identify the factors responsible for M-learning acceptance for K12 education in Saudi Arabia. Specifically, *performance expectancy, effort expectancy, hedonic motivation, system quality, and self-management of learning* were found to have a direct impact on M-learning acceptance. *Social influence* was not found to have a direct influence on the acceptance of M-learning.

By developing an M-learning app for learning English (from their textbook) for the use of high school students, Phase 3 was intended to practically confirm and validate the findings of the statistical model developed in Phase 2, and to discover any factors which had not been covered by the statistical model (UTAUT). Similar to the findings of Phase 2, the results showed that *performance expectancy, effort expectancy, hedonic motivation, system quality,* and *self-management of learning* were significant towards using the mobile app. S*ocial influence* did not influence the use of the mobile app. Furthermore, the experiment found that *affordability* was a potential factor that affected students' use of the educational app. At the end of Phase 3, the challenges for implementing M-learning in public schools in Saudi Arabia were reviewed from the perspective of teachers and education officials in the government.

The study provided deep insight about the factors that influence M-learning acceptance in K12 education in Saudi Arabia. Indeed, the study has made valuable contributions by exploring and identifying the crucial factors that affect M-learning acceptance in K12 education in Saudi Arabia and identifying the major challenges when implementing M-learning in public schools in Saudi Arabia. This study should be considered as a beacon, illuminating the path and guiding the journey towards the successful integration and implementation of mobile technologies in K12 education. The ability to use information and communication technologies, in both learning and the creation of new knowledge, will determine whether Saudi Arabia is able to successfully compete in the emerging global knowledge economy.

Appendices

Appendix A

August 2015

A survey on

Students' perceptions and attitudes towards using M-learning in secondary school in the Kingdom of Saudi Arabia

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Flinders UNIVERSITY

LETTER OF INTRODUCTION

(To Survey participants)

Dear Sir/Madam

This letter is to introduce Tamim Alkhalifah who is a PhD student in the School of Computer Science, Engineering and Mathematics at Flinders University.

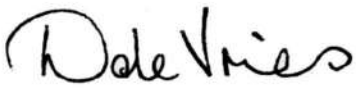
He is undertaking research leading to the production of a thesis or other publications on the subject of "M-learning in K-12 education in Saudi Arabia". He would like to invite you to assist with this project by completing a questionnaire investigating students' perceptions and attitudes towards M-learning. This questionnaire will take approximately 10-15 minutes to complete.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on (+61 8 8201 3639), fax (+61 8 8201 3602) or e-mail (denise.devries@flinders.edu.au)

Thank you for your attention and assistance.

Yours sincerely



Dr Denise de Vries BCompInfSc, BSc(Hons), PhD, MACS
Lecturer
School of Computer Science, Engineering and Mathematics
Flinders University

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 6951). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

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INFORMATION SHEET

Title: 'Students' perceptions and attitudes toward using mobile learning in secondary schools in Saudi Arabia'

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Description of the study:

This study is part of the project entitled 'Toward an effective mobile learning in secondary schools in Saudi Arabia'. This project is supported by Flinders University, School of Computer Science, Engineering and Mathematics.

Purpose of the survey:

The survey aims:

- Investigate students' perceptions and attitudes towards the use of M-learning in their learning activities.
- The results of this study will be of interest to the decision makers in Saudi Arabia who are concerned with adopting new mobile technologies in secondary schools and to help them to consider the factors relevant to the acceptance of M-learning in secondary schools.

- Propose a conceptual model based on the findings obtained from the survey.

What will I be asked to do?

You are invited to take part in this survey. It includes questions about your views, perceptions, attitude about mobile learning in general. The survey will take about 10-15 minutes. Your participation in this survey is completely voluntary; you do not have to respond to every item, and you discontinue participation at any time without reprisals. The information collected during the study will only be used to accomplish the research requirements, and all responses provided on this survey will remain confidential.

What benefit will I gain from being involved in this study?

The sharing of your experiences will help us to determine the readiness of students and teachers to use mobile learning in their learning and teaching activities.

Will I be identifiable by being involved in this study?

We do not need your name and you will be anonymous.

Are there any risks or discomforts if I am involved?

No.

How do I agree to participate?

Participation is voluntary. You may answer 'no comment' or refuse to answer any questions and you are free to withdraw from the online survey at any time without effect or consequences. A consent form accompanies this information sheet. If you agree to participate please read and sign the form and send it back to the school office box.

How will I receive feedback?

Outcomes from the project will be summarised and given to you by the investigator if you would like to see them.

Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

Students' perceptions and attitudes towards using M-learning in secondary school in the Kingdom of Saudi Arabia

Important definitions

Electronic learning. The delivery of a learning, training or education program by electronic means. E-learning involves the use of a computer or electronic device.

Mobile learning. Education or training conducted by means of portable computing devices such as smartphones or tablet computers.

Please answer the questions as accurately as you can.

Personal Information

1. What is your gender?

- ☐ Male
- ☐ Female

2. What is your level of secondary school?

- ☐ First
- ☐ Second
- ☐ Third

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3. Which of the following mobile computing/communication do you use/own?

- ☐ Mobile phone for calls and text
- ☐ Smart phone with advanced computing ability and connectivity
- ☐ Tablet PC
- ☐ Laptops

4. Do you access the internet at your home?

- ☐ Yes
- ☐ No

5- How often do you use the internet from your mobile device per day?

- ☐ Less than 1 hour
- ☐ 1-2 hours
- ☐ 2-3 hours
- ☐ More than 3 hours

6. Have you used any educational application on your mobile device?

- ☐ Yes
- ☐ No

7. Do you think it is useful to access your learning contents online using your mobile device?

- ☐ Yes
- ☐ No

8. Have you heard about Mobile Learning (M-Learning) before?

- ☐ Yes
- ☐ No

9. What is your opinion of M-Learning?

- ☐ Good idea and I would like to use it,
- ☐ Good idea but I would not like to use it,
- ☐ I do not think it is a good idea.
- ☐ Others

10. On a scale of 1 to 5 indicate with X how strongly you agree or disagree with each statement.

Statements	Strongly disagree	disagree	Natural	Agree	Strongly agree
I find it easy to use mobile applications.	☐	☐	☐	☐	☐
Training is needed to be familiar with a M-learning system.	☐	☐	☐	☐	☐
Using M-learning will enhance the flexibility of learning (anytime and anywhere).	☐	☐	☐	☐	☐
Using M-learning will enhance efficiency of learning make the educational process easier and more enjoyable	☐	☐	☐	☐	☐
I am confident when using my mobile device for learning.	☐	☐	☐	☐	☐
M-learning will bring new methods and opportunities to learn	☐	☐	☐	☐	☐
I like to use my own mobile device for my learning.	☐	☐	☐	☐	☐
I think that using M-learning will help me to get good grades.	☐	☐	☐	☐	☐
M-learning will enhance and boost contacts between students and teachers	☐	☐	☐	☐	☐
M-learning will support personalized learning	☐	☐	☐	☐	☐
M-learning will enhance the quality of the curriculum	☐	☐	☐	☐	☐
There is adequate technical support to implement M-learning	☐	☐	☐	☐	☐
It is hard to implement M-learning	☐	☐	☐	☐	☐

11. For which of the following services you find mobile learning might be useful for learning:

Type of M-learning service	**Not useful %**	**Neutral %**	**Useful %**
1. to access educational content online			
2. to access educational content offline			
3. to receive supporting educational information via SMS/MMS.			
4. to collaborate with others students			
5. to collaborate with the teachers			

12. Are there any other comments you would like to add in relation to the concept of using M-Learning tools and applications to help students in their learning?

Appendix A1

أغسطس 2015

إستبانة بعنوان

"دراسة مدى تقبل وفهم واستعداد الطلاب للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية"

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ADELAIDE • AUSTRALIA

خطاب تقديم
(للمشاركين في الإستبانة)

عزيزي/عزيزتي المشارك/ة

هذا الخطاب هو لتقديم الطالب تميم خليفة الخليفة وهو طالب دكتوراه في كلية علوم الحاسب والهندسة والرياضيات بجامعة فلندرز باستراليا. سيقوم الطالب بتقديم بطاقته الخاصة كإثبات لهويته. يقوم الطالب بعمل دراسة حول إستخدام الأجهزة المتنقلة في التعليم بعنوان "دراسة مدى تقبل وفهم واستعداد الطلاب للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية".

يود الطالب أن يدعوكم لمساعدته والمشاركة في الإستبانة والذي يستغرق تقريباً عشرون دقيقة لإستكمالها.

ثق/ي تماماً أن المعلومات المقدمه في الإستبانة سوف يتعامل معها بسرية تامة ولن يتم التعرف على هوية المشاركين والمشاركات في الإجابة على الإستبانة. وتستطيع/ تستطيعين كذلك الإنسحاب من الإستبانة في أي وقت تريده أو الإمتناع عن إجابة فقرات محددة كذلك.

إذا كان لديك إستفسارات بخصوص الاستبانه أو الدراسة بشكل عام، فلا تتردد عزيزي/عزيزتي المشارك/ة في الاتصال بي عبر الهاتف: +61882013639 أو الفاكس:+61882013602 البريد الإلكتروني: Denise.devries@flinders.edu.au

شكراً على إهتمامك ومساعدتك.

المخلصه لك

الدكتوره دينيس دي فرايس

محاضره

كلية علوم الحاسب والهندسة والرياضيات بجامعة فلندرز باستراليا

هذا المشروع تم قبوله من قبل جامعة فاندرز (لجنة أخلاقيات البحوث) برقم 6951. لمزيداً من المعلومات حول المشروع يرجى الإتصال على *8201 3116* أو فاكس *8201 2035* أو عبر الإيميل human.researchethics@flinders.edu.au

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ورقة معلومات

العنوان: "دراسة مدى تقبل وفهم واستعداد الطلاب والمعلمين للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية "

الباحث:

تميم خليفة الخليفة

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

جوال: 02053541 4 61+

المشرفين:

الدكتورة: دينيس دي فرايس

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

هاتف: 3639 8201 8 61+

الدكتورة: جيزيل رامبيرساد

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

هاتف: 15746 820 8 61+

وصف الدراسة:

هذه الدراسة هي جزء من مشروع تحث عنوان "نحو تعليم متنقل فعال في المدارس الثانوية في المملكة العربية السعودية" هذا المشروع هو مدعوم من قبل جامعة فلندرز, كلية علوم الحاسب والهندسة والرياضيات.

الهدف من الإستبانة:

- نتائج هذه الدراسة سوف تكون ذات إهتمام مباشر لصناع القرار المهتمين في تطبيق وتجربة تكنولوجيا الأجهزة المتنقلة في المرحلة الثانوية في المملكة العربية السعودية. وكذلك النظر في العوامل المؤثرة في قبول تكنولوجيا الأجهزة المتنقلة للطلاب والمعلمين في المرحلة الثانوية.
- التحقق من أراء وتقبل واستعداد الطلاب والطالبات للإستخدام تكنولوجيا التعليم المتنقل في التعليم.
- إقتراح نموذج خاص (لتقبل التعليم المتنقل) للطلاب والطالبات بناءاً على نتائج الإستبانة .

ماذا سوف يُطلب مني أن أفعل؟

أنت مدعو للمشاركة في إستبانة. تحتوي هذه الإستبانة على أسئلة حول وجهات النظر والتصورات والمواقف الخاصة بالطلاب والطالبات حول التعليم المتنقل بشكل عام. سوف يستغرق الإجابة على الإستبانة 10-15 دقيقة تقريباً. مشاركتكم في هذا الاستبان هو عمل تطوعي تماما؛ ، يمكنك الإنسحاب في أي وقت دون إكمال الإستبانة . سوف يتم استخدام المعلومات التي تم جمعها أثناء الدراسة لإنجاز متطلبات البحث فقط ، وجميع المشاركات المقدمة في هذه الدراسة سوف تكون سرية.

ما الفائدة المكتسبة للمشاركة في هذه الدراسة؟

تحديد الخبرات والمهارات الخاصة بك سوف يساعد الباحث على تحديد مدى جاهزية الطلاب والطالبات لإستخدام التعليم المتنقل في أنشطة التعليم والتدريس الخاصة بهم.

هل ستكون هويتي مكشوفة في هذه الدراسة؟

لا. نحن لسنى بحاجه إلى الإسم، جميع المشاركات في هذه الدراسة سوف تكون سرية.

هل هناك مخاطر أو مضايقات إذا شاركت؟

لا

كيف أوافق على المشاركة؟

المشاركة في هذه الإستبانة هي تطوعية. يمكنك الإجابة ب "لا تعليق" أو الإمتناع عن الإجابة ويمكنك الإنسحاب من الإستبانة في اي وقت بدون عواقب. تم إرفاق نموذج الموافقة على المشاركة في حال الرغبة في المشاركة في هذه الإستبانة. فضلاً قم بقراءة الإرشادات ومن ثم وقّعها وأرسلها إلى الصندوق المخصص في الإدارة.

كيف أطلع على نتائج الدراسة؟

سيقوم الباحث بتلخيص نتائج الدراسة. ومن ثم سيقوم الباحث بتزودكم بالنتائج إذا أردتم ذلك.

شكراً لأخذك الوقت الكافي لقراءة ورقة المعلومات هذه ونأمل بأن تقبل دعوتنا للمشاركة.

مدى تقبل وفهم واستعداد الطلاب والطالبات للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية

تعاريف مهمة

التعليم الإلكتروني: تقديم برنامج التعلم أو التدريب أو التعليم بالوسائل الإلكترونية. التعلم الإلكتروني ينطوي على استخدام جهاز كمبيوتر أو جهاز إلكتروني

التعليم المتنقل: التعليم أو التدريب الذي يتم عن طريق أجهزة الحوسبة المحمولة مثل الهواتف الذكية أو أجهزة الكمبيوتر اللوحي.

1- الجنس
☐ ذكر
☐ أنثى

2- المرحلة الدراسية
☐ أول ثانوي
☐ ثاني ثانوي
☐ ثالث ثانوي

3- أي من الأجهزة التالية تستخدم / تمتلك؟ (يمكنك إختيار أكثر من إجابة)
☐ جوال قديم (مثل نوكيا)
☐ جوال ذكي (مثل اي فون، بلاك بيري، سامسونج جالكسي..... إلخ)
☐ كمبيوتر لوحي (مثل اي باد، جالكسي تاب)
☐ لاب توب

4- هل لديك انترنت في المنزل؟
☐ نعم
☐ لا

5- كم تستغرق من الوقت يومياً في استخدام الانترنت عبر جهازك المتنقل (سواء الجوال أو الكمبيوتر اللوحي "مثل اي باد"، او اللاب توب)
☐ أقل من ساعة يوميا
☐ من 1-2 ساعات يوميا
☐ من 2-3 ساعات يوميا
☐ أكثر من ثلاث ساعات يوميا

6- هل سبق لك أن استخدمت برامج تعليمية على جهازك المتنقل؟ (سواء الجوال أو الكمبيوتر اللوحي "مثل اي باد"، او اللاب توب)
☐ نعم
☐ لا

7- هل تعتقد أنه من المفيد الدخول واستعراض المناهج التعليمية عبر الجهاز المتنقل (سواء الجوال أو الكمبيوتر اللوحي "مثل اي باد"، او اللاب توب)

☐ نعم
☐ لا

8- هل سبق ان سمعت بالتعليم المتنقل؟ (وهو التعليم الذي **يتم عبر إستخدام الأجهزة الالكترونية الشخصية** مثل الهواتف الذكية iPhone والكمبيوتر اللوحي iPad)

☐ نعم
☐ لا

9- ما هو رايك بالتعليم المتنقل؟

☐ فكرة جيدة وأود استخدامها
☐ فكرة جيدة ولكنني لا أود أن أستخدمها
☐ لا أعتقد أنها فكرة جيدة

أخرى، حدد:.....

10- إلى اي مدى تتفق مع العبارات التالية حول استخدام التعليم المتنقل.

	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
أجد انه من الصعب استخدام البرامج والتطبيقات في الأجهزة المتنقلة (apps)	☐	☐	☐	☐	☐
أحتاج للتدريب لكي استطيع أستخدام البرامج في الأجهزة المتنقلة	☐	☐	☐	☐	☐
إستخدام الأجهزة المتنقلة في التعليم سوف يزيد المرونة في التعلم بحيث يكون في اي وقت واي زمن.	☐	☐	☐	☐	☐
تعجبني فكرة أستخدامي للجهاز المتنقل الخاص بي في التعليم	☐	☐	☐	☐	☐
أشعر بالثقة عند استخدامي للجهاز المتنقل الخاص بي	☐	☐	☐	☐	☐
التعليم المتنقل سوف يجلب أساليب وفرص تعلم جديدة	☐	☐	☐	☐	☐
أعتقد بأن استخدام التعليم المتنقل (للتدريس والتعلم) سوف يزيد من جودة التعليم ويجعله أكثر سهولة ومتعة.	☐	☐	☐	☐	☐
أعتقد بأن استخدام التعليم المتنقل سوف يساعدني في الحصول على درجات جيدة.	☐	☐	☐	☐	☐
أعتقد بأن استخدام التعليم المتنقل سوف يزيد من فرصة التعاون والتواصل بين الطالب والمعلم	☐	☐	☐	☐	☐
أعتقد بأن تطبيق التعليم المتنقل سوف يساعدني في الحصول على تعليم مستقل	☐	☐	☐	☐	☐
أعتقد بأن تطبيق التعليم المتنقل سوف يحسن جودة المقررات التعليمية	☐	☐	☐	☐	☐
أعتقد بانه لا يوجد دعم فني كافي لتطبيق التعليم المتنقل في المدارس	☐	☐	☐	☐	☐
أعتقد بانه من الصعب تطبيق التعليم المتنقل في المدارس	☐	☐	☐	☐	☐

11- قيم مدى فائدة الخدمات التالية التي من الممكن الحصول عليها من قبل التعليم المتنقل.

	مفيد جداً	مفيد	عادي	غير مفيد	غير مفيد إطلاقاً
للدخول على المناهج التعليمية (مثلاً عبر الاي فون او الاي باد) مباشرة عبر الانترنت	☐	☐	☐	☐	☐
للدخول على المناهج التعليمية (مثلاً عبر الاي فون او الاي باد) عبر تطبيقات محملة مسبقاً (apps)	☐	☐	☐	☐	☐
لإستقبال رسائل نصية تعليمية (عبر الهواتف الشخصية)	☐	☐	☐	☐	☐
للتعاون مع زملائي الطلاب	☐	☐	☐	☐	☐
للتعاون مع المعلمين	☐	☐	☐	☐	☐

12- هل هناك أي تعليقات أخرى تود أن تضيفها فيما يتعلق باستخدام أدوات التعليم المتنقل (مثل الاي فون والاي باد) لمساعدة الطلاب في العملية التعليمة.

Appendix B

October 2015

A survey on the

"Factors that influence students' acceptance of M-learning in K-12 education in Saudi Arabia"

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LETTER OF INTRODUCTION

(To Survey participants)

Dear Sir/Madam

This letter is to introduce Tamim Alkhalifah who is a PhD student in the School of Computer Science, Engineering and Mathematics at Flinders University.

He is undertaking research leading to the production of a thesis or other publications on the subject of "M-learning in K-12 education in Saudi Arabia". He would like to invite you to assist with this project by completing a questionnaire investigating the factors that influence students' acceptance of M-learning. This questionnaire will take approximately 10-15 minutes to complete.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on (+61 8 8201 3639), fax (+61 8 8201 3602) or e-mail (denise.devries@flinders.edu.au)

Thank you for your attention and assistance.

Yours sincerely

Dr Denise de Vries BCompInfSc, BSc(Hons), PhD, MACS
Lecturer
School of Computer Science, Engineering and Mathematics
Flinders University

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 6951). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

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INFORMATION SHEET

Title: "Factors that influence students' acceptance of M-learning in K-12 education in Saudi Arabia"

Investigator:

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Description of the study:

This study is part of the project entitled 'Toward an effective mobile learning in secondary schools in Saudi Arabia'. This project is supported by Flinders University, School of Computer Science, Engineering and Mathematics.

Purpose of the survey:

The survey aims:

- To statistically investigate the conceptual model of this research by applying Structural Equation Modelling (SEM) techniques (proposed in previous chapter in this thesis).
- The results of this study will be of interest to the decision makers in Saudi Arabia who are concerned with adopting new mobile technologies in K-12 education and to help them to consider the factors relevant to the acceptance of M-learning in K-12 education.

What will I be asked to do?

You are invited to take part in this survey. It includes questions about the factors that influence your acceptance of M-learning. The survey will take about 10-15 minutes. Your participation in this survey is completely voluntary; you do not have to respond to every item, and you discontinue participation at any time without reprisals. The information collected during the study will only be used to accomplish the research requirements, and all responses provided on this survey will remain confidential.

What benefit will I gain from being involved in this study?

The sharing of your experiences will help us to determine what factors influence the acceptance of M-learning in K-12 education.

Will I be identifiable by being involved in this study?

We do not need your name and you will be anonymous.

Are there any risks or discomforts if I am involved?

No.

How do I agree to participate?

Participation is voluntary. You may answer 'no comment' or refuse to answer any questions and you are free to withdraw from the online survey at any time without effect or consequences. A consent form accompanies this information sheet. If you agree to participate please read and sign the form and send it back to the school office box.

How will I receive feedback?

Outcomes from the project will be summarised and given to you by the investigator if you would like to see them.

Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

Factors that influence students' acceptance of M-learning in K-12 education in Saudi Arabia

Important definitions

Performance Expectancy (PE). The level of usefulness attributed by an individual to an information system as regards work performance.

Effort expectancy (EE). The degree of ease associated with the use of the system.

Social influence (SI). The degree to which an individual usage of a system is promoted or influenced by other students, friends, teachers and parents.

Hedonic motivation (HM). The enjoyment an individual derives from using a technology (mobile learning in the present case).

System quality (SQ). The extent to which the general M-learning system and the services it offers exhibit clarity, precision and reliability denotes system quality.

Self-management of learning (SMoL). How an individual feels they are able to work under their own steam.

Behavioral intention (BI) is the measure of the likelihood of a person employing the application.

Part 1:

1- Gender:
- ☐ Male
- ☐ Female

2- Educational Level in secondary school:
- ☐ First
- ☐ Second
- ☐ Third

3- How would you describe your general learning via computer and internet?
- ☐ Very poor
- ☐ Poor
- ☐ Moderate
- ☐ Good
- ☐ Very Good

4- Which of the following devices you have? (you can pick more than one)
- ☐ Old phone
- ☐ Smart pone
- ☐ Tablet PC
- ☐ Laptop

5- Do you use any M-learning systems or applications in your device?

☐ Yes
☐ No

If yes which do you use:.....

6- How would you describe your general M-technologies knowledge?

☐ Very poor
☐ Poor
☐ Moderate
☐ Good
☐ Very Good

Part 2:

Indicate with an X how strongly you agree or disagree with each of the following statements:

No.	Statements					
Performance Expectancy (PE)		Strongly disagree	disagree	Neutral	Agree	Strongly agree
PE1	Using M-learning would improve my learning results					
PE2	I would find M-learning useful in my school study					
PE3	Using M-learning would enable me to accomplish tasks more quickly					
PE4	Using M-learning would increase my productivity					
Effort Expectancy (EE)		Strongly disagree	disagree	Neutral	Agree	Strongly agree
EE1	I would find the M-learning system easy for me to use					
EE2	I would find it easy for me to become skilful at using the M-learning system					
EE3	My interaction with the M-learning system is clear and understandable					
EE4	Learning to operate the system is **difficult**					

Social Influence (SI)		Strongly disagree	disagree	Neutral	Agree	Strongly agree
SI1	My teachers think that I should use M-learning.					
SI2	My peers think that I should use M-learning in my studies					
SI3	My parents have been supportive in the use of M-learning.					
SI4	I would use M-learning if it was recommended to me by the school administration					
System quality (SQ)		Strongly disagree	disagree	Neutral	Agree	Strongly agree
SQ1	It is **not** important for M-learning systems to be clear.					
SQ2	It is **not** important that M-learning services to be accurate.					
SQ3	It is **not** important for M-learning services to increase the quality of learning.					
SQ4	It is **not** important that M-learning systems to be reliable.					
Hedonic Motivation (HM)		Strongly disagree	disagree	Neutral	Agree	Strongly agree
HM1	I think that using a mobile device for learning is fun					
HM2	Using a mobile device for learning would be enjoyable					
HM3	Using mobile devices for learning is very entertaining.					
HM4	If I use a mobile device for learning, my teachers will be highly motivated.					
Self-management of learning		Strongly disagree	disagree	Neutral	Agree	Strongly agree
SMoL1	I would find using mobile learning helps me set aside reading and assignment time.					
SMoL2	I would find using mobile learning helps me in					

	managing study time and schedules effectively and complete assignment on time					
SMoL3	I would find using mobile learning helps me in fulfilling learning goals for the course					
Behavioural Intention (BI)		Strongly disagree	disagree	Neutral	Agree	Strongly agree
BI1	I intend to use M-learning in my future learning activities.					
BI2	I predict that I will use M-learning frequently					
BI3	I believe I will enjoy using M-learning systems.					
BI4	I would recommend other students to use M-learning systems.					

Appendix B1

أكتوبر 2015

إستبانة بعنوان

"العوامل المؤثرة في قبول الطلاب والطالبات للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية"

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Flinders UNIVERSITY
ADELAIDE • AUSTRALIA

خطاب تقديم
(للمشاركين في الإستبانة)

عزيزي/عزيزتي المشارك/ة

هذا الخطاب هو لتقديم الطالب تميم خليفة الخليفة وهو طالب دكتوراه في كلية علوم الحاسب والهندسة والرياضيات بجامعة فلندرز باستراليا. سيقوم الطالب بتقديم بطاقته الخاصة كإثبات لهويته. يقوم الطالب بعمل دراسة حول إستخدام الأجهزة المتنقلة في التعليم العام في المملكة بعنوان " العوامل المؤثرة في قبول الطلاب والطالبات للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية ".

يود الطالب أن يدعوكم لمساعدته والمشاركة في الإستبانة والذي يستغرق تقريباً 10-15 دقيقة لإستكمالها.

ثق/ي تماماً أن المعلومات المقدمه في الإستبانة سوف يتعامل معها بسرية تامة ولن يتم التعرف على هوية المشاركين والمشاركات في الإجابة على الإستبانة. وتستطيع/ تستطيعين كذلك الإنسحاب من الإستبانة في أي وقت تريده أو الإمتناع عن إجابة فقرات محددة كذلك.

إذا كان لديك إستفسارات بخصوص الاستبانه أو الدراسة بشكل عام، فلا تتردد عزيزي/عزيزتي المشارك/ة في الاتصال بي عبر الهاتف: +61882013639 أو الفاكس:+61882013602 البريد الإلكتروني: Denise.devries@flinders.edu.au

شكراً على إهتمامك ومساعدتك.

المخلصه لك

Dale Vries

الدكتوره دينيس دي فرايس

محاضره

كلية علوم الحاسب والهندسة والرياضيات بجامعة فلندرز باستراليا

هذا المشروع تم قبوله من قبل جامعة فاندرز (لجنة أخلاقيات الأبحاث) برقم 6951. لمزيداً من المعلومات حول المشروع يرجى الإتصال على *3116 8201* أو فاكس *2035 8201* أو عبر الإيميل *human.researchethics@flinders.edu.au*

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ورقة معلومات

العنوان: " **العوامل المؤثرة في قبول الطلاب والطالبات للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية**"

الباحث:

تميم خليفة الخليفة

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

جوال: 02053541 4 61+

المشرفين:

الدكتورة: دينيس دي فرايس

كلية علوم الحاسب والهندسة والرياضيات

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الدكتورة: جيزيل رامبيرساد

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

هاتف: 15746 820 8 61+

وصف الدراسة:

هذه الدراسة هي جزء من مشروع تحث عنوان "نحو تعليم متنقل فعال في المدارس الثانوية في المملكة العربية السعودية" هذا المشروع هو مدعوم من قبل جامعة فلندرز, كلية علوم الحاسب والهندسة والرياضيات.

الهدف من الإستبانة:

- التحقق إحصائياً من النموذج الذي تم طرحة في فصل سابق من هذه الرسالة (بإستخدام تقنيات نمذجة المعادلات الهيكلية)
- نتائج هذه الدراسة سوف تكون ذات إهتمام مباشر لصناع القرار المهتمين في تطبيق وتجربة تكنولوجيا الأجهزة المتنقلة في المرحلة الثانوية في المملكة العربية السعودية. وكذلك النظر في العوامل المؤثرة في قبول تكنولوجيا الأجهزة المتنقلة للطلاب والمعلمين في المرحلة الثانوية.

ماذا سوف يُطلب مني أن أفعل؟

أنت مدعو للمشاركة في إستبانة. تحتوي هذه الإستبانة على أسئلة حول العوامل المؤثرة في قبول الطلاب والطالبات للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية. سوف يستغرق الإجابة على الإستبانة 10-15 دقيقة تقريباً. مشاركتكم في هذا الاستبان هو عمل تطوعي تماما؛ ، يمكنك الإنسحاب في أي وقت دون إكمال الإستبانة . سوف يتم استخدام المعلومات التي تم جمعها أثناء الدراسة لإنجاز متطلبات البحث فقط ، وجميع المشاركات المقدمة في هذه الدراسة سوف تكون سرية.

ما الفائدة المكتسبة للمشاركة في هذه الدراسة؟

تحديد وإختبار العوامل المؤثرة في تقبل الطلاب والطالبات للتعليم المتنقل إحصائياً سوف يساعد الباحث على تحديد مدى تأثير هذه العوامل على تقبل الطلاب والطالبات للتعليم المتنقل.

هل ستكون هويتي مكشوفة في هذه الدراسة؟

لا. نحن لسنى بحاجه إلى الإسم، جميع المشاركات في هذه الدراسة سوف تكون سرية.

هل هناك مخاطر أو مضايقات إذا شاركت؟

لا

كيف أوافق على المشاركة؟

المشاركة في هذه الإستبانة هي تطوعية. يمكنك الإجابة ب "لا تعليق" أو الإمتناع عن الإجابة ويمكنك الإنسحاب من الإستبانة في اي وقت بدون عواقب. تم إرفاق نموذج الموافقة على المشاركة في حال الرغبة في المشاركة في هذه الإستبانة. فضلاً قم بقراءة الإرشادات ومن ثم وقّعها وأرسلها إلى الصندوق المخصص في الإدارة.

كيف أطلع على نتائج الدراسة؟

سيقوم الباحث بتلخيص نتائج الدراسة. ومن ثم سيقوم الباحث بتزودكم بالنتائج إذا أردتم ذلك.

شكراً لأخذك الوقت الكافي لقراءة ورقة المعلومات هذه ونأمل بأن تقبل دعوتنا للمشاركة.

" العوامل المؤثرة في قبول الطلاب والطالبات للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية"

تعاريف ومصطلحات مهمة

الأداء المتوقع. مستوى الفائدة التي يعزوها الفرد إلى نظام المعلومات فيما يتعلق بأداء العمل.

الجهد المتوقع. درجة سهولة المرتبطة باستخدام النظام.

التأثير الاجتماعي. التأثير على إستخدام الجهاز المتنقل في التعليم من قبل الطلاب الآخرين والأصدقاء والمعلمين وأولياء الأمور.

المتعة في الإستخدام. المرح والإستمتاع الحاصل باستخدام أجهزة التعليم المتنقل.

جودة النظام. مدى وضوح ودقة النظام أو التطبيق المستخدم في الجهاز المتنقل وكذلك الخدمات المقدمة من النظام أو التطبيق التعليمي.

الإدارة الذاتية للتعلم. قدرة الفرد على تحفيز نفسه عل التعلم الذاتي.

النية السلوكية. وهي نية الفرد إستخدام (أو عدم) أجهزة التعليم المتنقل في المستقبل.

الجزء الاول:

1- الجنس:
- ☐ ذكر
- ☐ أنثى

2- المرحلة الدراسية:
- ☐ أول ثانوي
- ☐ ثاني ثانوي
- ☐ ثالث ثانوي

3- كيف تقيّم تعليمك العام عبر الكمبيوتر والانترنت:
- ☐ جيد جداً
- ☐ جيد
- ☐ عادي
- ☐ ضعيف
- ☐ ضعيف جداً

4- أي من الأجهزة التالية تملك (يمكنك إختيار أكثر من جهاز)
- ☐ هاتف قديم
- ☐ هاتف ذكي (مثل الآي فون والجالكسي... إلخ)
- ☐ جهاز لوحي (الآي باد أو الجالكسي تاب .....إلخ)
- ☐ لابتوب

5- هل تستخدم برامج تعليمية عبر جهازك المتنقل؟ (مثل الاي فون او الاي باد.....إلخ)
- ☐ نعم
- ☐ لا

إ

ذا كانت الإجابة "نعم" حدد:.....

6- كيف تقيّم مهاراتك في استخدامك للأجهزة المتنقلة (مثل الاي فون او الاي باد.....إلخ) ؟

- ☐ جيدجداً
- ☐ جيد
- ☐ عادي
- ☐ ضعيف
- ☐ ضعيف جداً

الجزء الثاني:

حدد بعلامة X مدى موافقتك أو عدم موافقتك على كل من العبارات التالية:

رقم						
	الأداء المتوقع	موافق بشدة	موافق	محايد	لا أوافق	لا أوافق بشدة
PE1	إستخدام التعليم المتنقل (الذي يتم عبر إستخدام الأجهزة المتنقلة كالآي فون أو الآي باد.....إلخ) من الممكن أن يحسن نتائج التعليم الخاصة بي	☐	☐	☐	☐	☐
PE2	أجد أنه من الممكن للتعليم المتنقل أن يكون مفيداً في تعليمي	☐	☐	☐	☐	☐
PE3	إستخدام التعليم المتنقل يمكنني من إنجاز المهام التعليمية بسرعة أكبر	☐	☐	☐	☐	☐
PE4	إستخدام التعليم المتنقل من الممكن أن يزيد من إنتاجي التعليمي	☐	☐	☐	☐	☐
	الجهد المتوقع	موافق بشدة	موافق	محايد	لا أوافق	لا أوافق بشدة
EE1	أجد سهولة في إستخدام برامج وتطبيقات التعليم المتنقل (الذي يتم عبر إستخدام الأجهزة المتنقلة كالآي فون أو الآي باد.....إلخ)	☐	☐	☐	☐	☐
EE2	أجد أنه من السهل أن أكون ماهر في إستخدام برامج وتطبيقات التعليم المتنقل	☐	☐	☐	☐	☐
EE3	تفاعلي مع برامج و تطبيقات التعليم المتنقل مفهوم وواضح	☐	☐	☐	☐	☐
EE4	تعلم تشغيل النظام أمر صعب	☐	☐	☐	☐	☐

	التأثير الإجتماعي	موافق بشدة	موافق	محايد	لا أوافق	لا أوافق بشدة
SI1	أساتذتي يعتقدون أنه ينبغي لي أن أستخدم التعليم المتنقل (الذي يتم عبر إستخدام الأجهزة المتنقلة كالآي فون أو الآي باد.....إلخ)	☐	☐	☐	☐	☐
SI2	زملائي الطلاب يعتقدون أنه ينبغي لي أن أستخدم التعليم المتنقل	☐	☐	☐	☐	☐
SI3	الوالدين داعمين لفكرة إستخدام التعليم المتنقل	☐	☐	☐	☐	☐
SI4	ساستخدم التعليم المتنقل إذا أوصاني بذلك إدارة المدرسة	☐	☐	☐	☐	☐
	جودة النظام	موافق بشدة	موافق	محايد	لا أوافق	لا أوافق بشدة
SQ1	**ليس** من المهم أن تزيد الأدوات والبرامج والتطبيقات في التعليم المتنقل (الذي يتم عبر إستخدام الأجهزة المتنقلة كالآي فون أو الآي باد.....إلخ) من جودة التعليم	☐	☐	☐	☐	☐
SQ2	**ليس** من المهم أن تكون الأنظمة والتطبيقات في التعليم المتنقل واضحة.	☐	☐	☐	☐	☐
SQ3	**ليس** من المهم أن تكون الأنظمة دقيقة.	☐	☐	☐	☐	☐
SQ4	**ليس** من المهم أن تكون أنظمة التعليم المتنقل موثوقة	☐	☐	☐	☐	☐
	المتعة في الإستخدام	موافق بشدة	موافق	محايد	لا أوافق	لا أوافق بشدة
HM1	أعتقد بأن إستخدام الأجهزة المتنقلة في التعليم أمر مرح	☐	☐	☐	☐	☐
HM2	أعتقد بأن إستخدام الأجهزة المتنقلة في التعليم سوف يكون ممتعاً	☐	☐	☐	☐	☐
HM3	أعتقد بأن إستخدام الأجهزة المتنقلة في التعليم سوف يكون عملية مسلية جداً	☐	☐	☐	☐	☐

HM4	أعتقد بأن إستخدام جهاز متنقل للتعليم سوف يجعل المعلمين والمعلمات متحفزين أكثر	☐	☐	☐	☐	☐
	الإدارة الذاتية للتعليم	موافق بشدة	موافق	محايد	لا أوافق	لا أوافق بشدة
SMoL1	إستخدام الأجهزة المتنقلة في التعليم سوف يساعدني على إدارة الواجبات والقراءة أكثر فاعلية من التعليم العادي	☐	☐	☐	☐	☐
SMoL2	إستخدام الأجهزة المتنقلة في التعليم سوف يساعدني في إدارة وقت التعلم وإكمال الواجبات الدراسة في الوقت المحدد	☐	☐	☐	☐	☐
SMoL3	إستخدم الأجهزة المتنقلة في التعليم سوف يساعدني في تحقيق الأهداف المرجوه من المادة	☐	☐	☐	☐	☐
	النية المستقبلية	موافق بشدة	موافق	محايد	لا أوافق	لا أوافق بشدة
BI1	أنوي إستخدام التعليم المتنقل (الذي يتم عبر إستخدام الأجهزة المتنقلة كالآي فون أو الآي باد.....إلخ) في المستقبل	☐	☐	☐	☐	☐
BI2	أعتقد بأنني سأستخدم التعليم المتنقل بإستمرار	☐	☐	☐	☐	☐
BI3	أتوقع بأنني سوف أستمتع بإستخدام تكنولجيا التعليم المتنقل	☐	☐	☐	☐	☐
BI4	سأنصح زملائي الطلاب بإستخدام برامج وتطبيقات التعليم المتنقل	☐	☐	☐	☐	☐

Appendix C

November 2016

A survey on the

"Implementation of a mobile learning project (English app) for high school education in Saudi Arabia"

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LETTER OF INTRODUCTION

(To Survey participants)

Dear Sir/Madam

This letter is to introduce Tamim Alkhalifah who is a PhD student in the School of Computer Science, Engineering and Mathematics at Flinders University.

He is undertaking research leading to the production of a thesis or other publications on the subject of "M-learning in K-12 education in Saudi Arabia". He would like to invite you to assist with this project by completing a questionnaire after using a mobile learning app (English app). This questionnaire will take approximately 10-15 minutes to complete.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on (+61 8 8201 3639), fax (+61 8 8201 3602) or e-mail (denise.devries@flinders.edu.au)

Thank you for your attention and assistance.

Yours sincerely

Dr Denise de Vries BCompInfSc, BSc(Hons), PhD, MACS
Lecturer
School of Computer Science, Engineering and Mathematics
Flinders University

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 6951). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

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INFORMATION SHEET

Title: "Implementation of a mobile learning project (English app) for the K-12 education in Saudi Arabia"

Investigator:

Mr Tamim Alkhalifah

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Description of the study:

This study is part of the project entitled 'Toward an effective mobile learning in secondary schools in Saudi Arabia'. This project is supported by Flinders University, School of Computer Science, Engineering and Mathematics.

Purpose of the survey:

The survey aims:

- To ***practically*** confirm and validate the theoretical model proposed in this research by obtaining answers from students after using a mobile learning app for some time.
- To discover any additional factors that have not been included in the theoretical proposed model.
- The results of this survey will be of interest to the decision makers in Saudi Arabia who are concerned with adopting new mobile technologies in K-12 education and to help them to consider the factors relevant to the acceptance of M-learning in K-12 education.

What will I be asked to do?

You are invited to take part in this survey. It includes questions about the factors that influence your acceptance of M-learning after using a mobile learning app (English language). The survey will take about 10-15 minutes. Your participation in this survey is completely voluntary; you do not have to respond to every item, and you discontinue participation at any time without reprisals. The information collected during the study will only be used to accomplish the research requirements, and all responses provided on this survey will remain confidential.

What benefit will I gain from being involved in this study?

The sharing of your experiences will help us to determine what factors influence the acceptance of M-learning in K-12 education.

Will I be identifiable by being involved in this study?

We do not need your name and you will be anonymous.

Are there any risks or discomforts if I am involved?

No.

How do I agree to participate?

Participation is voluntary. You may answer 'no comment' or refuse to answer any questions and you are free to withdraw from the online survey at any time without effect or consequences. A consent form accompanies this information sheet. If you agree to participate please read and sign the form and send it back to the school office box.

How will I receive feedback?

Outcomes from the project will be summarised and given to you by the investigator if you would like to see them.

Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

Implementation of a mobile learning project (English app) for the K-12 education in Saudi Arabia

Important definitions

Performance Expectancy (PE). The level of usefulness attributed by an individual to an information system as regards work performance.

Effort expectancy (EE). The degree of ease associated with the use of the system.

Social influence (SI). The degree to which an individual usage of a system is promoted or influenced by other students, friends, teachers and parents.

Hedonic motivation (HM). The enjoyment an individual derives from using a technology (mobile learning in the present case).

System quality (SQ). The extent to which the general M-learning system and the services it offers exhibit clarity, precision and reliability denotes system quality.

Self-management of learning (SMoL). How an individual feels they are able to work under their own steam.

Behavioral intention (BI) is the measure of the likelihood of a person employing the application.

Part 1:

1- Gender:
- ☐ Male
- ☐ Female

2- Educational Level in secondary school:
- ☐ First
- ☐ Second
- ☐ Third

Part 2:

- Performance expectancy

☐ ***Did you found the English app useful in your studies that made you consider using it for your studies in the future? Explain.***

☐ ***Did you found the English app useful in your teaching that made you consider using it for your teaching in the future? Explain (for teachers)***

- Effort expectancy

☐ ***Did you found the English app easy to use in your studies that made you consider using it for your studies in the future? Explain.***

☐ ***Did you found the English app easy to use in your teaching that made you consider using it for your teaching in the future? Explain. (for teachers)***

- Social influence

☐ ***Did your parents, friends and teachers influenced you or may influence you in the future to use the English app?***

☐ ***As a teacher, how important is teacher role towards influencing students to use such educational apps/mobile learning? (for teachers)***

- System quality

☐ ***Are you satisfied on how the app is designed? How?***

☐ ***Do you think that there is a relation between a good designed app and continuous usage of it?***

☐ ***Do you think that there is a relation between a good designed app and continuous usage of it? (for teachers)***

- Hedonic motivation

☐ ***Was the app enjoyable and fun that made you think to use mobile learning apps more frequently to learn? Explain.***

☐ ***Was the app enjoyable and fun that made you think to use mobile learning more frequently to teach? Explain (for teachers)***

- Self-management of learning

☐ ***Do you think there is a relationship between time management and the adopting or accepting the use of mobile learning?***

☐ ***Do you think there is a relationship between time management and the adopting or accepting the use of mobile learning? (for teachers)***

Additional factors

Are there any more (potential) factors that students experienced that influenced their use of the mobile learning app? Explain? (students and teachers)

Appendix C1

نوفمبر 2016

إستبانة حول

"تطبيق مشروع برمجي تعليمي (تطبيق تعليم اللغة الإنجليزية) لطلاب المرحلة الثانوية في التعليم العام في اللملكة العربية السعودية"

Dr Denise de Vries
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Flinders UNIVERSITY
ADELAIDE • AUSTRALIA

خطاب تقديم
(للمشاركين في الإستبانة)

عزيزي/عزيزتي المشارك/ة

هذا الخطاب هو لتقديم الطالب تميم خليفة الخليفة وهو طالب دكتوراه في كلية علوم الحاسب والهندسة والرياضيات بجامعة فلندرز باستراليا. سيقوم الطالب بتقديم بطاقته الخاصة كإثبات لهويته. يقوم الطالب بعمل دراسة حول إستخدام الأجهزة المتنقلة في التعليم العام في المملكة.

يود الطالب أن يدعوكم لمساعدته والمشاركة في الإستبانة بعد إستخدام تطبيق تعليمي لتعلم اللغة الإنجليزية بعنوان "تطبيق مشروع برمجي تعليمي (تطبيق تعليم اللغة الإنجليزية) لطلاب المرحلة الثانوية في التعليم العام في المملكة العربية السعودية "والذي يستغرق تقريباً 10-15 دقيقة لإستكمالها.

ثق/ي تماماً أن المعلومات المقدمه في الإستبانة سوف يتعامل معها بسرية تامة ولن يتم التعرف على هوية المشاركين والمشاركات في الإجابة على الإستبانة. وتستطيع/ تستطيعين كذلك الإنسحاب من الإستبانة في أي وقت تريده أو الإمتناع عن إجابة فقرات محددة كذلك.

إذا كان لديك إستفسارات بخصوص الاستبانه أو الدراسة بشكل عام، فلا تتردد عزيزي/عزيزتي المشارك/ة في الاتصال بي عبر الهاتف: +61882013639 أو الفاكس:+61882013602 البريد الإلكتروني: Denise.devries@flinders.edu.au

شكراً على إهتمامك ومساعدتك.

المخلصه لك

Dale Vries

الدكتوره دينيس دي فرايس

محاضره

كلية علوم الحاسب والهندسة والرياضيات بجامعة فلندرز باستراليا

هذا المشروع تم قبوله من قبل جامعة فاندرز (لجنة أخلاقيات البحوث) برقم 6951. لمزيداً من المعلومات حول المشروع يرجى الإتصال على *8201 3116* أو فاكس *8201 2035* أو عبر الإيميل *human.researchethics@flinders.edu.au*

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ورقة معلومات

العنوان: **تطبيق مشروع برمجي تعليمي (تطبيق تعليم اللغة الإنجليزية) لطلاب المرحلة الثانوية في التعليم العام في المملكة العربية السعودية "**

الباحث:

تميم خليفة الخليفة

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

جوال: 02053541 4 61+

المشرفين:

الدكتورة: دينيس دي فرايس

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

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الدكتورة: جيزيل رامبيرساد

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

هاتف: 15746 820 8 61+

وصف الدراسة:

هذه الدراسة هي جزء من مشروع تحت عنوان "نحو تعليم متنقل فعال في المدارس الثانوية في المملكة العربية السعودية" هذا المشروع هو مدعوم من قبل جامعة فلندرز, كلية علوم الحاسب والهندسة والرياضيات.

الهدف من الإستبانة:

- للتأكد من نتائج البحث (عملياً) عبر إستخدام النظام (التطبيق) وذلك عن طريق إستطلاع نتائج الإستبانة بعد إستخدام النظام.
- الكشف عن عوامل أخرى مؤثرة في قبول الطلاب للتعليم المتنقل (لم يتم دراستها سابقاً في نموذج البحث)
- نتائج هذه الدراسة سوف تكون ذات إهتمام مباشر لصناع القرار المهتمين في تطبيق وتجربة تكنولوجيا الأجهزة المتنقلة في المرحلة الثانوية في المملكة العربية السعودية. وكذلك النظر في العوامل المؤثرة في قبول تكنولوجيا الأجهزة المتنقلة للطلاب والمعلمين في المرحلة الثانوية.

ماذا سوف يُطلب مني أن أفعل؟

أنت مدعو للمشاركة في إستبانة. تحتوي هذه الإستبانة على أسئلة حول العوامل المؤثرة في قبول الطلاب والطالبات للتعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية بعد إستخدام تطبيق برمجي تعليمي (لتعليم اللغة الإنجليزية). سوف يستغرق الإجابة على الإستبانة 10-15 دقيقة تقريباً. مشاركتكم في هذا الاستبان هو عمل تطوعي تماماً ، يمكنك الإنسحاب في أي وقت دون إكمال الإستبانة . سوف يتم استخدام المعلومات التي تم جمعها أثناء الدراسة لإنجاز متطلبات البحث فقط ، وجميع المشاركات المقدمة في هذه الدراسة سوف تكون سرية.

ما الفائدة المكتسبة للمشاركة في هذه الدراسة؟

تحديد وإختبار العوامل المؤثرة في تقبل الطلاب والطالبات للتعليم المتنقل إحصائياً سوف يساعد الباحث على تحديد مدى تأثير هذه العوامل على تقبل الطلاب والطالبات للتعليم المتنقل.

هل ستكون هويتي مكشوفة في هذه الدراسة؟

لا. نحن لسنى بحاجه إلى الإسم، جميع المشاركات في هذه الدراسة سوف تكون سرية.

هل هناك مخاطر أو مضايقات إذا شاركت؟

لا

كيف أوافق على المشاركة؟

المشاركة في هذه الإستبانة هي تطوعية. يمكنك الإجابة ب "لا تعليق" أو الإمتناع عن الإجابة ويمكنك الإنسحاب من الإستبانة في اي وقت بدون عواقب. تم إرفاق نموذج الموافقة على المشاركة في حال الرغبة في المشاركة في هذه الإستبانة. فضلاً قم بقراءة الإرشادات ومن ثم وقّعها وأرسلها إلى الصندوق المخصص في الإدارة.

كيف أطلع على نتائج الدراسة؟

سيقوم الباحث بتلخيص نتائج الدراسة. ومن ثم سيقوم الباحث بتزودكم بالنتائج إذا أردتم ذلك.

شكراً لأخذك الوقت الكافي لقراءة ورقة المعلومات هذه ونأمل بأن تقبل دعوتنا للمشاركة.

" تطبيق مشروع برمجي تعليمي (تطبيق تعليم اللغة الإنجليزية) لطلاب المرحلة الثانوية في التعليم العام في اللملكة العربية السعودية"

تعاريف ومصطلحات مهمة

الأداء المتوقع. مستوى الفائدة التي يعزوها الفرد إلى نظام المعلومات فيما يتعلق بأداء العمل.

الجهد المتوقع. درجة سهولة المرتبطة باستخدام النظام.

التأثير الاجتماعي. التأثير على إستخدام الجهاز المتنقل في التعليم من قبل الطلاب الآخرين والأصدقاء والمعلمين وأولياء الأمور.

المتعة في الإستخدام. المرح والإستمتاع الحاصل باستخدام أجهزة التعليم المتنقل.

جودة النظام. مدى وضوح ودقة النظام أو التطبيق المستخدم في الجهاز المتنقل وكذلك الخدمات المقدمة من النظام أو التطبيق التعليمي.

الإدارة الذاتية للتعلم. قدرة الفرد على تحفيز نفسه عل التعلم الذاتي.

النية السلوكية. وهي نية الفرد إستخدام (أو عدم) أجهزة التعليم المتنقل في المستقبل.

الجزء الاول:

1- الجنس:
- ☐ ذكر
- ☐ أنثى

2- المرحلة الدراسية:
- ☐ أول ثانوي
- ☐ ثاني ثانوي
- ☐ ثالث ثانوي

الجزء الثاني:

حدد بعلامة X مدى موافقتك أو عدم موافقتك على كل من العبارات التالية:

الأداء المتوقع

- هل وجدت إستخدام التطبيق التعليمي مفيد في دراستك بحيث جعلك تفكر في إستخدامه مستقبلاً في دراستك؟ اشرح.
- هل وجدت إستخدام التطبيق التعليمي مفيد في تدريسك بحيث جعلك تفكر في إستخدامه مستقبلاً في الشرح؟ اشرح. (للمعلمين فقط)

الجهد المتوقع

- ☐ هل وجدت إستخدام التطبيق التعليمي سهل في دراستك بحيث جعلك تفكر في إستخدامه مستقبلاً في دراستك؟ اشرح
- ☐ هل وجدت إستخدام التطبيق التعليمي سهل في تدريسك بحيث جعلك تفكر في إستخدامه مستقبلاً في الشرح؟ اشرح. (للمعلمين فقط)

التأثير الإجتماعي

- ☐ هل أثر والديك وأصدقائك ومعلموك في إستخدامك للتطبيق التعليمي (أو إستخدامك له في المستقبل)؟
- ☐ كمعلم، ما مدى أهمية دورك نحو التأثير على الطلاب لاستخدام هذه التطبيقات التعليمية أو التعليم المتنقل؟ (للمعلمين فقط)

جودة النظام

- ☐ هل أنت راضي عن كيفيه تصميم التطبيق؟ اشرح.
- ☐ هل تعتقد بأن هناك علاقة بين جودة تصميم التطبيق والإستخدام المستمر له؟ اشرح.
- ☐ هل تعتقد بأن هناك علاقة بين جودة تصميم التطبيق والإستخدام المستمر له؟ اشرح. (للمعلمين فقط)

المتعة في الإستخدام

- ☐ هل كان إستخدام التطبيق التعليمي سهلاً وممتعاً مما جعلك تفكر في إستخدام التطبيق أو تطبيقات أخرى للتعليم مستقبلاً؟
- ☐ هل كان إستخدام التطبيق التعليمي سهلاً وممتعاً مما جعلك تفكر في إستخدام التطبيق أو تطبيقات أخرى للتدريس مستقبلاً؟ (للمعلمين فقط)

الإدارة الذاتية للتعليم

عوامل أخرى

- ☐ هل هناك المزيد من العوامل التي يمكن تحديدها كعوامل مؤثرة إضافية أثرت على الطلاب عند إستخدامهم للتطبيق؟ (للمعلمين والطلاب)

Appendix C2

November 2016

A survey on the

"Challenges and obstacles that prevent the implementation of mobile learning in K-12 education in Saudi Arabia"

Dr Denise de Vries
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LETTER OF INTRODUCTION

(To Survey participants)

Dear Sir/Madam

This letter is to introduce Tamim Alkhalifah who is a PhD student in the School of Computer Science, Engineering and Mathematics at Flinders University.

He is undertaking research leading to the production of a thesis or other publications on the subject of "M-learning in K-12 education in Saudi Arabia". He would like to invite you to assist with this project by completing a questionnaire about the challenges and obstacles that prevent the implementation of mobile learning in K-12 education in Saudi Arabia. This questionnaire will take approximately 20 minutes to complete.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on (+61 8 8201 3639), fax (+61 8 8201 3602) or e-mail (denise.devries@flinders.edu.au)

Thank you for your attention and assistance.

Yours sincerely

Dr Denise de Vries BCompInfSc, BSc(Hons), PhD, MACS
Lecturer
School of Computer Science, Engineering and Mathematics
Flinders University

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 6951). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au

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Flinders UNIVERSITY

INFORMATION SHEET

Title: "Challenges and obstacles that prevent the implementation of mobile learning in K-12 education in Saudi Arabia"

Investigator:

Mr Tamim Alkhalifah

School of Computer Science, Engineering and Mathematics

Flinders University

Ph: +61 402053541

Supervisors:

Dr Denise de Vries

School of Computer Science, Engineering and Mathematics

Flinders University

Ph: +61 8 82013639

Dr Giselle Rampersad

School of Computer Science, Engineering and Mathematics

Flinders University

Ph: +61 8 82015746

Description of the study:

This study is part of the project entitled 'Toward an effective mobile learning in secondary schools in Saudi Arabia'. This project is supported by Flinders University, School of Computer Science, Engineering and Mathematics.

Purpose of the survey:

The survey aims:

- Explores the challenges and obstacles that face the implementation of M-learning in high schools from the perspectives of teachers and education officials in order to present a comprehensive view and discover the common obstacles which need to be considered.
- The results of this survey will be of interest to the decision makers in Saudi Arabia who are concerned with adopting new mobile technologies in K-12 education and to help them to consider the challenges and obstacles that face the implementation of M-learning in high schools.

What will I be asked to do?

You are invited to take part in this survey. It includes questions about the challenges and obstacles that face the implementation of M-learning in high schools. The survey will take about 20 minutes. Your participation in this survey is completely voluntary; you do not have to respond to every item, and you discontinue participation at any time without reprisals. The information collected during the study will only be used to accomplish the research requirements, and all responses provided on this survey will remain confidential.

What benefit will I gain from being involved in this study?

The sharing of your experiences will help us to identify the challenges and obstacles that face the implementation of M-learning in high schools

Will I be identifiable by being involved in this study?

We do not need your name and you will be anonymous.

Are there any risks or discomforts if I am involved?

No.

How do I agree to participate?

Participation is voluntary. You may answer 'no comment' or refuse to answer any questions and you are free to withdraw from the online survey at any time without effect or consequences.

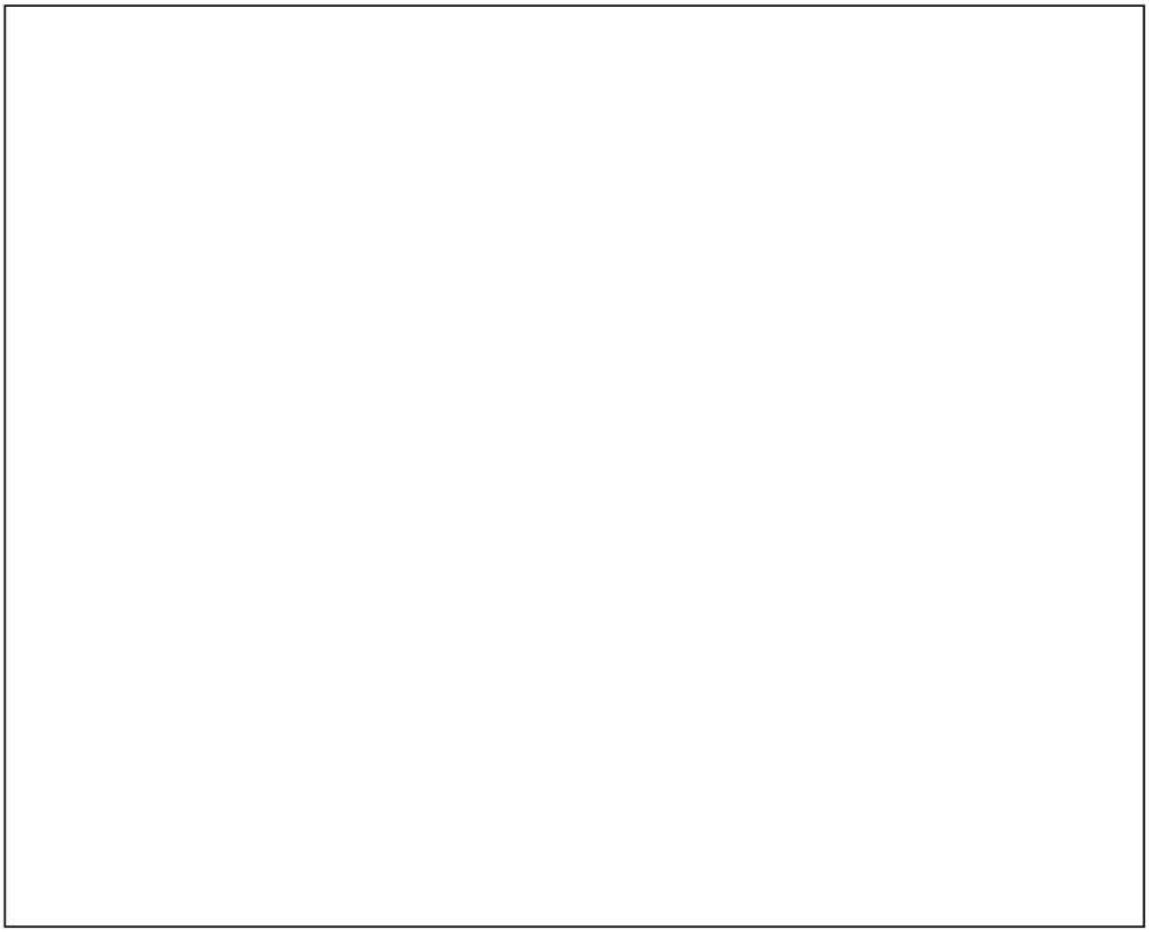
How will I receive feedback?

Outcomes from the project will be summarised and given to you by the investigator if you would like to see them.

Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.

Challenges and obstacles that prevent the implementation of mobile learning in K-12 education in Saudi Arabia

What are the challenges and obstacles that face the implementation of mobile learning in high schools in the Kingdom of Saudi Arabia?



Appendix C3

نوفمبر 2016

إستبانة حول

"التحديات والعقبات التي تحول دون تنفيذ التعلم المتنقل في مرحلة التعليم الأساسي في المملكة العربية السعودية"

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(للمشاركين في الإستبانة)

عزيزي/عزيزتي المشارك/ة

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ثق/ي تماماً أن المعلومات المقدمه في الإستبانة سوف يتعامل معها بسرية تامة ولن يتم التعرف على هوية المشاركين والمشاركات في الإجابة على الإستبانة. وتستطيع/ تستطيعين كذلك الإنسحاب من الإستبانة في أي وقت تريده أو الإمتناع عن إجابة فقرات محددة كذلك.

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شكراً على إهتمامك ومساعدتك.

المخلصه لك

Dale Vries

الدكتوره دينيس دي فرايس

محاضره

كلية علوم الحاسب والهندسة والرياضيات بجامعة فلندرز باستراليا

هذا المشروع تم قبوله من قبل جامعة فاندرز (لجنة أخلاقيات البحوث) برقم 6951. لمزيداً من المعلومات حول المشروع يرجى الإتصال على *8201 3116* أو فاكس *8201 2035* أو عبر الإيميل *human.researchethics@flinders.edu.au*

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ورقة معلومات

العنوان: التحديات والعقبات التي تحول دون تنفيذ التعلم المتنقل في مرحلة التعليم الأساسي في المملكة العربية السعودية

الباحث:

تميم خليفة الخليفة

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

جوال: 02053541 4 61+

المشرفين:

الدكتورة: دينيس دي فرايس

كلية علوم الحاسب والهندسة والرياضيات

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الدكتورة: جيزيل رامبيرساد

كلية علوم الحاسب والهندسة والرياضيات

جامعة فلندرز

هاتف: 15746 820 8 61+

وصف الدراسة:

هذه الدراسة هي جزء من مشروع تحث عنوان "نحو تعليم متنقل فعال في المدارس الثانوية في المملكة العربية السعودية" هذا المشروع هو مدعوم من قبل جامعة فلندرز, كلية علوم الحاسب والهندسة والرياضيات.

الهدف من الإستبانة:

- استكشاف التحديات والعقبات التي تواجه تنفيذ المتنقل في المدارس الثانوية من وجهة نظر المعلمين ومسؤولي التعليم من أجل تقديم نظرة شاملة واكتشاف العقبات المشتركة التي تحتاج إلى النظر فيها.
- نتائج هذه الدراسة سوف تكون ذات إهتمام مباشر لصناع القرار المهتمين في تطبيق وتجربة تكنولوجيا الأجهزة المتنقلة في المرحلة الثانوية في المملكة العربية السعودية. وكذلك مساعدتهم على النظر في التحديات والعقبات التي تواجه تنفيذ التعليم المتنقل في المدارس الثانوية.

ماذا سوف يُطلب مني أن أفعل؟

أنت مدعو للمشاركة في إستبانة. تحتوي هذه الإستبانة على أسئلة حول التحديات والعقبات التي تواجه تنفيذ التعليم المتنقل في المرحلة الثانوية في المملكة العربية السعودية. سوف يستغرق الإجابة على الإستبانة 20 دقيقة تقريباً. مشاركتكم في هذا الاستبان هو عمل تطوعي تماما؛ ، يمكنك الإنسحاب في أي وقت دون إكمال الإستبانة . سوف يتم استخدام المعلومات التي تم جمعها أثناء الدراسة لإنجاز متطلبات البحث فقط ، وجميع المشاركات المقدمة في هذه الدراسة سوف تكون سرية.

ما الفائدة المكتسبة للمشاركة في هذه الدراسة؟

إن تبادل خبراتكم سيساعدنا على تحديد التحديات والعقبات التي تواجه تنفيذ التعليم المتنقل في المدارس الثانوية.

هل ستكون هويتي مكشوفة في هذه الدراسة؟

لا. نحن لسنى بحاجه إلى الإسم، جميع المشاركات في هذه الدراسة سوف تكون سرية.

هل هناك مخاطر أو مضايقات إذا شاركت؟

لا

كيف أوافق على المشاركة؟

المشاركة في هذه الإستبانة هي تطوعية. يمكنك الإجابة ب "لا تعليق" أو الإمتناع عن الإجابة ويمكنك الإنسحاب من الإستبانة في اي وقت بدون عواقب.

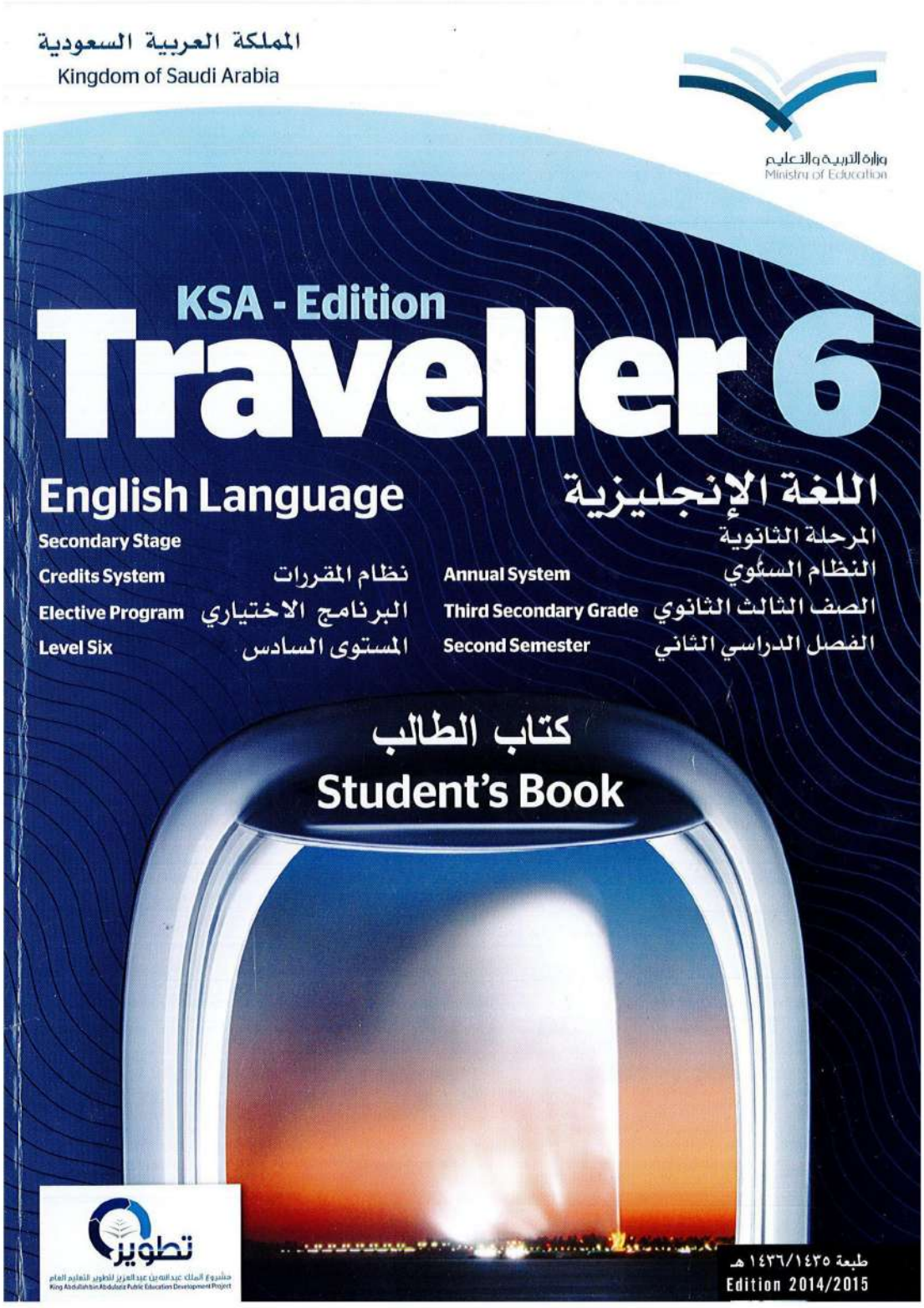
كيف أطلع على نتائج الدراسة؟

سيقوم الباحث بتلخيص نتائج الدراسة. ومن ثم سيقوم الباحث بتزودكم بالنتائج إذا أردتم ذلك.

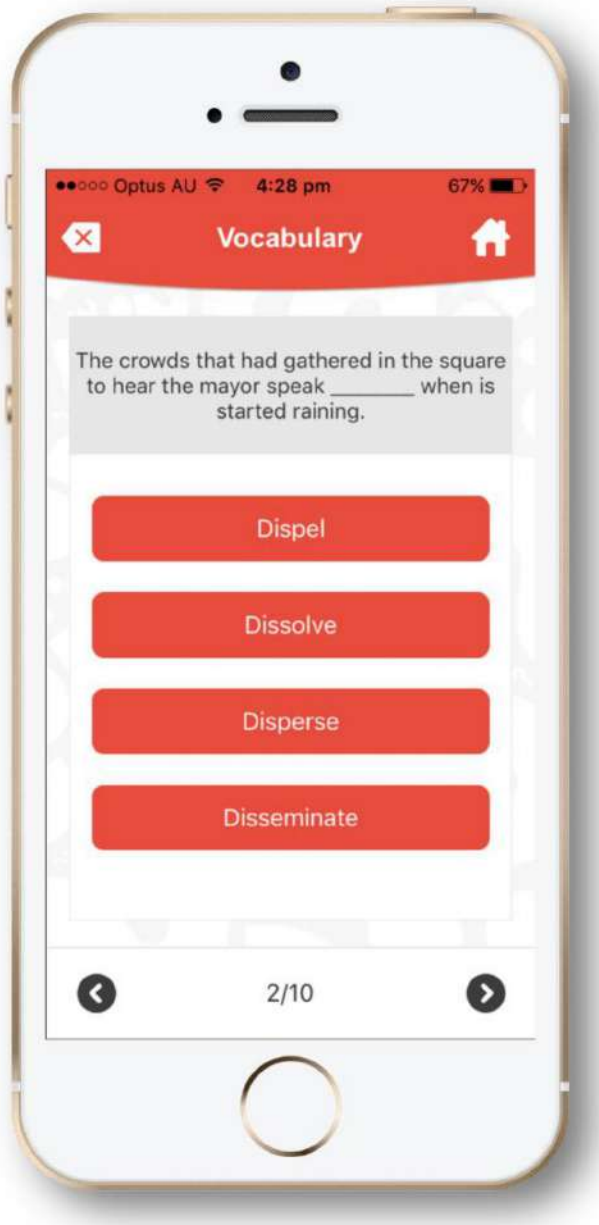
شكراً لأخذك الوقت الكافي لقراءة ورقة المعلومات هذه ونأمل بأن تقبل دعوتنا للمشاركة.

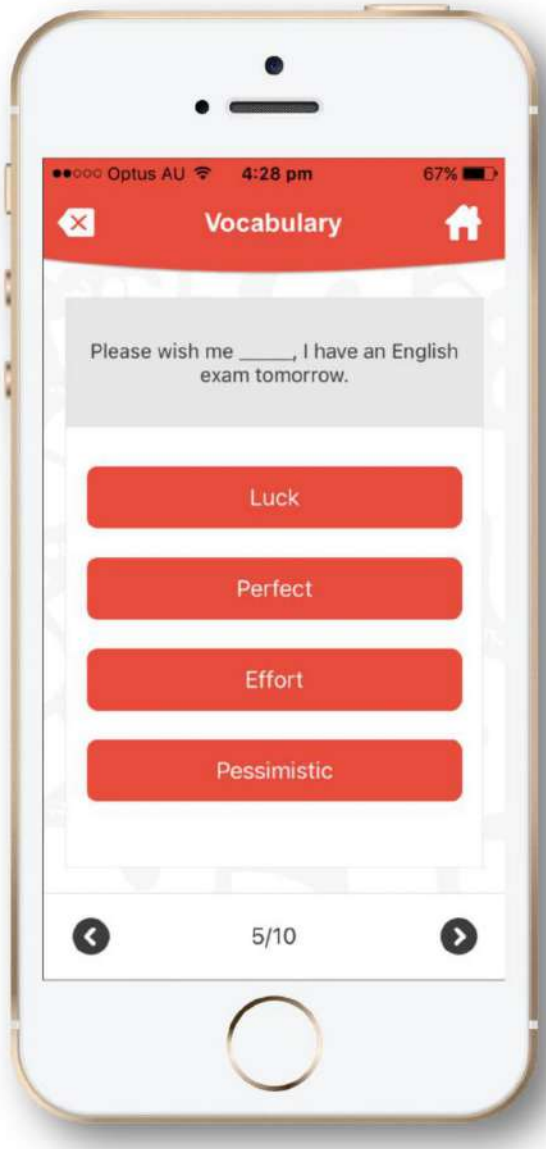
ما هي التحديات والعقبات التي تواجه تنفيذ التعلم المتنقل في المدارس الثانوية في المملكة العربية السعودية؟

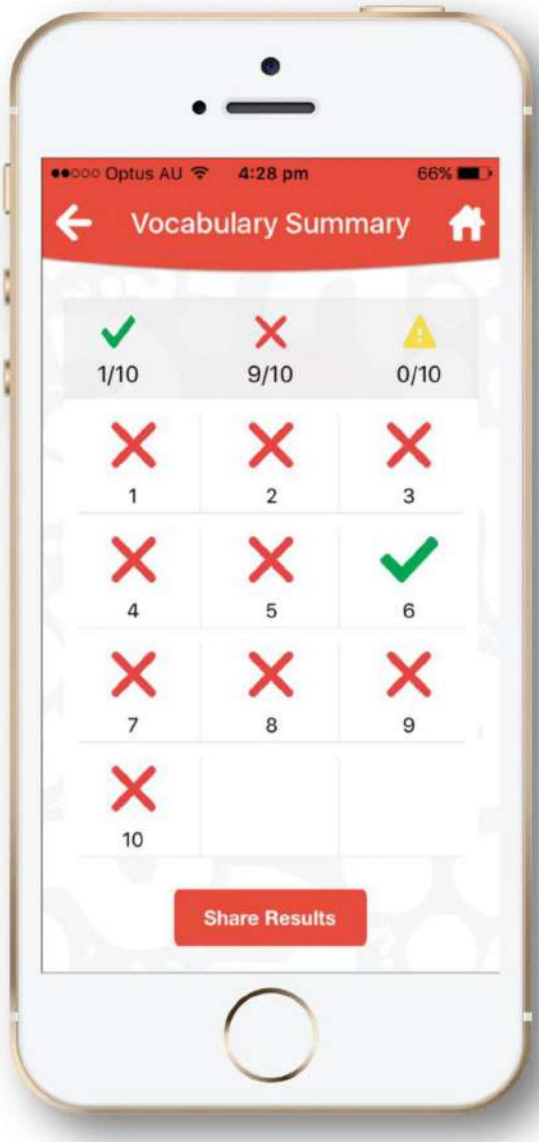
Appendix C4

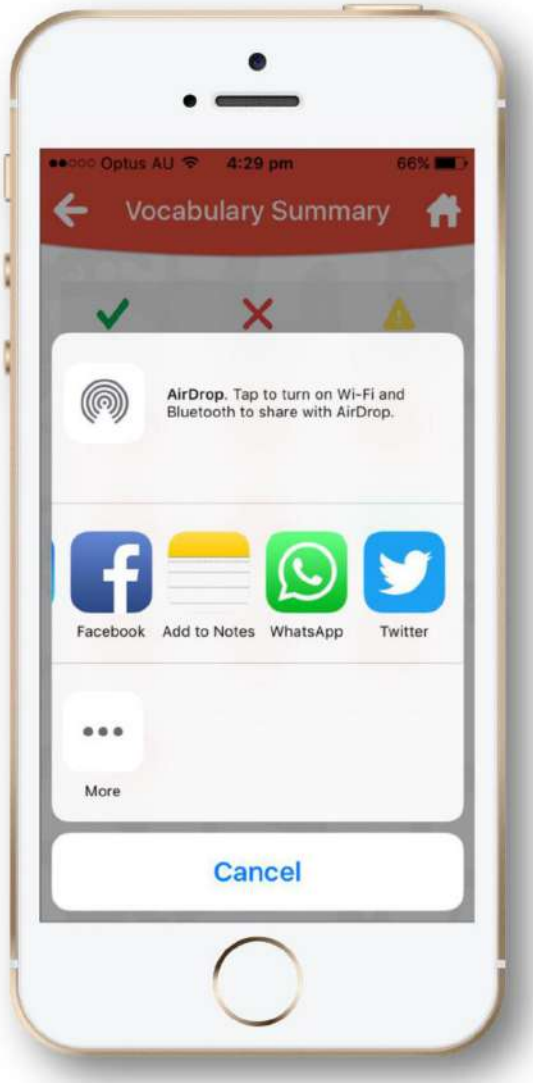

المملكة العربية السعودية
Kingdom of Saudi Arabia
وزارة التربية والتعليم
Ministry of Education
KSA - Edition
Traveller 6
English Language
اللغة الإنجليزية
Secondary Stage
المرحلة الثانوية
Credits System
نظام المقررات
Annual System
النظام السنوي
Elective Program
البرنامج الاختياري
Third Secondary Grade
الصف الثالث الثانوي
Level Six
المستوى السادس
Second Semester
الفصل الدراسي الثاني
كتاب الطالب
Student's Book
تطوير
مشروع الملك عبدالله بن عبدالعزيز لتطوير التعليم العام
King Abdullah bin Abdulaziz Public Education Development Project
طبعة ١٤٣٥/١٤٣٦ هـ
Edition 2014/2015

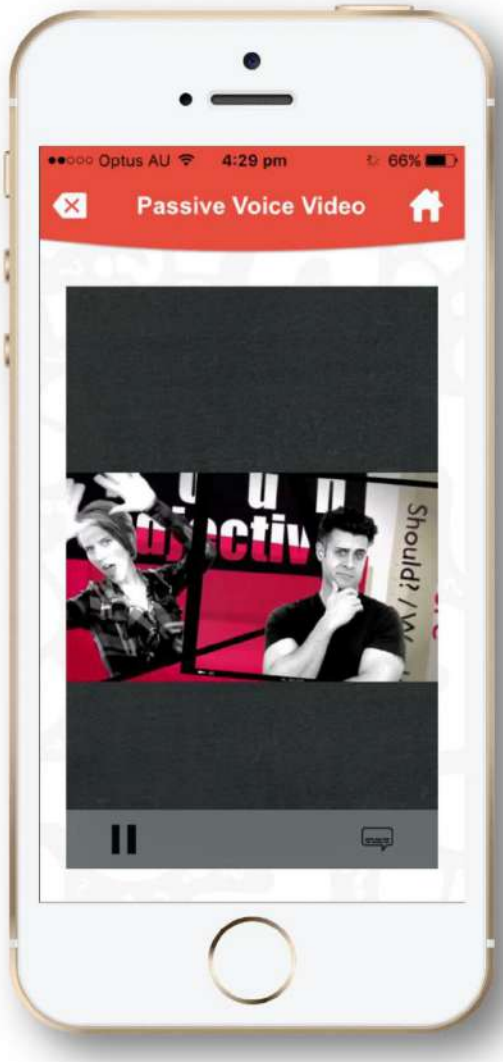
Appendix C5 (screenshots)




Optus AU
4:28 pm
67%
Vocabulary
Please wish me _____, I have an English exam tomorrow.
Luck
Perfect
Effort
Pessimistic
5/10


Optus AU 4:28 pm 66%
Vocabulary Summary
1/10
9/10
0/10
1
2
3
4
5
6
7
8
9
10
Share Results


Optus AU 4:29 pm 66%
Vocabulary Summary
AirDrop. Tap to turn on Wi-Fi and Bluetooth to share with AirDrop.
Facebook
Add to Notes
WhatsApp
Twitter
More
Cancel

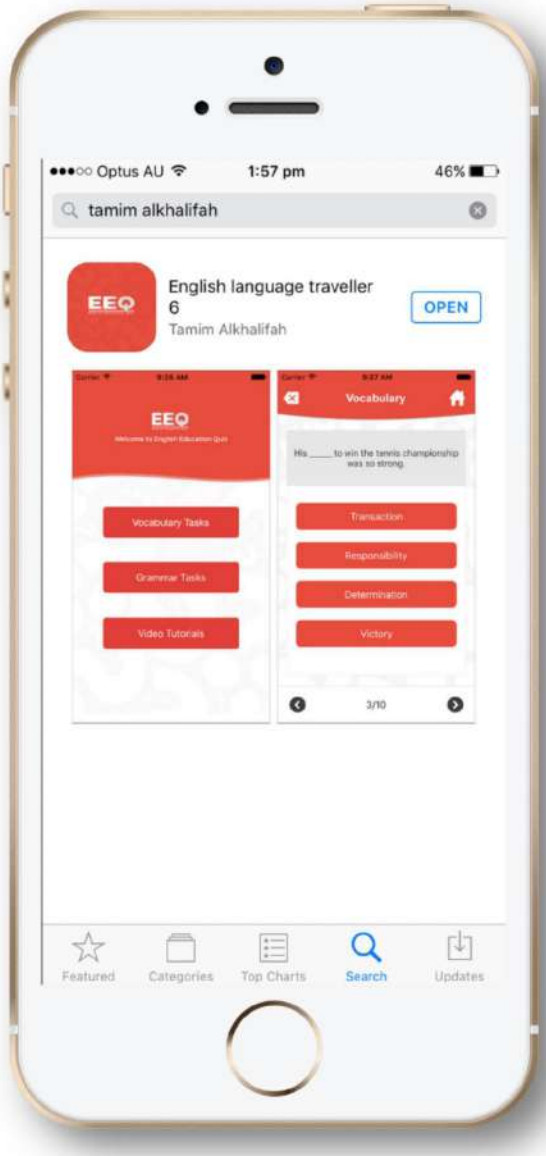

Optus AU
4:29 pm
66%
Passive Voice Video

Quiz Master »

Web Panel

Index	Category	Sub Category	Question	Opt 1	Opt 2	Opt 3	Opt 4	Answer	Image	Action
1	Vocabulary		Please wish me _____, I have an English exam tomorrow.	Luck	Perfect	Effort	Pessimistic	Luck		
2	Vocabulary		Current technology allows for greater _____ in how we do our jobs.	Time	Flexibility	Realm	Backtrack	Flexibility		
3	Vocabulary		His _____ to win the tennis championship was so strong.	Transaction	Responsibility	Determination	Victory	Determination		
4	Vocabulary		Thank you for helping us, we really appreciate your _____	Cooperation	Fruition	Proceedings	Premonition	Cooperation		
5	Vocabulary		There were attacked by a _____ lion in the jungle.	Fierce	Forceful	Savage	Wild	Wild		
6	Vocabulary		The crowds that had gathered in the square to hear the mayor speak _____ when is started raining.	Dispel	Dissolve	Disperse	Disseminate	Disperse		
7	Vocabulary		The_____ of any eyewitness is not always reliable	Evidence	Testimony	Witness	Proof	Testimony		
8	Vocabulary		What's the_____ for the next five days?	Forecast	Foresight	Insight	Premonition	Forecast		
9	Vocabulary		His ground-breaking discovery in the field of computer science led to him being given a _____ for his research.	Donation	Compensation	Fine	Grant	Grant		
10	Vocabulary		I hate it when people put the_____ on others and don't take responsibility for their mistakes.	Pressure	Blame	Money	Encode	Blame		
11	Grammar	Passive	All the furniture ____ been removed from the living room.	was	has	is	were	has		

Availability in the app store



Appendix D

Ethics Approval

Dear Tamim,

The Chair of the Social and Behavioural Research Ethics Committee (SBREC) at Flinders University considered your response to conditional approval out of session and your project has now been granted final ethics approval. This means that you now have approval to commence your research. Your ethics final approval notice can be found below.

FINAL APPROVAL NOTICE

Project No.:	**6951**
Project Title:	Towards an effective M-learning in secondary schools in the Kingdom of Saudi Arabia
Principal Researcher:	Mr Tamim Alkhalifah
Email:	alkh0065@flinders.edu.au

Approval Date:	10 August 2015	Ethics Approval Expiry Date:	**30 January 2019**

The above proposed project has been **approved** on the basis of the information contained in the application, its attachments and the information subsequently provided

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