An Investigation of the Critical Factors for Integration of ICT in Saudi Primary Schools: A Comprehensive Exploration of Teachers', Principals' and Students' Points of View

by

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Abstract

Ongoing innovations in Information and Communication Technology (ICT) have revolutionised the knowledge sharing and learning capacities of people around the globe. The adoption of this technology within the early years of education is an important goal for many nations and can have an immense impact on the creation and sharing of knowledge, which ultimately contributes to the greater good of the society. In general, developed nations have heavily reformed the traditional education system to a more technology based education system at all levels (i.e. higher, secondary, and primary). While developing nations are trying to follow this trend, many lag behind in the successful adoption ICT in their education system. A major concern, is the lack of ICT action for the primary education level within developing nations when compared to secondary or tertiary institutions. ICT is not only important for higher education, but it is a tool to reform primary education and prepare children for the digital world. While some studies have investigated reasons for lower usage of ICT in secondary schools, a major knowledge gap remains in exploring the factors that influence the *behavioural intention* and *actual use* of ICT for Saudi primary school principals, teachers and student.

Developing countries, such as the Kingdom of Saudi Arabia (KSA), have put immense importance of ICT in education, particularly for higher education. Primary and secondary schools however have not experienced the same focus as tertiary institutions. Previous research has explored ICT in higher education, which has motivated the Saudi Ministry of Education to invest considerably in ICT for the higher education sector. However, Saudi primary schools have not received the same level of attention. It is important that research is conducted to understand the reasons behind lower adoption and use of ICT by the teachers, principals and students within primary schools.

The research has utilised a mixed method approach, with post validation of research findings. In the mixed method, both qualitative and quantitative exploration of factors have been conducted via semi-structured interviews, and questionnaires. After that, triangulation of results and literature has been conducted, along with a post validation of research findings with focus group discussion with principals, teachers and students.

The study has developed three conceptual models based on Unified theory of acceptance and use of technology (UTAUT) technology adoption model for principals, teachers and students. Using partial least square structural equation model (PLS-SEM), the models were evaluated, to find the significant factors that influence the intention and *actual use* of ICT by the three target groups (principal, teacher, and student). The analysis found, *effort expectancy*, *computer literacy* and *system quality* are common factors that influence the *behavioural intention* to use ICT for all target

groups. Furthermore, *social influence*, *facilitating conditions*, *performance expectancy* and *cultural factors* play vital roles for some groups.

The research presented here has contributed significantly in both practical and academic sectors. Several recommendations are provided for policy makers, such as to improve training and professional development, monitoring ICT usage at different levels, developing ICT infrastructure, and raising awareness. From an academic point of view, the study contributed new knowledge by exploring and documenting the factors that encourage or hinder the use of ICT by principals, teachers and students. Additionally, the use of PLS-SEM with traditional technology ICT acceptance models is a novel approach. Finally, this research added new insight about ICT usage in primary education within Islamic culture for developing nations like Saudi Arabia. The research concluded by noting the practical implications, limitations and future directions for ICT in primary education in the Kingdom of Saudi Arabia.

Declaration

I, Sami Alshmrany, certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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________________________________ December, 2017

Sami Alshmrany

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An Investigation of the Critical Factors for Integration of ICT in Saudi Primary Schools: A Comprehensive Exploration of Teachers',
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Chapter 1

Introduction

The use of information and communication technology (ICT) within education to support teaching, learning, administration and communication has seen widespread acceptance, support and innovation throughout many nations. While the use of technology within schools has become an expectation for many countries around the world the facility and functionality of such endeavours has not been realised in many developing nations. Identifying what the difficulties of adoption are remains an important step to try and determine best practices for utilising ICT within schools, especially at the primary school age education level.

This chapter outlines the approach for the research presented in this thesis. A brief background is provided to frame the importance of ICT and its use within education institutions. Following from this background section are several examples of the use of ICT in education environments. The chapter then discusses the significance of the research, objectives and research questions to be considered. A brief outline of the methodology is presented as well as an identification of limitations surrounding the research approach. Finally, the chapter is concluded with a description of the structure of the remaining thesis.

1.1 Background

Information and communication technology generally refers to the 'diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information' (Yadav, & Mehta, 2014), although the meaning is quite fluid because the components of ICT change and evolve rapidly. Information and communication technologies are part of everyday life for many people worldwide in business, social and education arenas.

ICT is pervasive across the world, particularly in the form of the mobile phone (Yadav, & Mehta, 2014). According to *eMarketer*, in 2013 there were 4.01 billon individual cell phone users in the world. In 2017, this number had risen to 4.77 billon (eMarketer, & AP., n.d.). Additionally, technological literacy has become an integral requirement for successful participation in the political, social and economic aspects of our lives. While much use of ICT is intuitive or even unconscious by design, other aspects of using technology must be learned, along with sophisticated application of the technologies for work or for pleasure. For this reason, the integration of ICT in education system activities has become a must to ensure a nation's citizens are competent with modern technology. Widespread competency and confidence leads to further advancement of the development process, such as economic progress at a national level because of greater connectivity to markets (Jin, & Cho, 2015; Wang, 1999). Social issues, communication, services, industry and education are all influenced by digital technology adoption.

In addition, investment for ICT in education can accelerate national development. Kozma (2008) has argued that investment for ICT in education supports economic growth, promotes social development, advances education reform and supports education management.

ICT cannot solve all the problems encountered in an education system, such as low literacy rates or lack of resources, but it can provide novel solutions to the *obstacles* encountered in a traditional educational system by providing a platform for new teaching methodologies and efficient administration tools (Watson, 2001; Coupe, 2004). Teachers can guide student learning in diverse subjects, arguments and theories with interactive ICT tools (Bikas, 2001; Tinio, 2002). ICT can provide an easy way to share different ideas (Capper, 2001), and offers teachers the opportunity to participate more fully in the learning process, which offers subsequent benefits to the learners (Coupe, 2004).

ICT can assist in the unification and bonding of students and schools through channels of communication, and enhance good quality learning (Braslavsky, & Fumagalli, 2004). The use of ICT offers an opportunity for children to access information in a variety of ways, organise it and construct meaning from it. Thus, ICT in education can improve individual academic performance (Skryabin, Zhang, Liu, & Zhang, 2015).

One must remain aware of the fact, however, that while introducing ICT into a system, whether it is business, education or government, sounds simple, ICT is actually a fairly new phenomenon in both society and schools, with the internet, a critical element of ICT, only becoming commercial in the 1990s and then being introduced widely into higher education. After being nurtured in universities, ICT as a teaching and learning tool is only slowly moving through the rest of the education system, in various ways, at various speeds, in various countries. Its use at the primary school level continues to lag behind its use in secondary and tertiary institutions.

The research presented in this thesis, therefore, sought to find the positive and negative factors that are influencing the adoption of ICT in Saudi Arabian primary school education as a learning or teaching tool. The use of the internet and computers, phones and tablets is becoming ubiquitous. For example, according to CITC, there were 11.5 million internet users in Saudi Arabia in 2010, whereas there were 20.8 million users by 2016. Additionally, there were 50 million mobile phone subscriptions in the year 2014, increasing to 54 million by 2015 (CITC, 2016). These figures demonstrate the increasing adoption of ICT (Alshehri & Meziane, 2017). However, the adoption of telecommunications tools is uneven, with a variety of factors determining their take up in primary schools in countries like Saudi Arabia (Almalki, & Williams, 2012; Al Mulhim, 2014).

1.2 ICT in primary education

> *Education will become the centre of the knowledge society, and the school its key institution. What knowledge must everybody have? What is 'quality' in learning and teaching? These will of necessity become central concerns of the knowledge society, and central political issues. (Drucker, 1994, p. 66)*

The importance of education for individuals and societies is well understood. A better educated civil society is more likely to be innovative and productive, healthier and wiser. For this reason, the second of the eight United Nations Millennium Development Goals (2000) was the achievement of universal primary education. Behind this goal was the belief that primary schooling would encourage young people to be open to new ideas, show creativity, develop critical thinking and absorb information for informed decision-making at later stages in life (Tuparova, Kaseva, & Tuparov, 2014; Yadav, & Mehta, 2014).

In 2000, when the millennium goals were established, ICT was only just appearing as a teaching and learning tool in the university sector in the West, where it has been maturing over the last two decades, with ideas about how to use new, digital technologies gradually filtering throughout the whole school systems. After the university sector, ICT has become of increasing importance in both the secondary and the primary sectors, and is now regarded as immensely important in primary education (Yadav, & Mehta, 2014).

ICT has been introduced in primary schools in many countries, which has led to an improvement in education, according to multiple studies (e.g., Losada-Iglesias, Correa-Gorospe, & Fernandez-Olaskoaga, 2017; Hollow, & Masperi, 2009; Wall, Higgins, & Smith, 2005; Goodison, 2002). And the use of ICT has also provided opportunities for primary school teachers to develop professionally (Chapman, 1997; Haddad, & Jurich, 2002). In the following sections, brief descriptions of the adoption of ICT in primary education in different countries, along with Saudi Arabia, are provided.

1.2.1 ICT in primary education: Europe

The European Union has shown great interest in encouraging innovation and digital skills in schools. To assist schools and universities in their delivery of high quality education and digital skills, the EU launched the *Opening up Education* website in September 2013 (Mura, & Diamantini; 2014). The Innovative Methods for Award Procedures of ICT Learning in Europe (IMAILE) project is the first project on a European level to address the promotion of ICT in the field of education and e-learning from both demand and supply sides (Bel, & Fernandez, 2014). Due to such supporting initiatives, computer numbers in European schools have doubled since 2006 (Mura, & Diamantini, 2014). However, the level of equipment does not represent the level of computer use in Europe; that is, some countries with the highest use of computer equipment were the ones with the lowest scores on equipment provision in schools (Mura, & Diamantini; 2014).

Among the factors influencing the integration of ICT in education in Europe are:

- the attitude towards the use of ICTs in education
- the teachers' level of confidence in ICT use
- the amount of technical support or training that combines ICT and pedagogical aspects, or teachers' constructivist vs. traditional educational beliefs. (Mura, & Diamantini; 2014)

In each European country different initiatives are in place to promote the use of ICT in schools (Sergis, Sholla, Zervas, & Sampson, 2014).

In the **United Kingdom**, the government spent about 2.5 billion Euros in 2008-09 on educational ICT (Buabeng-Andoh, 2012). In **Ireland**, Ireland's National Digital Strategy has promoted high speed broadband in all second level schools to support greater use of ICT in education (Devitt, Lyons, & McCoy, 2014).

In **Italy**, ICT is widespread and diffused among teachers, but the level of integration with educational practice is still too low (Mura, & Diamantini, 2014). Mura and Diamantini (2014) point out that integration can be increased by the additional training for teachers on the didactic use of ICTs and specific regulation. They also revealed that teachers' attitudes towards ICTs in education are positive, but they recognise the risks connected with students' Internet use, and generally believe that the school should take action to help the students to be safe online so that they can develop a healthy relationship with ICTs (Mura, & Diamantini; 2014). In **Cyprus**, the education system has been undergoing systematic reform efforts over the last two decades, working towards the adoption of ICT, for example, to equip all public schools with computers and provide them with access to the Internet (Vrasidas, 2015).

In **Germany**, there has been a rapid growth in the availability of computers and internet connectivity in recent years. However, there has been considerable variation between schools in terms of accessibility to the technology (Schulz-Zander, 2004). In **Bulgaria**, their approach appears to be holistic. ICT is provided as an elective subject and also used to support other school subjects. For these reasons, schools have put in place the necessary infrastructure to attract pupils and encourage their parents to choose the school. The syllabi for the elective ICT subject are outlined by The Ministry of Education, Youth and Science (MEYS) in Bulgaria, which develops an annual schedule. The pupils may express their opinion and attitude towards different topics from the school subjects and from daily life through learned ICT.

During the first year of ICT education, the focus is on the 'Computer system' and 'Information and information activities', where the pupils obtain basic knowledge about the computer system, information, skills for the use of the keyboard and mouse, and software for drawing and writing of simple texts.

In the second year, the basic topics from the first year are extended and the new topic 'Information culture' is added, where the main purpose is to provide the necessary circumstance for the implementation of ICT in other subjects. The syllabus for the third grade is extended with e-communication topics related to searching the Internet for information relevant to the topics of other school subjects, where the main focus is a combination of different types of information – images, text, audio, video, animations.

At primary level, the subject is taught one hour per week, but in some schools the hours can be extended to two hours per week. In this way, primary school students in Bulgaria are becoming competent in different aspects of electronic communication. At the secondary level, ICT is compulsory, where the syllabi are directed to mastering key digital skills and competences and the implementation of acquired skills in studying other school subjects. At this stage, pupils study ICT one hour per week (Tuparova, Kaseva, & Tuparov, 2014).

1.2.2 ICT in primary education: American region

In the **United States**, the government spent $10.7 billion for ICT in education in 2009 (Buabeng-Andoh, 2012). Moreover, the National Education Technology Plan was launched in the USA in 2010 (Goodwin, Low, Ng, Yeung, & Cai, 2015). The plan emphasises the use of technology-based learning and assessment systems to continuously monitor and improve education at all levels.

In response to local, regional and international demands and initiatives, the government of **Ecuador** has promoted an innovative program Sistema Integral de Tecnologías para la Escuela y la Comunidad (SíTEC) [Translation: Integral System Technologies for School and Community] to place ICT into the hands of students, teachers, and other educational institutions (Aruch, Loja, & Sanders, 2014). In **Uruguay**, the Plan Ceibal was imposed on the existing school infrastructure regarding how the use and upkeep of available facilities might need to be altered to accommodate the new technology. Through this plan, every public primary school child was provided with a laptop free of charge (Cardellino, & Leiringer, 2014).

1.2.3 ICT in primary education: Asian region

In **India**, the government has introduced a number of measures at both the primary and higher education levels (Gupte, 2015; Prasad, Lalitha, & Srikar, 2015). The draft education policy of 1986, which was further modified in 1992, emphasises the role of ICT in promoting economic development. Several schemes have accordingly been adopted (Gupte, 2015). In **Bangladesh**, Vision 2021: Digital Bangladesh has been adopted, setting out the agenda for ‘improving the education sector through ICT in education’, which included six focus areas:

- general and Technical and Vocational Education and Training (TVET) education systems (Haolader, Foysol, & Clement, 2017)
- the professional development of teachers using ICT
- education related citizen services
- ICT literacy for students
- ICT infrastructure and delivery channels
- ICT in the educational administration (Khalid, & Nyvang, 2014).

In **Singapore**, the Ministry of Education (MOE) introduced the third Master Plan for ICT in Education in 2008, which is one of a series of initiatives that introduce ICT into teaching and learning processes (Goodwin, Low, Ng, Yeung, & Cai, 2015).

1.2.4 ICT primary education: Saudi Arabia

In the early 1990s, the government of Saudi Arabia began to promote ICT as an important tool in education and business. At the university level, in particular, ICT was funded and vigorously supported, with adoption widely encouraged. ICT integration strategies in developed countries were copied almost directly into the Saudi tertiary system, with few contextual modifications.

ICT as a subject was introduced to Saudi special advanced secondary schools in 1985 through three subjects: an introduction to computer sciences, programming in BASIC, and systems programming and the use of information systems. Over 15 years later, in 2003, the Ministry of Education (MoE) expanded the program by introducing a computer studies curriculum into all secondary schools. The subject was compulsory, with two, one hour classes per week, whereas it had been offered as a study option in private schools for some time. The government continues to set the curriculum, the syllabus and the textbooks throughout Saudi Arabia's school system.

In order to encourage community awareness of ICT, the MoE established ICT clubs based in the secondary schools' computer labs. In 1996, 25 schools began offering services in their labs. Their role in raising technological awareness is important. They are used to educate the community and provide access to the technology outside of school hours, which eases inequality of access to technology among the students (Ibrahim, 2010). MoE policy also recognises the benefits of having computer literate teachers, and offers the teachers a number of opportunities to gain or improve their ICT skills.

Another government strategy for promoting the use of ICT in all aspects of daily life is the Home Computer Initiative (HCI) sponsored by the Communications and Information Technology Commission (CITC) (CITC, online) in association with The National Commercial Bank. The HCI is working to provide one million Saudi families the opportunity to buy new PCs in the next five years using a simple payment plan.

Furthermore, the public education curriculum has been revised and electronic devices have been introduced to facilitate teaching. Training and developmental programs have also been introduced for educators to ensure sufficient use of ICT in education. Approximately a quarter of the overall Saudi government budget for 2014 to 2016 is dedicated to the educational sector (more than $50 billion). This major fund is being used in education for developing educational institutes (i.e. Jeddah University, Hafr Al-Batin University), increasing facilities in the higher education sector and providing a relatively smaller impetus to the implementation of technology in the school curricula of the secondary and primary sectors and improving ICT facilities (Aldiab, Chowdhury, Kootsookos, & Alam, 2017; Albugami, & Ahmed, 2015).

1.3 Context of the current study

Having briefly considered ICT in primary education in several geographic regions, including Saudi Arabia, it is important to consider the larger context of primary education for the purposes of this study. In this subsection, the culture of Saudi Arabia, its society and issues of gender are discussed, including the influence of religion on culture, gender, innovation and education. Then the political and administrative context of the country are considered. After that, the evolution and implication of ICT in Saudi Arabia are discussed, including different initiatives adopted by the government to integrate and promote ICT in the nation. Afterwards, the education system in Saudi Arabia is examined, including the objectives and administration, with special emphasis on primary education.

The current situation of ICT usage and ICT implementation in Saudi education have also been presented to show the level of ICT adoption. Furthermore, Saudi VISION 2030 has been discussed to show that, in order to diversify the economy and to reduce the dependence of the country's economy on oil, the government has greatly emphasised ICT in education.

Finally, ICT in the Saudi education system is considered, including different initiatives along with their descriptions, the availability of ICT in schools and a review of the literatures on ICT in education in Saudi Arabia, with a focus on the barriers hampering the adoption of ICT in education.

1.3.1 Culture and society in the Kingdom of Saudi Arabia

As the birthplace of Islam, the country contains two of the religion's holiest sites – Mecca and Medina – and Islamic religious practice in Saudi Arabia is severe and conventional within the context of Islam (Cavendish, 2006). The government acts as the warden of Islam, and the judicial system is based on the *Shari'ah* (Islamic law). Utilising this stewardship as justification, the government allows no religious practice other than Islamic practice in public. Thus, Saudi Arabia is culturally and ethnically very homogeneous, where native Saudis are Arab Semites.

1.3.2 Political and administrative environment in the kingdom of Saudi Arabia

Saudi Arabia is an inherited kingdom headed by a king since its founding by King Abdul-Aziz Al-Saud, who is also the head of the judicial system, and commander-in-chief of the military. Thus, the king is both the ruler as well as the prime minister who is generally chosen by either a previous king or members of the royal family.

There is no written constitution in the country. By declaration in 1992, the *Qur'an* and the Sunnah [the Prophet Mohammed's (PBUH[1]) traditions] are regarded as Saudi Arabia's constitution, which has not been codified. The absence of codification creates uncertainty regarding the extent of the legislation. Royal decrees promulgated as regulations are considered the basis of the country's legislation, which govern most areas of jurisprudence that can be considered 'modern', such as intellectual property law or corporate law. Thus, regulations covering ICT are progressive, which is a positive influence for integrating ICT into education. However, the vulnerability of the law to the unpredictable interpretation of religious law creates an area of uncertainty for technology related initiatives (Saudi Embassy Washington DC, 2006; Ansary, 2008)

The Ministries Council, headed by the King, is an appointed body consisting of 22 ministers with portfolios and seven ministers of state, who serve at the discretion of the King and advise him on issues that confront the country. The Consultative Assembly is referred to as the *Majlis as-Shura* or *Shura* Council, which advises the King regarding laws and amendments. The assembly consists of 150 members divided into 12 committees, who are appointed by the king for a term of four years:

- Judicial and Islamic Affairs
- Youth, Family and Social Affairs
- Energy and Economic Affairs
- Safety Affairs
- Scientific Research and Educational Affairs
- Informational and Cultural Affairs

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[1] *Peace be upon him.*

- Foreign Affairs
- Environmental and Health Affairs
- Economic Affairs
- Information Technology, Communications and Transportation
- Water and Public Services and Facilities
- Human Resources Administration
- Petitions and Human Rights (Majlis Al-Shura, 2014).

The judicial system in Saudi Arabia is founded upon the doctrines of Islam, which is based upon *Shari'ah* (Islamic Law) as provided in the *Qur'an*, in the Sunnah, as informed by the *Ijma'* and with reference to *Qias* or analogy. The court system is hierarchical, which includes specialist courts and administrative courts. The final court of appeal is the King (Ansary, 2008). The judges must prove to be of good character and trained in Islamic law. To ensure this, relevant *Shari'ah* colleges and a dedicated Judicial Academy have been established in Saudi Arabia to train legal professionals and judges respectively.

1.3.3 ICT in the kingdom of Saudi Arabia

Despite being a deeply religious country and having religious proscription against innovation, many modern ICT practices have been adopted in Saudi Arabia due to the positive attitude of the government towards technological modernisation (Sait, Al-Tawil, & Ali, 2003). For example, in the country, the Internet was introduced in 1997, and was made available at Saudi Arabia's universities and selected government agencies in February 1999 (Al-Tawil, 2001; Alzoman, 2002). Since then, Internet use has expanded dramatically in the country, which can be demonstrated by the fact that the number of users has increased steadily, from one million (5% of the population) in 2001 to 16.5 million (55%) at the end of 2013 (CITC, 2013). Such growth is the result of government support, as well as the growth in broadband availability, increased public awareness, growth in the use of Internet enabled handheld devices, decreasing costs of personal computers and laptops, increased consumer ICT literacy, growth in Internet access, growth in the availability of local content and the growing perception of the value to individuals of using the Internet.

Since the reign of King Faisal which started in 1964, the government of Saudi Arabia has been broadly in favour of massive modernisation programs for the kingdom (William, 2015). In 1986, the King Abdul-Aziz City for Science and Technology (KACST) was chartered to support such modernisation with a mandate to 'Propose a national policy for the development of science and technology and to devise on the strategy and plans necessary to implement them' (King Abdul-Aziz City for Science and Technology, 2002). Such initiative gives clear indication of the government's contention that any attempt to modernise the kingdom must include strong support for ICT infrastructure in order to support world class industries.

The government attitude has resulted in various efforts to upgrade ICT infrastructure in Saudi Arabia, which have included:

- the launch of a long-term (2001-2010) general strategy for technology and science supported by the KACST in association with the Ministry of Economy and Planning in 2001
- the establishment of a dedicated Ministry of Communications and Information Technology (MCIT) in 2003
- the e-Government initiative in launched in 2005
- the launch of a non-subscription based dial-up service, *EasyNet*, in 2005 to enhance Internet access to an e-Awards program (CITC, 2005).

Among these initiatives, the e-Government initiative was so successful that by 2014, seven different government ministries had won international awards for their online services (MCIT, 2014).

Several other programs were launched in Saudi Arabia from time to time to enhance the mass adoption of ICT. In 2005, the Home PC Initiative was launched by the Communications and Information Technology Commission (CITC) in association with The National Commercial Bank with a view to rapidly transform Saudi society and to enhance the mass adoption of modern computing technologies in the home (http://www.citc.gov.sa/english/Pages/default.aspx). The goals of the project were:

- the transformation of the country into an information society
- improving computer skills among the population
- increasing the number of Internet users and reducing the social divide between ICT users and non-users.

To achieve these goals, one million families of Saudi Arabia were enabled to buy a new PC in simple and easy to pay installments at a monthly cost to the consumer of US$27 per computer over the span of four to five years. Thus, this program offered beginning PC users an economical set of hardware, software and online tools to help them develop both computer and online skills, which included a one year free subscription of Microsoft *Windows* and *Office Professional*, and 15 hours of free internet usage monthly, as well as free educational CDs. Additionally, training schemes were offered at very low and affordable prices.

In 2007, the Council of Ministers approved the new MCIT for a new National Communications and Information Technology Plan (NCITP), which was a 20 year meta-level plan for the ICT future of the whole of Saudi Arabia (MCIT, 2013). The plan relied on individual five year plans to move the overall vision forward. It consisted of two elements: the long-term perspective offering a vision of ICT in Saudi Arabia over the long term and the five year plans for ICT in Saudi.

Figure 2.7 shows visions of the (NCITP) including individual five year plans. The long term perspective has two components: a future vision and general objectives. The future vision is:

- to transform and transition to a knowledge and information based society, with a digital economy that would increase productivity.
- the provision of telecommunication services and IT for all segments of society in all parts of the country
- to develop strong industrial conditions by integrating ICT into the economy so that the use of ICT becomes one of the main drivers of productivity.

The general objectives are to:

- raise the productivity and efficiency of all sectors, provide services electronically for governmental, commercial and social sectors, and encourage tele-working through optimum utilisation of ICT
- organise the ICT sector fairly, creating a catalyst and attractive environment for investments
- build the ICT industry to be strongly competitive locally and internationally by means of scientific research and innovation and expansion in strategic areas, to become a major source of income
- optimise use of ICT in education and ensure training at all education levels regarding the use of ICT
- enable all segments of society in all parts of the country to deal with ICT effectively and bridge the digital divide.

- optimise use of ICT to serve national identity, national belonging and the Arabic language, and promote the message of Islam
- provide qualified and trained capabilities of males and females in various disciplines of ICT, through the concentration of national cadres, and attract global expertise.

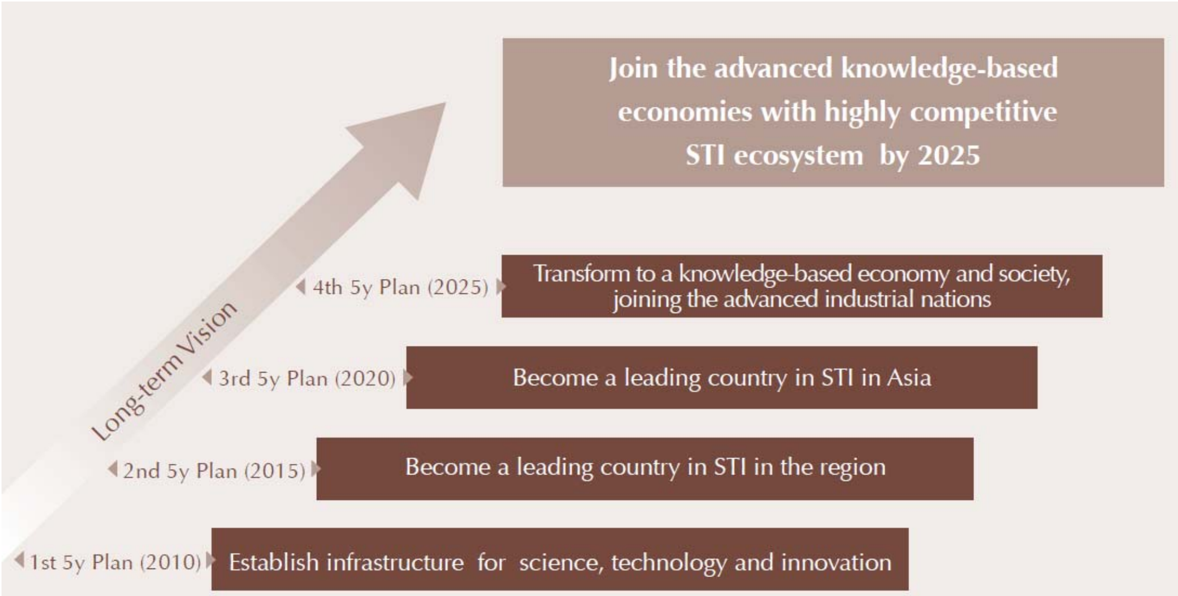


Figure 1.1 Visions of National Communications and Information Technology Plan (NCITP) (MCIT, 2013)

At present, Saudi Arabia is the Middle East's largest ICT marketplace. Overall spending in ICT has increased significantly in Saudi Arabia, which can be observed from ICT spending in 2014 which totalled SAR 111.98 billion (approximately US$30 billion) compared to SAR 21 billion in 2002. In FY 2014, Saudi Arabia's ICT expenditure included SAR 17.83 billion (approximately US$ 4.81 billion) for direct ICT investments, and SAR 4.86 billion for communication equipment (CITC, 2015). Thus, considering the long-term commitment to improving ICT infrastructure, the government has ensured double digit growth rates in expenditure year to year since 2002 (CITC, 2013).

1.3.4 The education system in the KSA

In the KSA, every education policies are subject to government control and management. The Educational Policy Document issued by the Council of Ministries provide the basic reference on the fundamentals, goals and education that should be implemented at different levels of education. According to this document, the general goals of Saudi education are:

> *To have students understand Islam in a correct and comprehensive manner; to plant and spread the Islamic creed; to provide the students with the values, teachings and ideas of Islam; to equip them with various skills and knowledge; to develop their conduct in constructive directions; to develop the society economically and culturally; and to prepare the individual to be a useful member in the building of his/her community. (Ismail, 2016, p. 21)*

Thus, the religion and culture have great influence on education in Saudi Arabia. In this case, the aims of Saudi education policies are: to make education efficient; to meet the religious, economic and social needs of the country; and to reduce illiteracy among Saudi Arabians. Thus, education is compulsory for children aged between six and 15 years in Saudi Arabia, where girls and boys are educated separately.

The education system can be divided into two broad categories: first, general education and second, higher education. General education in this country consists of three stages: six years of primary schooling, then three years of intermediate school, and finally three years of secondary or high school. The curriculum, syllabus and textbooks are provided and taught uniformly all over the country for all the stages in general education. Students going to university usually have to have four years for a Bachelor's degree in the social sciences or the arts, but often five or more years for a Bachelor's degree in other sciences, such as engineering and medicine are required. In case of Saudi Arabia, the universities and teachers' colleges provide the teachers for primary and secondary level schools.

The Ministry of Education (MoE) and the Ministry of Higher Education (MoHE) are the two administrative bodies that manage education in Saudi Arabia. Figure 2.8 shows a hierarchy of the Saudi Arabian education ministries. Although there are other government agencies with some minor responsibilities, such as text book preparation and curriculum development, these two agencies are the main service providers.

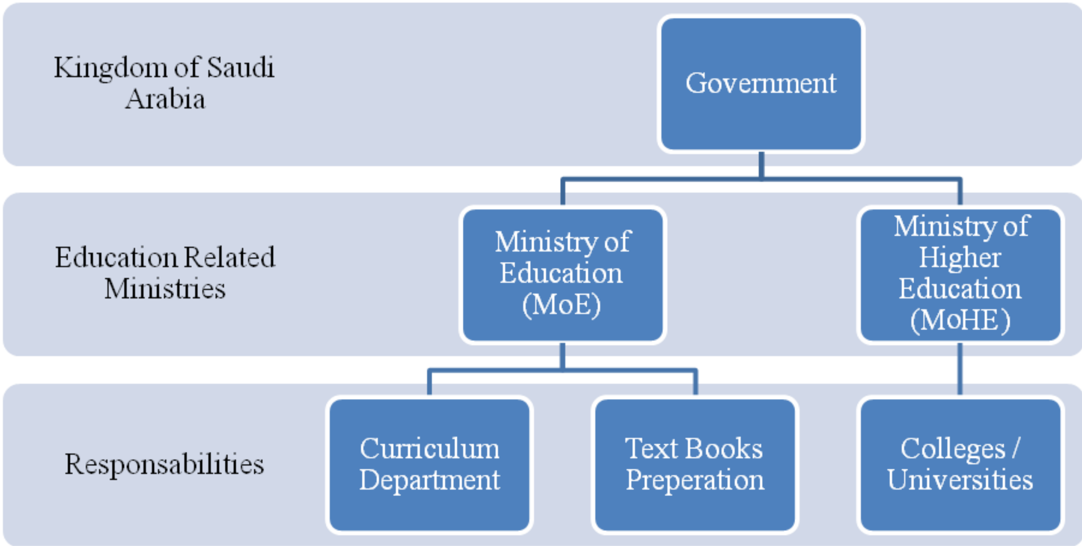


Figure 1.2 Hierarchy of Education Ministries and their responsibilities within Saudi Arabia (from Oyaid, 2009 and MoE)

The MoE was founded in 1954. The MoE is responsible for managing schools for boys and girls, including junior colleges, teacher training, as well as adult education; for the provision and the organisation of construction and maintenance of school buildings; for equipping schools; often providing materials, such as hardware and teaching materials; supplying students with textbooks; and for the country's educational policy. The MoE (through the Supervision Department) is also in charge of developing teachers and organising pedagogical programs. In addition, curriculum development for all levels of education is managed by the Curricula Development Department and the text books are prepared by the Text Book Preparation Department.

The Ministry of Higher Education (MoHE) was established in 1975. It is responsible for supervising all aspects of higher education learning in Saudi Arabia. The MoHE provides and manages scholarships, international and national academic relations, and educational offices abroad. Additionally, the Higher Education Council is responsible for issues related to higher education in Saudi Arabia.

This research focuses on primary education in Saudi Arabia. So, here the discussion is elaborated focusing on the primary education system. Children enter primary school at the age of six in Saudi Arabia, and primary schooling lasts for six years. The net enrolment rate in primary education in 2014 reached 96.42%, which included 94.89% of female children and 97.87% of male children. Moreover, the completion rate in primary education in 2014 reached 110.89% including both over-age and under-age students, which includes 108.55% of female students and 113.14% of male students. (In this case, the rate can possibly exceed 100%, as often over-aged and under-aged students are included because of early or late school entrance, as well as grade repetition) (The World Bank Group, 2015).

The main objectives of primary education are:

- instilling the basic and actual Islamic belief and creed in the spirit at an early age, as well as developing and delivering comprehensive Islamic lessons and creating the state of mind that reflects Islamic ideas
- prepare children with basic skills in the area of language (e.g., English, Arabic), basic numeracy and physical skills
- evolving a state of mind to accept responsibility, to understand the rights of Islam and the state, as well as their duties within the limits of the children's ages
- crafting the mind of the children to have passion and desire to learn new things, and preparing them for useful work and training them to make use of their time.

The subjects emphasised at this stage are religious studies, Arabic, general culture and science. In the evaluation process, often examination-based educational evaluation methods are used. In this case, children are promoted from one grade to the next if they pass an examination at the end of the academic year. At the end of grade six, the students passing the Elementary Education Certificate following a final exam are considered qualified for secondary education.

1.3.5 ICT in the Saudi education system

In Saudi Arabia, ICT is perceived to be an important tool for improving performance, collaboration, learning experience and learning outcomes (Albugami, & Ahmed, 2015). Saudi students also have positive attitudes towards ICT for having a positive effect on their learning (Oyaid, 2009). Though Saudi Arabia does not have effective ICT programs like developed nations, the government is making efforts to improve the whole educational system, especially in terms of using ICT (Al Sulaimani, 2010; Al Mulhim, 2013; Alzahrani, 2017). The country has a relatively short involvement with ICT usage in education, as it was only introduced into education after several previous calls for the improvement and reform of education. It was officially implemented throughout secondary schools less than a decade ago (year 2007). In the rush to catch up with developed countries, Saudi policy makers introduced ICT related policies, borrowing from developed countries without any major contextual modification to fit Saudi Arabia. As discussed earlier in sections related to Saudi politics and law, as well as Islamic culture, Saudi Arabia does not resemble Western countries. Cultural beliefs and social values are different in Saudi Arabia, and without modifications of a technology to match the social and cultural values, it is difficult to get a technology widely adopted and put to the same use as in the developed nations.

Initiatives to integrate ICT in education. The future of ICT in Saudi education is promising since raising ICT awareness and promoting ICT usage in all aspects of daily life, including education, is now a national policy rather than an educational one only.

Integration of ICT in the curriculum. Initially the government introduced ICT into the Saudi education system in order to integrate ICT related subjects into the curriculum. In 1985, ICT was introduced to Saudi special advanced secondary schools by way of three subjects. These subjects are: An Introduction to Computer Sciences, Programming in BASIC, and Systems Programming and The Use of Information Systems. These subjects were successfully implemented and that encouraged the MoE to introduce computer studies into the curriculum in secondary schools for both boys and girls. These were two hour classes which were taught two days per week (Oyaid, 2009).

Afterward, ICT was introduced as a mandatory subject to girls' schools to promote girls advancement, and to the primary level of education in the 2003 academic year. It should be carefully considered that computer studies already existed in the curriculum of some private schools at both primary and secondary stages as an optional subject, where the students are often taught what a computer is, computer history and how they can be used in daily life. No detailed computer-oriented training nor the use of any new technologies are undertaken. Since 1999, the subjects being taught in primary education are: Information Technology, Computer Science, Computer Applications, Information Systems, and the Information Age. Later on, ICT was integrated in the teaching and learning of many subjects in the curriculum (Al-Madani, & Allaafiajiy, 2014; Oyaid, 2009).

The National Project (Watani). The National Project (*Watani*) was launched in 2000 aimed to furthering the usage of computers as an educational technology as clarified in the following quotation taken from its website (http://www.wataninet.com/):

> *The Schools' Net Project will connect all Saudi Schools and Educational Directorate Districts by means of a wide area network covering the entire kingdom of Saudi Arabia and local area networks within every educational directorate and school. The Schools' Net Project will provide every student, teacher, parent and educator with a multitude of services and a huge source of reference information. The services of Schools' Net project include (but are not limited to) the curricula of all courses, references of educational material, e-books and more, Teachers' Guides, services for students and other users with special needs, course syllabuses, interactive multimedia, teacher training, school management systems, web design tools for schools, e-mail, chatting, announcements, Internet links, a students' magazine, a teachers' magazine, educational statistics, students' training, students' sites, information technology skills for all, and a Q&A bank. These contents and applications will be mostly in Arabic. The first phase of the School's Net Project will provide one million students with their IT requirements in a ratio of one PC to ten students. (Oyaid, 2009, p. 24)*

As mentioned on the *Watani* website, there are six objectives for this project:

The first objective is to cultivate the skills of the students by widely using information technology (IT) in education to ensure that students are prepared for the future. The second objective is to enhance the teachers' capabilities by engaging information technology in all educational actions and practices. The third objective is the provision of an advanced environment, scientific content and directional education base for both the students and teachers. The fourth objective aims to increase the product of the educational process, by means of graduating exceptional generations of students who have advanced capabilities to use ICT for everyday purposes. The fifth objective is to contribute in the formation of a cutting-edge IT industry in Saudi Arabia. Finally, the sixth objective is to formulate an inclusive mindfulness among the general population regarding the benefits of employing IT in education and publicising knowledge of IT all the way through the society (Al-Madani, & Allaafiaji, 2014; Al-Maini, 2013; Oyaid, 2009).

Ten-year Strategic Plan (from 2004 to 2014). As a result of the MoE's focus on improving and developing ICT infrastructure and employing it in education, a number of initiatives were undertaken by the MoE. Significant among them is the Ten Year Plan. The Ten-year Strategic Plan (from 2004 to 2014) issued by the MoE in Saudi Arabia aims to progress and grow numerous aspects of the Saudi educational system, based on an increase of ICT in education at different levels (Maroun, Samman, Moujaes, & Abouchakra, 2008). In order to achieve this goal, the MoE has initiated several projects that focus on the use of new technologies in classrooms by building strong ICT infrastructure in all schools, including learning resources centres (LRCs), computer labs, and digital technology centres (DTCs). School libraries have been converted to LRCs containing ICT resources both in print and non-print forms and integrating them into the educational sector to create an environment for the use of advanced learning systems (Oyaid, 2009; Alenezi, 2017).

Computer labs have been introduced into a few secondary schools and limited numbers of primary schools in order to provide students some practical experience through hands-on activities. This represents a constructive modification from traditional educational approaches. In the traditional system the students depend on the memorisation of study materials, whereas in the more modern ICT-oriented schools, students are provided with the chance to learn via experimentation and investigation. DTCs have been established in different educational regions of the kingdom with the aim of meeting the educational requirements in the area of digital content and application of ICT in education (Alenezi, 2017). These centres are equipped with a unit for the production of digital interactive educational aids to support school curricula (Albugami, & Ahmed, 2015).

Integration of ICT in public education. The Saudi government has also made investment very significantly in public education, investing approximately £2bn in reforming and enhancing education by means of modern technologies since 2007, an aspect of the pioneer *Tatweer* Project, which has integrated ICT in a few secondary schools (Alenezi, 2015). Additionally, the public education curriculum has been revised and electronic devices have been introduced to facilitate teaching. Training and developmental programs have also been introduced for educators to guarantee adequate application of ICT in schools (Oyaid, 2009). Furthermore, Figure 1.3 illustrates the budget allocation from 2014-2016, and there was a growing trend toward high government expenditure in the education sector, as evidenced in the yearly budget after adjusting for yearly inflation rate (Statistical Yearbook, 2015) . This indicates that the government is determined to enhance public education, and ICT is one of the prime tools (Aldiab, Chowdhury, Kootsookos, & Alam, 2017).

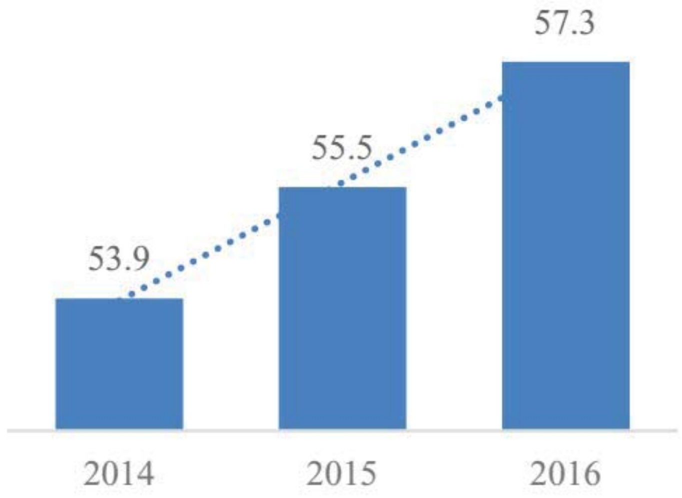


Figure 1.3 Government spending on education in Saudi Arabia from 2014-2016 in billions of US dollars (Aldiab et al., 2017, p. 578)

About 25% of the Saudi government budget for the year 2015 was allocated to the educational sector (more than £36 billion), which continued the trend of funding education very well in order to integrate the use of technology into the school curriculum and improve ICT facilities (Albugami, & Ahmed, 2015).

Teachers' technical development initiatives. Saudi ICT educational policy started to provide attention to teachers' training in ICT facilities, as better trained teachers can provide students with a number of chances to increase or improve their ICT skills. Various computer training programs have been organised for both teachers and students, although they are mostly aimed at students at secondary school (Oyaid, 2009; Al Mulhim, 2014).

The Jehazi Project (2006) is a scheme operated by the MoE that aimed to increase ICT awareness among the teachers in the kingdom. It also empowers teachers to own their personal laptop and other ICT equipment (e.g., printers and scanners) at affordable prices, with no deposit, and easy to pay settlements (Al-Asmari, & Rabb Khan, 2014). The Jehazi Project has three main objectives:

- *to raise technological awareness among Saudi teachers*
- *to increase the number of teachers trained to use ICT*
- *to increase the number of Internet users among teachers and prepare them to make use of electronic government applications*. (Oyaid, 2009, p. 25)

The main benefit of this scheme is that is provides basic computational devices, such as laptops and desktops, along with flash drives, optical mice, and a free subscription to the Internet for one year. Free basic training is also included at the New Horizon Computer Training Centre for six hours, as well as free training to attain an international computer driving license (ICDL) (Oyaid, 2009; Ageel, 2011). Although the Jehazi Project was available over many years, current reviews of the situation in Saudi Arabia have shown that teachers lack ICT equipment and training (Al Mulhim, 2014). Thus, new initiatives are required to advance the current level of ICT competence among teachers.

Community's technical development through ICT clubs. The MoE considers students and teachers to be their main stakeholders and focus on their development. In addition, the Ministry supports ICT clubs in different regions and cities. Initially, 25 school clubs based in secondary schools' computer labs were supported by the MoE. The clubs broaden the use of the existing computers and the latest technology in the labs. Community based PC labs are a new idea in Saudi Arabia and they have helped to raise ICT awareness in the community by providing access to the technical equipment and affordable training courses (Oyaid, 2009). As has been common in the history of new ideas in Saudi Arabia, the club initiative was taken at a micro scale and not widely implemented throughout the kingdom.

Saudi VISION 2030. Saudi Arabia. the heart of the Arab and Islamic worlds, the investment powerhouse, and the hub connecting three continents (VISION 2030, 2017a). Saudi VISION, 2030 is a transformation guideline for Saudi Arabia, where the main goal is to transform to a knowledge based economy from an oil based economy (Nurunnabi, 2017). There are aims to be at the heart of the Arab and Islamic worlds, maintaining strong Islamic beliefs and support, and becoming an investment powerhouse through diversification, as well as a global hub by connecting three continents (VISION 2030, 2017a). This vision includes many initiatives in the areas of education and ICT.

The National Transformation Program 2020 (*NTP 2020*). The government has focused on investing in primary education improvements as part of its efforts to achieve the wider VISION 2030 (VISION 2030, 2017b). As part of achieving the vision, projects have been developed and funded. The National Transformation Program 2020 includes several projects concentrated particularly on primary education, ICT improvements and teacher capacity building. These are, *Shifting to digital education to support student and teacher progress; Fund: 1,600,000 thousand SAR*

Improving the quality of primary education; Fund: 250,000 thousand SAR

Continuing professional development for teachers and educational leaders; Fund: 2,000,000 thousand SAR

Community clubs' entertainment and educational programs; Fund: 2,017,632 thousand SAR (VISION 2030, 2017b, pp. 100-101)

These programs are being allocated funds and are intended to take place within the five fiscal years from 2015-2021. However, the details of these projects have been unavailable. It is not known how these projects were designed, or how their success in terms of digital education, professional development and improving the quality of primary education in Saudi Arabia will be measured.

The research described in this thesis has the potential to help formulate, implement and assess projects offered as part of NTP 2020 and VISION 2030. All these initiatives, such as adding ICT learning to the curriculum, the *Watani* Project, the Ten Year Strategic Plan, the *Tatweer* Project, VISION 2030, and NTP 2020 show the growing interest of Saudi authority in ICT in education at levels below the university level. It is likely that in the near future ICT implementation at the primary level will be of major interest, for which information regarding the acceptance of ICT by students, teachers and others might be crucial to take informed and successful decisions.

1.3.6 Availability of ICT in schools

At present nearly all young children are enrolled in primary education. In 2012, the gross enrolment rate in primary education reached 103%, including both over-age and under-age students (gross enrolment rate can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition) (The World Bank Group, 2012). Political liberalisation for women has resulted in the increased involvement of women in education and work outside the home.

Regardless of goodwill and enormous resources provided by the Saudi government to incorporate ICT in education, several barriers are making it difficult (Al Sulaimani, 2010). Despite having considerable funding, there is still a real gap between the availability and accessibility of ICT facilities in Saudi primary schools and the desire to integrate ICT into primary schools and reform the pedagogical process. There remains a lack of access to technology, a lack of hardware and the unavailability of Internet access (Alwani, & Soomro, 2010; Al Mulhim, 2014; Albugami, & Ahmed, 2015).

The reason for these gaps is a lack of a clear strategic framework directed at ensuring all necessary ICT resources are made available in education (Alwani, & Soomro, 2010; Albugami, & Ahmed, 2015). Saudi teachers from different levels, who are a priority for the MoE, lack most of the minimum skills for using ICT in the teaching process (Hew, & Brush 2007; Alsahli, 2012; Al Mulhim, 2013). Overall, the use of ICT in the schools of the kingdom, especially secondary schools, is very low (Hew, & Brush 2007; Alotaibi, 2011; Alkanani, 2012; Alsahli, 2012). Saudi teachers at all stages lack effective training and skills in the area of ICT (Alkanani, 2012; Alsahli, 2012; Al Mulhim, 2014; Albugami, & Ahmed, 2015).

It is believed that by introducing ICT in early education, students will become more proficient and confident with these tools and this will translate into a deeper penetration of ICT in the education sector. This will also set the students up for continued, confident use throughout the rest of their education through secondary and tertiary institutions. So, at primary level education, ICT has become immensely important. Despite such importance, integration of ICT in primary schools has been largely ignored by the MoE in Saudi Arabia (Al Mulhim, 2013).

Teachers in Saudi Arabian primary schools suffer from lack of ICT knowledge and experience, and still lack even the basic technical and pedagogical skills that would enable them to use technology in teaching (Al Mulhim, 2013; Albugami, & Ahmed, 2015). Their current use of technology is also very low (Al Mulhim, 2013). Therefore, innovative, flexible and efficient strategies are crucial for encouraging and improving the practice of ICT use in the Saudi primary school system (Almalki, & Williams, 2012).

1.3.7 Saudi studies on ICT in education

Several studies have been undertaken in Saudi Arabia to understand the adoption of ICT in education. Al-Zahrani (2015) aimed to comprehend the level of technology incorporation in the Saudi pre-service teacher education curriculum. Alwani and Soomro, (2010) explored the barriers to the use of ICT in science education at the Yanbu school district in Saudi Arabia, where they found that ICT infrastructure and resources, as well as school policy and support, science teachers' personal beliefs, and staff development greatly limited the use of ICT in the teaching process.

Al Mulhim (2014) studied the barriers to the use of ICT in teaching in Saudi Arabia on the basis of studies from various regions of the world, while focussing on Saudi Arabia, where the researcher noted barriers, such as, the lack of access to technology, lack of training and lack of time. Amoudi and Sulaymani, (2014) studied the integration of technology in education for girls in Saudi Arabia, including the challenges and benefits of implementing ICT systems. The main challenges they found were the unavailability of resources and cultural factors that do not give importance to girls' education.

The Saudi studies related to ICT in education have mainly been carried out for higher education. Hend (2010), Al-Khalifa (2010), Alkhalaf, Nguyen and Drew (2010), and Ibrahim (2010), studied and assessed e-learning and ICT incorporation in Saudi colleges and universities. Al-Harbi (2011), Alfahad (2012), and Asiri, Mahmud, Bakar, & bin Mohd Ayub (2012) studied the potential and effectiveness, as well as the factors and challenges influencing the use of e-learning and information technology in higher education in Saudi Arabia.

Asiri, Mahmud, Bakar, & bin Mohd Ayub, (2012) found some internal and external factors influencing the use of e-learning and information technology in higher education in Saudi Arabia, where internal variables consisted of attitudes toward the use of technology, along with beliefs about e-learning and capability level., External variables included the *obstacles* faced by faculty members and demographic factors. Ageel (2011) and Alkhalaf, Drew, AlGhamdi, and Alfarraj (2012) studied ICT adoption by university teachers in Saudi Arabia. Ageel (2011) found that majority of teachers chose not to make use of ICT in their teaching because they thought that ICT would hinder the teaching process.

Many were unwilling to change long-standing teaching methods, whereas many teachers want to use more ICT in their teaching, but require more training. Alkhalaf et al. (2012) found that, university teachers show positive attitudes towards e-learning systems in higher education, and regard ICT as a tool to help faculty members improve their job performance, and educational organisations to provide better and new products and services to users.

Alenezi, Karim, Malek, and Veloo, (2010), Al-Harbi (2011), and Nassuora (2012) studied ICT adoption by higher education students in Saudi Arabia. Alenezi et al. (2010) investigated the role of enjoyment, *computer literacy*, computer anxiety and Internet experience in encouraging students' to use e-learning in Saudi governmental universities, where the results showed that computer familiarity, computer anxiety and enjoyment significantly influenced the students' intention to use technology. The Internet experience turned out to be insignificant.

Additionally, the results confirmed the importance of the relation between *behavioural intention* and perceived ease of use, as well as the perceived usefulness of using ICT by the students, which was mediated by their attitude toward using ICT facilities. Al-Harbi (2011) found that attitudes toward e-learning, perceived behavioural control, subjective norms, as well as ICT system attributes, were critical elements of students' intention to use ICT and e-learning in Saudi tertiary education. Nassuora (2012) revealed that the acceptance level of students for e-learning is high.

Several studies have also been carried out in Saudi Arabia related to ICT in secondary education. Alshmrany and Wilkinson (2014) evaluated ICT use in Saudi Arabian secondary schools. Al-Sulaimani (2010) studied the prominence of teachers in implementing and integrating ICT into teaching in secondary schools in the kingdom. Alotaibi (2011) studied the authenticity of the usage of educational technology in teaching science curricula at the secondary stage as perceived by female teachers. Alkanani (2012) studied the reality and the obstructions to using ICT in teaching social subjects in intermediate stage in boys' schools in the Kingdom of Saudi Arabia.

Alsahli (2012) studied the ICT training needs of geography teachers in the secondary stage. Albugami and Ahmed (2015) investigated the success factors for ICT implementation and integration in Saudi secondary schools from the viewpoint of ICT directors, head teachers (Principals), teachers and students, where the outcomes illustrated that ICT was perceived to be vital in enhancing performance, effective collaboration, learning involvement and learning outcomes. However, the challenges affecting the application of ICT in Saudi schools included a lack of space, resources, maintenance, a lack of ICT skills among school staff, along with a lack of clear ICT policies at different levels of education (mostly secondary or higher education).

Oyaid (2009) studied the education policy in Saudi Arabia and its relation to secondary school teachers' ICT use, perceptions, and views of the future of ICT in education, and then in 2010 considered secondary students' perceptions of information and communication technology and its usage inside and outside of school in Riyadh City, Saudi Arabia.

Few studies in Saudi Arabia have focused on ICT in primary education. Alhawiti (2013) studied the policies and action plans for incorporating ICT into Saudi elementary school curriculum. Bingimlas (2010) evaluated the quality of science teachers' practices in ICT-supported learning and teaching environments in Saudi primary schools. Al Mulhim (2013) studied the current use of ICT by novice female teachers in Saudi primary schools and their perceived training needs.

Almalki and Williams (2012), as well as Al-Rashed (2002) found three types of barriers affect the application and implementation of ICT in the kingdom of Saudi Arabia's primary school sector – lack of teacher confidence, lack of teacher competence, negative attitudes (the teacher factor), insufficient time, absence of efficient training, lack of local technical support, leadership barrier (school or institution factor), and local culture, lack of funding support; and lack of appropriate planning (extrinsic factor). Based on these findings, the researchers proposed some strategies to improve the usage of ICT in the primary school sector.

The majority of these studies has been concentrated on the areas of higher or secondary education. It can be argued that at the university level, ICT is already widely implemented, and its use is improving at the secondary level. The primary level, which is considered the foundation of education, is still lagging behind and despite the NTP 2020 offering funding for the improvement of primary education, there is no clear indication of how to secure the desired outcomes. Additionally, little information, exploration or studies have been conducted to understand the potential, the prospects and the challenges of implementing and integrating ICT at the primary level in Saudi Arabia. Therefore, the current study begins to fill this gap in our knowledge and aid decision makers to take informed decisions that can lead to the successful implementation of ICT at the primary level and help to positively reform Saudi primary education, moving it toward the modernity and future the Saudi government is seeking.

1.4 Significance of the study

Saudi Arabia is moving towards economic and social reform, with a goal of broadening the base of its economy by the year 2030. Writing in policy statements such as VISION 2030 and National Transformation Program 2020, the government has explained the steps it will take to transform its oil-reliant economy to a knowledge economy. In this vision, ICT and education are key players in the effort to improve existing human capital, lower unemployment and strengthen social security (Nurunnabi, 2017).

1.4.1 The reluctance to adopt ICT as a teaching tool

Secondary educational institutions and universities are critical to Saudi plans for the future, and the government has invested heavily in developing the education system. ICT was introduced into secondary education after numerous calls for the development and reform of education., but was officially implemented throughout secondary schools less than a decade ago. In the rush to catch up with developed countries, the Saudi policy makers introduced ICT related policies, borrowing from the developed countries without any contextual modification. This has resulted in the unsuccessful attempt to integrate ICT into the secondary school system as a teaching tool. The Saudi context is has proved too different, particularly cultural and social views regarding the use of ICT (Albugami, & Ahmed, 2015; Almalki, & Williams, 2012; Al Sulaimani, 2010).

Furthermore, in spite of considerable spending and support by the Saudi government for the incorporation of ICT into education, barriers, such as the lack of familiarity with ICT and inadequate training and facilities, have made it difficult to successfully implement ICT at all educational levels (Al Sulaimani, 2010). Schools are consistently faced with a lack of access to technology, lack of hardware and the lack of access to the Internet (Alwani, & Soomro, 2010; Al Mulhim, 2014; Albugami, & Ahmed, 2015). The use of ICT in Saudi Arabian schools, especially secondary schools is very low, and at primary level is nearly non-existent (Hew, & Brush 2007; Alotaibi, 2011; Alkanani, 2012; Alsahli, 2012). Furthermore, there is no organised or consistent training at any level, as has been observed by a number of researchers in the field (e.g., Hew, & Brush 2007; Alwani, & Soomro, 2010; Alkanani, 2012; Alsahli, 2012; Al Mulhim, 2014; Albugami, & Ahmed, 2015).

In terms of the focus of the current research, little attention has been directed at all toward primary education and its use of ICT (Nurunnabi, 2017; Aldiab, Chowdhury, Kootsookos, & Alam, 2017). It is obvious, however, that to achieve a knowledge economy, improvements in education should begin at its base – the primary sector. There existed, therefore, a need to be informed by greater knowledge of Saudi users of the technology, as well as the theories of technological adoption, and how they might assist in appreciating the reasons for technology adoption or rejection. With this knowledge, more successful strategies for promoting technology adoption might be developed by the MoE.

1.4.2 New strategies needed to deal with the complexity of ICT adoption

Integration of ICT in primary education has been largely ignored by the MoE in Saudi Arabia (Al Mulhim, 2013), and at the time that this study was undertaken, no clear data or research existed to explain what the students and teachers at primary level actually think about ICT as a tool for learning and teaching, what factors need to be considered for successful integration of ICT, and what programs need to be formulated to increase the digital literacy of teachers and students at the primary level, meaning that research such as that reported here and in the two current papers is clearly required.

The current research made it clear that, although the government is making efforts to improve the whole education system, Saudi Arabia has a relatively short experience with ICT use in the field of education, and most of the experiences are limited to major universities (Almalki, & Williams, 2012). The lack of a clear picture of the attitudes of principals, teachers and students towards the use of ICT in a primary school context has made it difficult to formulate ICT strategies for primary level education. Thus this early stage of education is lagging behind in progress towards VISION 2030, which should be a major concern for policy makers.

The research findings for this study capture the lack of a clear strategic framework for introducing ICT into education and the insufficient understanding of these technologies as educational tools by users, in particular in primary education (Alwani, & Soomro, 2010; Albugami, & Ahmed, 2015). Saudi teachers at all levels, including secondary teachers, who are the priority for the Ministry of Education (MoE), lack most of the basic skills for using ICT in teaching, or lack support from their administrations (Hew, & Brush 2007; Alsahli, 2012; Al Mulhim, 2013).

A negative attitude and intention to use ICT would be the logical result of this situation, and the attitudes of teachers, students and administrators need further probing. The data, as reported here and in the two early papers related to the study, indicate that attitudes towards the uptake of ICT in primary schools are ambivalent, but not negative on the whole. It is believed that by introducing ICT in the early stages of education (i.e., primary school), students will become more proficient and confident with these tools and this will translate into a deeper education through access to wider resources. The hope is that this would set the students up for continued, confident use throughout the rest of their education through secondary and tertiary institutions.

The findings from this study indicate, however, that the integration of technology into a curriculum is complex, depending on many interlinking variables, such as teachers' knowledge and skills and attitude to ICT, students' attitudes and aptitudes, the adequacy of ICT infrastructure, curriculum strategies, and school management's attitude (Al Sulaimani, 2010; Almalki, & Williams, 2012). By seeking to discover the attitudes and ideas of the individuals working and studying in the most basic level of the educational system, studies such as this could help guide the Saudi government to meaningful programs and outcomes by finding out more about the subtle motivators that result in ICT uptake as an educational tool and not communication devices only.

1.4.3 Studies of factors influencing ICT adoption

Several studies have been undertaken worldwide with a focus of finding out the positive and negative factors affecting the adoption of ICT in education. These studies are summarised in Table 1.1.

Table 1.1 Studies related to the positive and negative factors influencing the adoption of ICT in education internationally, categorised by the a) researchers' emphases, b) by country and c) in Saudi Arabia

a) Studies organised based on the researchers' special interests.	
ICT adoption in education from a general point of view	Somekh, 2008; Tondeur et al., 2008a; Afshari et al., 2009; Bingimlas, 2009; Agyei, & Voogt, 2014; Yadav, & Mehta; 2014.
ICT adoption in school education	Jimoyiannis, & Komis, 2007; Law, & Chow, 2008; Tondeur et al., 2008b; Kebritchi, 2010; Buabeng-Andoh, 2012; De Grove, Bourgonjon, & Van Looy, 2012; Aldunate, & Nussbaum, 2013; Kreijns et al., 2013; Albion et al., 2015,
ICT adoption in primary education	Hermans et al., 2008
ICT adoption in higher education	Keengwe, Kidd, & Kyei-Blankson, 2009; Dawson, Heathcote, & Poole, 2010; Abu-Al-Aish, & Love, 2013; Mac Callum, & Jeffrey, 2013
factors influencing students and teachers	Dawson, Heathcote, & Poole, 2010; Abu-Al-Aish, & Love, 2013; Mac Callum, & Jeffrey, 2013 Cox, Cox, & Preston, 1999; Jimoyiannis, & Komis, 2007; Hermans et al., 2008; Law, & Chow, 2008; Somekh, 2008; Tondeur et al., 2008b; Afshari et al., 2009; Aldunate, & Nussbaum, 2013; Kreijns et al., 2013; Agyei, & Voogt, 2014; Albion et al., 2015
perspectives of both principals and teachers	Tondeur et al., 2008a

b)	Studies that have been conducted on ICT adoption in education in specific countries.
influential factors in general	*Turkey* Usun, 2004; Tezci, 2011 *Bangladesh* Khan et al., 2012 *India* Sooryanarayan, Gupta, & Rekha, 2014 *Taiwan* Chuang, Weng, & Huang, 2015 *Korea* Baek, Jung, & Kim, 2008
factors influencing ICT adoption in school education	*USA* Chen, 2010 *Singapore* Teo, 2011 *South Africa* Cassim, & Obono, 2011, etc.
ICT adoption in primary education	*Belgium* Tondeur, Van Braak, & Valcke, 2007; Tondeur, Valcke, & Van Braak, 2008; Vanderlinde, & Van Braak, 2011 *China* Sang et al., 2011 *Korea* Shin, 2014, etc.
ICT adoption in secondary education	*Belgium* van Braak, 2001; De Smet et al., 2012 *China* Gu, Zhu, & Guo, 2013 *Kenya* Chege, 2014 *Finland* Hamari, & Nousiainen, 2015 *Ghana* Buabeng-Andoh, 2015, etc.
higher education	*USA* Lin, Huang, & Chen, 2014 *Spain* Iniesta-Bonillo et al., 2013 *Nigeria* Aladesote et al., 2014 *Turkey* Usluel et al., 2008 *Oman* Al-Senaidi et al., 2009 *Kenya* Macharia, & Pelser, 2014
students' perspective	*Spain* Iniesta-Bonillo et al., 2013 *Ghana* Buabeng-Andoh, 2015
teachers' perspective	*USA* Chen, 2010; Lin, Huang, & Chen, 2014, Belgium Van Braak, 2001; Tondeur, Valcke, & Van Braak, 2008; Vanderlinde, & Van Braak, 2011; De Smet et al., 2012 *Finland* Hamari, & Nousiainen, 2015 *Oman* Al-Senaidi, Lin, & Poirot, 2009 *China Sang et al., 2011* *Korea Baek et al., 2008; Shin, 2014* *Taiwan* Chuang, Weng, & Huang, 2015 *Singapore* Teo, 2011 *Turkey* Tezci, 2011 *South Africa* Cassim, & Obono, 2011
both students' and teachers' perspective	*China* Sang et al., 2010; Gu et al., 2013
both principals' and teachers' perspective	*Kenya* Chege, 2014

c) Several studies have also been undertaken in Saudi Arabia with a focus on finding out the positive and negative factors affecting the adoption of ICT in education.	
factors influencing ICT adoption in school education	Alwani, & Soomro 2010
factors influencing ICT adoption in primary education	Bingimlas, 2010; Almalki, & Williams, 2012; Al Mulhim, 2013; Alhawiti, 2013,
factors influencing ICT in secondary education	Al-Sulaimani, 2010; Oyaid, 2010; Alkanani, 2012; Alsahli, 2012; Albugami , and Ahmed, 2015 or higher education Alenezi et al., 2010; Alkhalaf, Nguyen, & Drew, 2010; Al-Khalifa, 2010; Ageel, 2011; Alfahad, 2012; Alkhalaf et al., 2012; Nassuora, 2012.
factors influencing ICT from the students' perspective	Alenezi et al., 2010; Oyaid, 2010; Nassuora, 2012,
factors influencing ICT from the teachers' perspective	Al-Sulaimani, 2010; Alwani and Soomro, 2010; Bingimlas, 2010; Ageel, 2011; Alotaibi, 2011; Alkanani, 2012; Alkhalaf et al., 2012; Alsahli, 2012; Alhawiti, 2013; Al Mulhim, 2013; Al Mulhim, 2014 perspectives.
factors for ICT implementation in Saudi secondary schools from the perspective of ICT directors, head teachers, teachers and students	Albugami , & Ahmed 2015

Analysis of relevant studies investigating factors for ICT implementation in education in Saudi Arabia revealed that most studies concentrated on ICT implementation in secondary and higher education. They tended to focus on barriers from the teachers' point of view. The very important educational level of the primary school – which underpins the higher levels – thus requires an investigation of the positive and negative factors affecting the adoption of ICT at the primary level from principals', teachers', and students' points of view. Greater emphasis on the first level of education could have a far reaching impact on the future studies and study methods of young students entering the education system in Saudi Arabia, helping to shape the way ICT is implemented at the very root of the education system.

1.5 Research objectives and research questions

1.5.1 Aims and objectives

The gap in the literature regarding the use of ICT in Saudi primary schools, and the existing problems, such as the lack of knowledge about the factors that have a positive or negative impact on ICT users and the inconsistent ICT strategy formulation, motivated this research. The aim of this research was to: *investigate the factors that have positive or negative impact on the adoption of ICT facilities at Saudi Arabian primary schools from principals', teachers', and students' points of view.*

The study specifically focussed on a number of randomly determined primary schools from specific cities within Saudi Arabia to examine a snapshot of the current situation of ICT facilities in the primary schools in Saudi Arabia. The study investigated the factors which encourage or discourage the principals, teachers, and students to use ICT facilities, such as computers, and internet availability in their schools and classrooms.

In addition, the study sought to identify strategies for emphasising the positive factors and for eliminating the negative factors influencing the adoption of ICT in Saudi primary education. The objectives of this study were to:

- identify the provision of current ICT facilities, and their usage in the Saudi Arabian primary school education system
- explore the factors that impact positively (potentials) or negatively (challenges) on the use of ICT by principals, teachers, and students in Saudi Arabian primary schools
- identify and suggest strategies in order to overcome the challenges and provide guidelines for the improvement of ICT usage in Saudi Primary schools.

Based on these objectives, answers were sought to the following questions. The objectives guided the overall research process and led towards achieving the aim of the research as a whole.

1.5.2 Research questions

In order to achieve the research aim, a broad research question was developed. The study investigated the question:

What are the prime factors that influence (positively or negatively) the use of ICT facilities in Saudi primary schools by the principals (headmasters), teachers and students?

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

RQ1: *What is the current condition of ICT facilities in Saudi education system?*

RQ2: *What is the current situation of ICT facilities and ICT use in Saudi primary schools?*

RQ3: *What are the major factors that influence the ICT behavioural intention, and actual use of ICT by the principals (head of school) of Saudi Arabian primary schools?*

RQ4: *What are the major factors that influence the ICT behavioural intention, and actual use of ICT by the teachers of Saudi Arabian primary schools?*

RQ5: *What are the major factors that influence the ICT behavioural intention, and actual use of ICT by the students of Saudi Arabian primary schools?*

RQ6: *What are the strategies to resolve the challenges of using ICT in Saudi Arabian primary schools?*

These questions guided the research.

1.6 Overview of methodology

In order to achieve the desired objectives of the research, the study was systematically conducted. At the beginning, a broad and in-depth literature review related to ICT in education was conducted. The literature relevant to ICT in education in Saudi Arabia was particularly sought and studied. However, literature specific to Saudi education was sparse, and ICT in the context of Saudi education was very limited.

Existing theories related to technology adoption were reviewed critically. The literature clarified the research background and provided insight into how the research problems and questions could be answered from scientific and academic perspectives. Insight gained from the literature contributed to the choice of both deductive and inductive approaches to the present investigation and assisted in the formulation of the study's research questions, hypotheses, and conceptual model.

Based on the research design and following the conceptual models, the next step was to conduct interviews for qualitative analysis and identify the key issues associated with ICT facilities in Saudi Arabian primary schools. Following the issues identified in the interviews, a primary survey was conducted to collect data related to the use of ICT facilities in Saudi Arabian primary schools for quantitative analysis using IBM-*SPSS,* and to test conceptual models using structural equation modeling techniques in *SmartPLS* software. Answers to the research questions were sought, and the developed hypotheses proved or disproved by the data analysis and model results.

In the methodology chapter, all the methods of the study have been explained in detail. In addition, both the qualitative and quantitative aspects of the study are discussed in greater detail in later chapters. Finally, the results triangulated and discussed and strategies recommended for improving ICT facilities in primary schools in Saudi Arabia.

1.7 Contributions, limitations and scope of the study

1.7.1 Contributions to the body of knowledge

The findings reported in this dissertation, also demonstrated by the two publications generated from this thesis (acknowledged below), address the need for greater insight into the adoption of ICT at the primary level, and confirm that issues previously recognised in other education sectors in Saudi Arabia also exist at the primary level. However, the results also demonstrate that, while faced with many barriers, students, teachers and administrators on the whole are interested in ICT as an educational tool, and that its uptake could be encouraged by more research-informed and appropriate government strategies.

The research emphasises the critical factors that academics should consider when integrating ICT into a primary education system. The research also developed a modified UTAUT model applicable to the Saudi Arabian education sector (primary level), which included the new constructs: culture and system quality. It identified the issues associated with ICT use in education within an Islamic cultural and country context. Finally the research demonstrated that using SEM modelling with a PLS algorithm in combination with an established UTAUT model enriches the relatively new, yet very powerful PLS-SEM method.

1.7.2 Limitations of the study

Limitations of a study are those things over which the researcher has no control. Evident limitations are potential weaknesses of a study. Researcher biases and perceptual misrepresentations are potential limitations in a qualitative study; in a quantitative study, a limitation may be the capability of an instrument to accurately record data.

1.7.3 Scope of the study

A study of the use of ICT in an education system involves a vast domain. Therefore, the research was confined by boundaries to keep the scope of the study realistic, and the research focused and efficient, in order to provide the best possible answers to the research questions and solve the research problem. For this reason:

- The investigation was confined to ICT facilities involved with primary education in Saudi Arabia.
- The models were limited to the modern theories available for technology acceptance and usage, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT).

- The research was restricted to determining the preferences of the principals, teachers, and students selected from specific locations in Saudi Arabia (Riyadh, Jeddah, Dammam).

1.8 Thesis structure

The dissertation of this research has been organised into eight chapters.

Chapter 1 introduces the research, explains the background and the rationale for the study, outlines the aims, objectives, and research questions and explains the significance of the research.

Chapter 2 presents the general literature review for the research, ideas of ICT facilities and their uses in education, their aspects and relationships. Additionally, theoretical models related to technology adoption and the use of ICT facilities in education are also presented. Furthermore, the national context of Saudi Arabia as a whole, and in particular the environment for ICT use in education, focusing on primary education, is discussed.

Chapter 3 presents the specific factors and constructs related to the adoption of ICT facilities in Saudi Arabian primary schools by principals, teachers and students, along with the research hypotheses and the conceptual models based on the literature review.

Chapter 4 presents all the methods used in this research in detail, including research methods used, population and sample, qualitative and quantitative data collection, and data analysis methods.

Chapter 5 focuses on qualitative data (interview) analysis. In this chapter, the interviews were summarised in relation to the factors of ICT adoption in primary education by principals, teachers and students.

Chapter 6 presents the quantitative analysis and results. In this chapter, the overall findings are described through descriptive statistics along with the tests for the models and the construct relations representing ICT adoption in primary education by principals, teachers and students.

Chapter 7 provides detailed discussions of the results from qualitative and quantitative analysis and findings.

Chapter 8 provides the suggested strategic solutions, discusses the contribution of the research, provides the recommendations, discusses limitations, and explores the scope for further studies.

1.9 Summary

It is believed that by introducing ICT in early education students will become more proficient and confident with these tools, providing them ultimately with access to a greater range of knowledge and information. Furthermore, increased familiarity with ICTs will enable students moving into secondary and tertiary education to adapt quickly to increasingly powerful, constantly changing computing and communication technologies.

Thus, at the primary level, ICT and its appropriate usage are matters deserving of greater research. Nevertheless, the integration of ICT into primary education has been largely ignored by the MoE in Saudi Arabia, although greater appreciation of the benefits and more strategic placement of ICT could have far reaching impact in the kingdom. Much will depend on the history, society, culture, religiosity and the people of Saudi Arabia.

The integration of technology into a curriculum is complex, and depends on many interlinking variables. In order to ensure the successful adoption of ICT at the primary level in Saudi Arabian schools, first and foremost both the positive and negative factors affecting the adoption of ICT at the primary level must be considered from the primary stakeholders' points of view. Principals, teachers, and students will all have to participate in the adoption of ICTs widely in the primary education sector. Before finding the strategies that would bring ICT into the primary classroom, research was needed to get a clear picture of the current use of ICT in education in Saudi Arabia, research provided by the study reported in this thesis.

Chapter 2

Literature review

This chapter presents a review of the literature relevant to the research topic. At the beginning of this chapter, information and communication technology (ICT) in education is discussed, including an accepted definition of ICT. Then the potential impact and effectiveness of ICT in learning and teaching different subjects at different levels is reviewed. After that, the potential of ICT in education is discussed. Then the barriers to the use of ICT in education for principals, teachers and students are canvassed. Afterward, case studies of ICT adoption in primary and secondary schools in different countries are presented before a summary of theoretical frameworks explaining technology acceptance in education are outlined. Finally, the chapter elaborates the country context of Saudi Arabia, where the current political, economic, and education sectors have been critically discussed, along with focus given to the use of ICT facilities in education.

2.1 Using ICT in education

The influence of digital technology is almost universally pervasive, particularly given the penetration of the Internet and the mobile phone into societies worldwide. We find ICT in manufacturing, agriculture, retail, marketing, communications, travel, health and education. In less than four decades ICT has changed the way people work, think, communicate and live (Al Sharija, & Watters, 2012; Pulkkinen, 2003). For over two decades, for example, educators and computer programmers in developed countries have pursued the use of ICT in education, and have been increasingly using information technology for learning and teaching, particularly in universities.

Because of the ubiquity of the technology, understanding the concepts and application of ICT are considered to be one of the major concerns for education in many countries (Noor-ul-Amin, 2013) in order to ensure that the population is able to participate fully in the society and help create an educated, dynamic workforce. According to Kozma (2008), investment for ICT in education supports economic growth, promotes social development, advances education reform, and supports education management. Over time, the use of communication technologies, particularly the internet, can produce remarkable social changes and paradigm shifts. Familiarity with ICT has been shown to improve professional performance and benefit student education (Haddon, 2016; Albion, Tondeur, Forkosh-Baruch, & Peeraer, 2015). Used correctly, its use challenges and enriches.

This indicates that increasing ICT capacity in the education sector improves the learning process, and helps to overcome learning difficulties, such as understanding complex issues or grasping complex knowledge.

In the classroom, ICT provides enormous flexibility and speed of access to information, as noted by Etherington (2008):

> *Can deliver instructional programs and information fast, covering virtually any area of the curriculum and geared to any age or ability level. (p. 29)*

ICT in education can promote an easy way of sharing different ideas (Capper, 2001; Livingstone, 2012) and allows teachers to participate in innovative ways in the learning process. The ease of access to a wide variety of knowledge and ways of knowing provides teachers with the resources to introduce diverse subjects, arguments and theories consisting of new and up-to-date information (Bikas, 2001; Coupe, Goveia, Haichour, & Ilukena, 2006; Tinio, 2002). This offers an opportunity for the children to enhance the way they acquire information, organise it and construct meaning from that information (Braslavsky, Fumagalli, Chapman, & Malhck, 2004; Skryabin, Zhang, Liu, & Zhang, 2015).

Furthermore, ICT in education provides opportunities for collaborative learning, promotes the dynamic immersion of students in the process of learning, offers flexible learning opportunities through access to information and interaction with content, and equips students with skills to solve real world problems (Department of Education, South Africa, 2003; Albugami, & Ahmed, 2015; Bjekic, Krneta, & Milosevic, 2010). Consequently, ICT in education has the power to improve individual academic performance (Noor-ul-Amin, 2013; Skryabin et al., 2015).

2.1.1 ICT definition and its evolution

ICTs are a product of the evolution of the tools of human communication. We use technology to store and to share knowledge, to create and communicate. The Internet, media and broadcasting, libraries and documentation centres, programs and computers, smartphones and sensors, all enable the processing, management and exchange of data, information and knowledge (Haddon, 2016; Noor-ul-Amin, 2013; Pulkkinen, 2003). According to Blurton (1999), ICT refers to the:

> *Diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information..(p. 1)*

Direct reference to 'technology' as an object emphasises the physical and material aspects of technology – the machinery – which relates closely to the natural sciences. Technology consists of the objects in our surroundings and defines the word as an instrument or a tool. The concept of technology for the purposes of this research, therefore, was concerned with physical systems, and their attendant products (Pulkkinen, 2003), as well as the ways that humans interact with and use them to communicate and to learn.

In the mid 1990s, the increased use of information technology in firms resulted in significant progress in economic performance (Seri, & Zanfei, 2013), and the use of ICT has grown exponentially during the past two decades. We have seen the introduction of more powerful computers, high capacity communication satellites, fibre-optic and wireless technology (e.g., WiFi), and increased and easier software development systems, such as multimedia authoring systems to create digital materials, for example, virtual games, computer simulations and materials to be used in education (Bates, 2001; Seri, & Zanfei, 2013; Yuen, Law, & Wong, 2003).

In the field of education, ICT is associated with networks, hardware and software and personal computing to provide a means to communicate, collaborate and engage at a distance, as well as within the classroom. For some educators, administrators and policy makers, 'technology' and ICTs represent a new operating environment in education (Bate, 2010; Ilomäki, 2008; Noor-ul-Amin, 2013; Pulkkinen, 2003).

2.1.2 Effectiveness of ICT use in teaching and learning

For many years, conventional teaching (at every level of education from primary to higher education) focused solely on courses and content written around texts, where teachers taught via lectures and presentations (e.g., black boards, illustrations) designed to consolidate and reinforce the content. These teaching methods dominated practice, and such processes orbited around teachers planning, designing and leading students through a series of instructional lectures (Noor-ul-Amin, 2013). Today, curricula are ideally designed to promote competency and performance, where learning is considered to be a skill in itself and life-long in its impact. Learning is seen as an active process of constructing knowledge rather than acquisition through a process of transmission and reception (Ben-Ari, 2001; Fosnot, 2013; Fu, 2013).

In this concept of education, the teachers' role is to guide the students in the way of knowledge construction, with tools such as ICT available to support the teaching and learning process, helping to translate the teachers' guidelines and providing opportunities to explore according to personal interest. (Details of ICT use at different levels of education can be found in section 2.1.3.) The goal is to ensure that students get to explore key ideas, think critically, and develop greater understanding in every aspect of education (Albugami, & Ahmed, 2015; Ilomäki, 2008; Noor-ul-Amin, 2013).

For example, Albugami and Ahmed (2015) explored the value of ICT and its implications for cirtical thinking and understainding of study materials in the context of secondary education. The researchers found that ICT can be a great supporting tools for achieving such goals, with the help of proper resources. These are modern educational goals in most developed nations, where technology has enabled anywhere, anytime learning and easy communication and collaboration. In the context of the research problem, introducing primary age students to ICTs and the culture of their use, is anticipated to nurture skills in knowledge acquisition which can be applied to all areas of study throughout their school careers.

According to Adegbija (2013), ICT is integrated in teaching and learning processes in three stages. The first stage is ICT input, which denotes to the acquisition, assimilation or absorption of issues, knowledge, messages and skills relating to ICT. Training in the usage of ICT will increase teacher confidence. The second is adopting ICT processing, the documentation and storing of updated and effective information. The third stage is using ICT for the dissemination of information for students by teachers. ICT, when successfully integrated into education, can offer opportunities for students and teachers to participate fully in the teaching and learning process, with subsequent benefits to the learners by allowing them to learn about diverse subjects, arguments and theories consisting of new information (Coupe, Goveia, El Haichour, & Ilukena, 2006; Tinio, 2002). There are new possibilities for independent thinking, and enriching the knowledgebase. The innovative and appropriate use of ICT can assist individual academic performance by encouraging the active involvement of students in the learning process, promoting cooperative learning, equipping students with problem solving skills, and offering flexible learning options (Albugami, & Ahmed, 2015; Skryabin, Zhang, Liu, & Zhang, 2015).

For example, through lectures combining text, sound, and static or moving images through video, television and multimedia computer software, teachers can attract the attention of the students to learn more complex and challenging content easily and effectively (Noor-ul-Amin, 2013). Students are able to acquire information in new ways, as well as share it, organise it and construct meaning from it, enhancing good quality learning (Braslavsky, & Fumagalli, 2004; Capper, 2001; Skryabin et al., 2015).

Several studies have been carried out to understand and ensure the effectiveness of ICT use in teaching and learning. Campbell (2009) and Cox, Abbott, Webb, Blakeley, Beauchamp, & Rhodes (2004) found in their studies that ICT enhances teaching and learning in primary school classrooms, as ICT makes it easy to convey challenging concepts. Webb and Way (2007) analysed ICT adoption in Australian primary schools and revealed three key dimensions that emerged from the teacher descriptions: ICT infrastructure; motivation and ICT use; and pedagogy and innovation. These elements work together to make ICT beneficial in the primary setting. However, their provision and uptake is not always guaranteed. The presence, use, or attitudes towards the dimensions of ICT use in a primary setting dimensions have not been well examined for Saudi primary schools, and needs further investigation as Saudi Arabia seeks to move from a country reliant on a single commodity and nurture the skills of its people. This research explored these dimensions of ICT in Saudi primary education to answer its research questions.

Ilomäki (2008) carried out a study to investigate the effects of ICT from teachers' and students' perspectives, and found that ICT offers the possibility of teaching and learning new skills and competencies while engaged in content development and learning. Noor-ul-Amin (2013) agrees that ICT has an effective influence on education, raising learning quality and giving greater accessibility, increasing learning motivation and boosting the learning environment. Alajmi (2011) investigated influential factors and barriers surrounding ICT implementation in government secondary schools in Kuwait from the perspectives of students, teachers and expert educators. The researcher found that ICT has a strong and positive influence in secondary school education, which is appreciated by all the stakeholders. Brooks, Borum, and Rosenørn (2014) developed guidelines for designing creative learning environments through the well-considered use of technology in secondary education. They argued that with properly designed ICT facilities, the creative potential of the students would be unlocked. In this regard, it can be argued that creative design of programs involving ICT for primary education might be one of the most critical features of the early stages of school life in order to have lifelong prospects of using ICT in the future, where society revolves around a digital world.

Albugami and Ahmed (2015) carried out a study to identify the critical success factors and barriers for the implementation of ICT in Saudi Arabian schools. Their study revealed that the use of technological tools actively engages the students in the learning process in contrast to traditional education where they are passive observers and listeners. Additionally, the study found that an effective implementation of ICT in education necessitates providing attention to some factors, such as ensuring the provision of adequate infrastructure, adequate technical and management support, adequate teacher training in ICT and pedagogy, a clear educational policy and evaluation on an ongoing basis.

These observations motivated the researcher to explore ICT facilities in Saudi primary schools. It was anticipated that ICT at primary school level would enhance the teaching and learning experience, give options for better communication, grow interest and enhance creative thinking.

2.1.3 ICT use at different levels of education

At different levels of education (from pre-school to higher education), ICT integration in education systems is important for enhancing economic growth and technological change (Haddon, 2016; Albion et al., 2015). Additionally, ICT can be integrated into new kinds of environments within educational institutions. which can also transform the traditional forms and structures of education at all levels (Pulkkinen, 2003). Thus, the integration of ICT into education systems at all levels is considered very important for coping with global changes (Fu, 2013; Chuang, Weng, & Huang, 2015; Haddon, 2016).

The introduction of ICT into primary schools is considered to be a significant development for teachers and students (Etherington, 2008). At that level, young minds are active and flexible and ready to accept new ideas, demonstrate creativity, formulate abilities of critical thinking and, above all, absorb surrounding information for informed decision-making at the later stages in life, which indicates the possibility of achieving sustainable education (Tuparova, Kasevaa, & Tuparov, 2014; Yadav, & Mehta, 2014). Innovation and transition to modern, playful and exploratory learning can be remarkably supported in the environment of primary education with the right tools and trained educators (Webb, & Way, 2007). In this setting, ICT becomes immensely important, as the confident use of ICT by their teachers and themselves would familiarise students with the advantages of using new technologies and exploring their potential (Yaday, & Mehta, 2014).

According to Campbell (2009), use of ICT can enhance the quality of learning in primary school classrooms, as it helps to better distribute ideas among the students. Recognising this importance, ICT has been introduced in primary schools in many countries, which has led to an improvement in education services, and provided opportunities for primary school teachers to develop professionally (Chapman, Mahlck, & Smulders, 1997; Haddad, & Jurich, 2002). ICT technologies commonly adopted in primary schools (mostly in developed nations such as the USA and the UK) involve a device (e.g., tablet PC, electronic board), the loaded or cloud-sourced software and the Internet Unfortunately, evidence indicates that younger students are often passive users, who do not directly use the ICT facilities in their classes. Much more student involvement with the devices and programs is required to improve the capacities of the students to make progress in their own ICT literacy (Bingimlas, 2010). In the case of Saudi Arabia, student involvement would certainly be desirable, as, according to government VISION 2030, the goal of the government is to prepare future generations to adapt to a new world of digital activities and economy (Nurunnabi, 2017).

In contrast to the primary level of schooling, at a secondary level, ICT technologies are utilised by the teachers for teaching, as well as the students for learning. At this stage of education, the students are encouraged to participate and share ideas, knowledge and materials. This makes their education appear less difficult, foreign and imposed on them (Alharbi, 2014). Alajmi (2011) and Alharbi (2014) explored the idea that ICT has a strong and positive influence in secondary school education, and Brooks, Borum, & Rosenørn (2014) have promoted the well-considered application of ICT in secondary education. In general, ICT in secondary education has already attracted a wider audience, and thus more and more secondary schools are utilising ICT, especially through the teachers (Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017). In Saudi Arabia, the King Abdullah bin Abdul-Aziz Project for Public Education Development (Year 2007), called *Tatweer* (meaning: to develop), has been introduced at the secondary school level. The *Tatweer* program is part of an effort to reform secondary education in Saudi Arabia via the *Tatweer* Smart School, *Tatweer* Education, and *Tatweer* Transportation programs (Alyami 2014; Tatweer, 2017).

ICT in higher education has provided flexible approaches of learning for students who lack opportunities due to factors such as employment, families, inadequate funding, long distances, and an overall lack of time. ICTs have improved communication and data management, facilitated learning and overcome the barriers of inflexible organisational structures (Venkatesh, Croteau, &

Rabah, 2014). It is becoming an inseparable part of higher education, featuring in lectures, assignments and research (Kigozi, Ekenberg, Hansson, Tusubira, & Danielson, 2008; Oliver, 2002; Talebian, Mohammadi, & Rezvanfar, 2014). All these studies have indicated that ICT is already widely used in higher education, and commitment is required at the primary level to educate students who one day will use the same facilities at mid or higher levels of schooling, as well as in their working and social lives.

2.1.4 The potential of ICT in education

In this Age of Information, it is essential for students to increase their competence in technology in order to participate in diverse creative processes and gain *doer's knowledge* (Olson, & Bruner, 1996; Ilomäki, 2008), which promotes agency and the experience of control through the mastery of technical ICT skills that allow them to:

- use technology to be creative (Ilomäki, 2008)
- communicate (Livingstone, 2012)
- collaborate (Livingstone, 2012; Howell, 2012),
- understand, produce, and evaluate digital contents (Kong, 2014; Ilomäki, 2008)
- think critically (Kong, 2014; Simpson, 2010)
- solve problems (Fessakis et al., 2013; Hsin et al., 2014)
- make decisions (Kong, 2014; Fessakis et al., 2013)
- learn (Livingstone, 2012; Howell, 2012; Kong, 2014)
- conduct research (Venkatesh et al., 2014; Ilomäki, 2008)
- process information (Kong, 2014; Fu, 2013; Khan et al., 2012)
- master the technology (Fessakis et al., 2013)
- technology operations and concepts (Kong, 2014)

Incorporation of ICT in education can promote such skill development (Ilomäki, 2008).

Several studies have been carried out to understand the potential of ICT use in education. Ilomäki (2008) investigated the effects of information and communication technology (ICT) on a school from teachers' and students' perspectives, finding that integrating ICT into teaching and learning improved efficiency and effectiveness. Noor-ul-Amin (2013) revealed that ICT has an effective influence on education; as well as ICT use in the teaching and learning process, quality and accessibility of education, learning motivation and learning environment.

ICT provides opportunities for collaborative learning at different stages of education. It also ensures the active involvement of students and improved capacities to solve problems, as well as offering flexible learning opportunities through access to information and interaction with content (Fessakis, Gouli, & Mavroudi, 2013; Albugami, & Ahmed, 2015; Bjekic, Krneta, & Milosevic, 2010). Consequently, ICT in education improves individual academic performance (Noor-ul-Amin, 2013; Skryabin et al., 2015).

ICT offers teachers the chance to participate fully in the learning process, benefiting learners by leading them to learn about diverse subjects, arguments and theories consisting of new information (Bikas, 2001; Coupe et al., 2006; Tinio, 2002). ICT can markedly improve the teaching and learning processs by changing access to information, teaching styles, and in the role of teachers. As a result of the integration of ICT into the school, students become more focussed on their classroom experience where teachers play the role of a facilitator or co-learner in setting project goals and providing guidelines and resources, working in collaboration with students, providing suggestions and support (Al-Sulaimani, 2010).

Using ICTs, ideas can be readily shared, and ways of acquiring information multiplied. Thus ICT can ensure the meaningful interaction of learners with information (Department of Education, South Africa, 2003), advance cognitive skills (e.g., comprehension, sound reasoning, problem-solving, higher-order thinking skills creative thinking, improved effective communication), improve interpersonal skills (e.g., writing, public speaking, teamwork and collaboration), and improve productivity skills (e.g., creating high-quality products) (Livingstone, 2012; Howell, 2012; Noor-ul-Amin, 2013;).

It is anticipated that in the future, the integration of ICT based instructional practices will result in improved learning outcomes (Holland, & Holland, 2014) since the integration of ICT in education will lead to opportunities for open education, less traditional lecturing and more facilitative and guided approaches to education (Yuan, Powell, & Cetis, 2013). These sorts of opportunities are critical for Saudi primary schools, where education is currently very traditional and inefficient. Students in Saudi primary schools tend to be rather passive, and primary teachers lecture, without any visual aids from digital media to enliven the lesson.

2.2 Barriers to the use of ICT in education

Despite evidence of the effectiveness of ICT in education, there are barriers to its adoption and integration. Several studies have explored the barriers to the use of ICT in education in different countries and cultural contexts. Albugami and Ahmed (2015) investigated barriers to ICT in Saudi secondary schools. du Plessis and Paul (2012) explored the barriers in a few South African primary schools, while Salehi and Salehi (2012) investigated barriers to the use of ICT among English teachers in the high schools of Iran. The results of these studies indicated that effective implementation of ICT in education is hindered by the:

- lack of ICT resources, e.g., ICT hardware and software, lack of simultaneous internet access, slowness of ICT systems, and limited availability of educational software. This is clearly the situation in Saudi primary schools. According to previous research only a few schools have obtained some ICT facilities (e.g., computer lab room). The majority of schools in Saudi Arabia have no proper provision of ICT facilities (Albugami, & Ahmed, 2015; Salehi, & Salehi, 2012).
- absence of detailed policy and strategy regarding the adoption of ICT in practice
- inadequate organisational support from school authorities
- lack of management, technical support and motivation for the teachers to integrate ICT into their lectures (Khan et al., 2012)
- limited time availability and complications of scheduling enough time for technology-oriented classes, i.e., over-loaded curriculums with minimum time and training to incorporate ICT in their daily activities (Salehi, & Salehi 2012; Oyaid, 2009)
- lack of training for teachers, who have inadequate knowledge to use ICT facilities in the classroom to develop their skills and knowledge, as well as the confidence necessary for undertaking a new task in the classroom
- lack of instructive training to improve the competency of the teachers in technology, pedagogy, and content for actual application of ICT in the teaching and learning process to improve student learning
- negative attitudes and beliefs of teachers about educational technology due to lack of understanding of the positive outcomes of using the technology and uncertainty about management support and guidance
- resistance of the teachers to change
- lack of progressive evaluation for the identification of faults and correcting them early before they escalate.

Kigozi, Ekenberg, Hansson, Tusubira, & Danielson (2008) earlier identified two problems in the effective implementation of e-learning to support learning, which were, firstly, the limited acceptance of technology as an instruction delivery method; and, secondly, the successful utilisation of technology to support learning. This study illustrated that, though ICT is available at various levels of education, teachers and authorities cannot use it to its full extent, and the use is not adequate due to lack of knowledge.

Regardless of the challenges, it is possible to integrate ICT and education successfully by changing the teaching and learning methodology, as long as teachers and learners have access to proper ICT facilities, such as computers, internet, educational software, and training, as well as support.

In the following section, barriers affecting the adoption of ICT in education by the principals, teachers and students are discussed.

2.2.1 Barriers for principals

For the effective adoption of ICT in education, ICT initiatives require school leaders to be enthusiastic and committed when introducing technology into their schools (Al Sharija, & Watters, 2012; Kahiigi-Kigozi et al., 2008). Principals who introduce ICT must also support their staff in its use. As a whole new pedagogy is required, besides technical skills, classroom teachers will need time and guidance to adjust to the appropriate use of technology (Al Sharija, & Watters, 2012).

Among different barriers, *social influence* is very important when the individual's behaviour is negatively affected by the ways in which they believe others will see them as a result of using the technology (Venkatesh, Morris, Davis, & Davis, 2003). Conversely, perceptions of ICT usage could be positive and boost the chances of ICT acceptance and usage. School principals face the difficult task of developing positive attitudes toward ICTs among numerous stakeholders in order to introduce it into their school. Colleagues, other schools' principals, the management committee members of the schools, as well as the parents, must be convinced to adopt ICT in their institutions, and the principals must believe in it themselves.

2.2.2 Barriers for teachers

Teachers are the direct users of ICT in educational institutions for teaching purposes. They are linked directly with the students and the school system, and are responsible for how the ICT is used. Therefore, the surroundings influence them the most (Bate, 2010). According to Bjekic et al. (2010), there are three dimensions of ICT competency:

> *A teacher knows what learning activities involving ICT can be used in teaching (ICT awareness); the teacher has the necessary skills for using hardware and software (ICT readiness); and the teacher knows the pedagogical-didactical elements of ICT (ICT drill and practice). (p.204)*

Teachers need to be aware of the benefits of using ICT, and to do so, they need greater interaction with ICT facilities at their organisations (school). The availability of organisational resources and support structures to facilitate the use of a system affect a person's insight regarding the ease or difficulty of carrying out a task. This essentially has an effect on their ICT awareness and their ability to operate the hardware and software, in other words ICT readiness (Ngai, Poon, & Chan, 2007; Teo, 2010; Venkatesh, & Bala, 2008). If they are not aware and ready to use ICT, it would be more likely that they would hesitate to use ICT facilities for their daily activities. Previous studies into teachers' acceptance of various technologies have concluded that a lack of *facilitating conditions* negatively influences a teacher's adoption of technology when they are unable to use the technology to improve the process of teaching. This also indicates the teachers do not participate in or are not provided ICT drills and practices (Bjekic et al. 2010; Fathema, Shannon, & Ross, 2015; Ngai, Poon, & Chan, 2007; Teo, Lee, & Chai, 2008).

Lack of access to technology, including the Internet, lack of training and lack of time negatively affect the development or improvement of teachers' ICT skills. As a result, teachers are likely to find the use of ICTs difficult and inefficient (Al Mulhim, 2014; Fanni, Rega, & Cantoni, 2013; Ilomäki, 2008; Kahiigi Kigozi et al., 2008). They have to manage students, deal with administrative tasks and prepare for classes. Without external support it would be difficult to use ICT on a regular basis.

Other barriers prohibiting the use of ICT in education include the attitudes of the teachers towards ICT, which some may find incompatible with their wider educational beliefs. There are also *obstacles* at the school level, including the personal characteristics of some teachers, such as a lack of confidence (Webb, & Way, 2007).

2.2.3 Barriers for students

It is for the sake of the students that ICT is used, or should be used, in primary schools, and the environment influences them the most. The students' acceptance and use of ICT reflects the ICT uses of their friends and family members. Students' negative judgment or lack of confidence in their own ability to learn can discourage them from using technology (Alenezi, Karim, & Veloo, 2010; Ilomäki, 2008). Moreover, they may not perceive the technology to be interesting or enjoyable, and reject it for those reasons (Lee, Cheung, & Chen, 2005).

Maintenance is always an issue with ICT, affecting its usability, availability and reliability. The lack of resources for managing and maintaining ICT is one of the main barriers hindering ICT application in schools for students in Saudi Arabia. There is no specific maintenance allowance given to any primary schools from the government. However, some secondary schools in Saudi Arabia have a small allowance for purchasing and repairing IT facilities. These schools are included in the government education reform project Tatweer (Albugami, & Ahmed, 2015; Alyami, 2014; Nassuora, 2012). Therefore, the supply and maintenance of ICT facilities remains a problem for primary schools in Saudi Arabia.

Furthermore, as has been noted in other countries, even those who have access to computers and the Internet in schools, find the lack of classroom time restricts their usage (Wang, Hsu, Campbell, Coster, & Longhurst, 2014). And without guidance, students who have access to a computer and the Internet outside school tend not to use ICT in sophisticated ways, preferring instead to focus on communication, entertainment, and researching web-based information (Wang, Hsu, Campbell, Coster, & Longhurst, 2014).

In Saudi Arabia, the misuse of technology is a major concern for several personal and social reasons. The cultural response to ICT adoption is a potential barrier in Saudi Arabia, considering Islamic culture and norms, and the ICT adoption rate is nearly non-existent in Saudi primary schools. It is important, therefore, to consider that the Saudi context presents additional barriers to the adoption of technology at the primary school level.

As part of the current study, examples from other countries were sought to identify factors that promote ICT in primary education, and overcome the barriers, which are discussed in the following sections.

2.3 Case studies of ICT adoption in primary/secondary schools

Many countries have realised the importance of ICT in education and have adopted it to improve their education services. It must be recognised, however, that the nature and the degree of the impact will vary in different countries, based on their economic, social and cultural contexts. In this section, ICT adoption, effectiveness and barriers in primary or secondary schools in different countries are reviewed and discussed to understand and highlight the effects of contextual variation on ICT adoption. The countries considered as case studies in this section are Australia, the United kingdom (UK), South Africa, and Kuwait.

Australia and the United kingdom are developed countries, where major initiatives have been implemented in the use of ICT in education. The UK and Australian education systems are totally different from Saudi Arabia. In addition, the government and political conditions are also different from Saudi Arabia. Case studies from these countries provide a sharp contrast with Saudi Arabia, which helps frame the current Saudi situation and demonstrates the difficulties Saudi Arabia faces as the country strives to employ ICT in its primary education system, and a picture of the schooling they might strive for.

In contrast, according to the CIA Factbook, South Africa is a developing nation, and a growing economy on the African continent. South Africa is also attempting to make progress in education, including the introduction of ICT into primary education. As a case study, South Africa provides the opportunity to explore the obstacles facing developing countries when implementing ICT in primary education.

Finally, the choice of Kuwait as a case study is because of it similarities to Saudi Arabia. Ascertaining how the Kuwaitis are approaching the use of ICT in their education system is an opportunity to see how a very similar country – an oil-based, Middle Eastern economy – with a similar history and culture, is attempting to manage the introduction of ICT.

2.3.1 Case study 1: Australia

Australia is a developed country where the increased availability of ICT in society has resulted in profound changes in schools with the expectation that the use of ICT will be commonplace. Schools in Australia ensure access to ICT knowledge and skills for students so they are prepared for life in a modern society (Buchanan, Holmes, Preston, & Shaw, 2012; Campbell, 2009).

Status of ICT adoption in education. In Australia there is a high ratio (1:4, student to computers) of computers among students in state and territory government schools, with most of their computers connected to the school network and Internet. Additionally, a third of the schools have a ‘lab’, a ‘learning technology resource room’, a ‘computer classroom’ or some other ‘technology resource centre’ (Webb, & Way, 2007).

ICT on the whole has become no longer just a topic to learn about, but a tool in teaching and learning (Buchanan, Holmes, Preston, & Shaw, 2012). ICT-oriented educational activities include:

- student-generated video as a standard tool in communicating
- a virtual learning environment to scaffold students' access to the web
- access to tasks and support, communication and other learning activities
- interactive white boards coupled with a focus on curriculum applications
- digital school newsletters produced by the students and distributed to parents, teachers and peers
- student engagement with locally constructed websites for local knowledge (e.g., geography), for example WebQuest, a classroom-based ICT application for teaching higher order thinking and analytic skills
- professional learning (Auld, Holkner, Fernando, Henderson, Romeo, Russell, & Edwards, 2008).

Influential factors. In Australia, the policies of state and territory governments favour the adoption of ICT in education to participate in the 'educational digital revolution'. To this end, all public schools have been connected to the Internet; professional development is provided for teachers; and extra computers have been installed in schools. In addition, curriculum support materials have been developed and used to assist and develop teachers (Campbell, 2009; Etherington, 2008; Webb, & Way, 2007). Computers are regarded as a part of the basic infrastructure of primary schools by policy makers and teachers, as such the proper facilitation of ICT infrastructure is guaranteed (Webb, & Way, 2007).

Australian policy initiatives have led to significant investment in ICT, particularly computers, for schools, and students are encouraged to use computers as part of their classroom activities to locate and use information, or work on commercially programmed software (Buchanan, Holmes, Preston, & Shaw, 2012; Etherington, 2008). Such favourable policies and attitudes have made it possible to achieve a significant increase in computer density in primary schools in a relatively short period of time (Webb, & Way, 2007). Additionally, with proper ICT infrastructure and support, most teachers could overcome the barriers of integrating the use of the ICT with their teaching and learning activities (Buchanan et al., 2012; Campbell, 2009), improving their teaching efficiency and effectiveness.

The school authorities in Australia consider ICT to be a curriculum tool, to be used to enhance traditional approaches to teaching and learning. Australians also perceive technologies in education as opportunities and use ICT to enhance the curriculum priorities of the school (Webb, & Way, 2007). Students and teachers in Australia have a very positive attitude toward developing the skills necessary to use ICTs as tools for learning, teaching and communication (Webb, & Way, 2007).

Challenges in ICT integration. Australian schools have been confronted with the challenge of understanding system level ICT policies to best serve individual schools' agendas. These agendas are influenced by the school's worldview regarding the learning process and knowledge dissemination, its motivations for incorporating ICT and associated social-cultural aspects, such as the specific requirements of the students, parents and the community as a whole (Webb, & Way, 2007).

Although Australia has attained success in equipping and maintaining their schools in terms of ICT, there nevertheless remains a wide variation in access to ICT facilities among students nationwide, and most of the schools that are sufficiently set up for the student use of ICT are in the private sector (Bate, 2010). Students are very willing to use ICT for educational purposes, but many have access to ICT only in their classrooms, which results in a lack of self-confidence, and a student-teacher communication gap outside the school (Campbell, 2009).

Furthermore, despite having support in place for teachers, many remain doubtful of the value of ICT in the classroom, and fail to make the best possible use of ICT with their classes (Bate, 2010; Campbell, 2009). The teachers (particularly early career teachers) use ICT for administration and preparation, but seldom in student-centred ways due to a lack of understanding regarding the link between ICT and improved literacy and numeracy outcomes (Bate, 2010). Using ICT as a teaching tool is unfamiliar to many teachers and challenging when they are trying to balance the demands of a crowded curriculum and administration with providing students opportunities to use ICT (Bate, 2010; Campbell, 2009).

From the point of view of the teachers and principals, although professional development is encouraged, the lack of time in the teacher's year for anything other than teaching is often overlooked. Therefore, staff feel that they lack the knowledge, skills and time to make the most of ICT (Bate, 2010; Campbell, 2009). Nor are staff members particularly confident that their colleagues can respond to new digital education paradigms, a feeling that reflects the social constraints of the teachers (Bate, 2010).

2.3.2 Case Study 2: The United kingdom

The UK is another developed country that has been studied, where the impact of ICT on business and society generally has increased dramatically in recent years and resulted in the concept of a knowledge-based society (Inspectorate of Education of Ireland, 2008; Cooke, & Leydesdorff, 2006). Realising the importance of an ICT-educated citizenry, the government started spending for the integration of ICT and education. In 2008-09 the government spent about 2.5 billion European dollars on educational ICT (Buabeng-Andoh, 2012). Thus, the whole environment in UK is positive about ICT in education (Balanskat, & Blamire, 2007).

Status of ICT adoption in UK education. In the UK, there is a high density of computers and other ICT equipment in schools. Most schools have computer rooms, science laboratories, or technology rooms, along with broadband Internet access (Hammond, 2014; BECTA, 2005; Inspectorate of Education of Ireland, 2008). All of the schools on average are excellently equipped, where the ICT-oriented tools include data projectors, interactive whiteboards, laptops for all teachers, open and non-open source software (BECTA, 2005; Balanskat, & Blamire, 2007). Now in UK schools, ICT is considered as a separate subject in the curriculum, as well as a tool in teaching and learning other subjects (Hammond, 2014).

Influential factors. In the UK, the government introduced ICT-related policies which addressed access to computer technology as a priority. In response to such policies, the government created a National Grid for Learning, which has provided students access to high quality educational materials, connected all of Britain's public schools to the Internet, and established a New Opportunities Fund to train teachers to use this new technology. This training has aimed to raise levels of competence and confidence among teachers (Campbell, 2009). Later the British Educational Communications and Technology Agency (BECTA) was established to support the UK's four education departments in their strategic use of ICT, which acts as a strategic advisor and coordinator of e-strategy, providing insight from analysis and research and working with partners for the strategic delivery of the e-strategy (BECTA, 2005). The curriculums of UK schools have also been reformed to include ICT, which has had an important impact on educational standards (Brown, Kölling, Crick, Peyton Jones, Humphreys, & Sentance, 2013; Hammond, 2014).

The school authorities make effective use of grants for developing their ICT systems. Most of the schools have a written ICT plan (Inspectorate of Education of Ireland, 2008). The facilitators provide technical support for the infrastructure, and training for staff which encourages the principals and teachers to integrate ICT in their schools (BECTA, 2005).

Challenges in ICT integration. ICT plans in most of the schools in the UK tend to concentrate more on infrastructural issues than on how ICT can be used to enhance teaching and learning (Balanskat, & Blamire, 2007; Inspectorate of Education of Ireland, 2008). Most of them face a lack of technical support and maintenance. Some schools have access to technical support and maintenance facilities, about which teachers are unaware. Additionally, they have low levels of awareness regarding the ICT advisory service, and teachers often do not know about the guidelines and cannot convey the information to the students. This indicates a lack of communication among the school authorities and the teachers (Inspectorate of Education of Ireland, 2008).

Though the government policy in the UK emphasises the professional development of teachers in ICT, it has failed to match teachers' requirements and has a shortage in pedagogical and practical aspects which would improve teaching and benefit the learning process. Thus, most of the teachers use ICT in lesson planning and preparation, but fewer teachers plan for the use of ICT in teaching and learning (Balanskat, & Blamire, 2007; Inspectorate of Education of Ireland, 2008). The reason behind such evidence is that the teachers find themselves inexperienced in teaching and learning methods facilitated by ICT (Balanskat, & Blamire, 2007; Inspectorate of Education of Ireland, 2008). Additionally, the ability of the students is limited for the most part to basic ICT skills (Inspectorate of Education of Ireland, 2008).

Summary of studies from developed countries

Studies in Australia and the UK reveal that in terms of ICT adoption at different levels of education in these countries, the governments are committed and progress has been made. Yet it is clear that there are, at the level of the schools themselves, a variety of issues that impede the best application of ICTs. Nevertheless, the governments of both the UK and Australia have played significant roles in implementing ICT in their education systems, which can be an example for Saudi primary schools to consider their own policy at a national level.

2.3.3 Case study 3: South-Africa

South Africa is a less developed country where the majority of learners are disadvantaged due to the economic condition and schools have great difficulty in providing children with access to computer hardware and internet connectivity (du Plessis, & Paul, 2012). The ICT landscape in South Africa has changed dramatically with the advent of the cell phone and its almost ubiquitous penetration into all levels of society (Ford, & Botha, 2010). So, despite of the challenges, ICT has been outlined as an integral part of modern education by the South African Department of Education (DoE) in recent years (Fanni, Rega, & Cantoni, 2013; Isaacs, 2007).

Status of ICT adoption in education. National e-education was a major policy intervention taken by the DoE in 2004 to integrate ICT into education in South Afric (Vandeyar, 2015). This policy was solely focused on integrating ICT for teachers and students at different levels, and there were several phases to implement this policy. However, despite so many national level initiatives, very few of the schools have ICT infrastructure and resources, and facilities are insufficient for requirements at those schools which do have some infrastructure in place (du Plessis, & Paul, 2012; Isaacs, 2007). Additionally, in 2013, the third phase (Phase 3) of the policy was initiated, although some major policy outcomes and goals from the first two phases had not yet been achieved, such as networking capabilities in shcools, teachers integrating ICT in the curriculum, and the use of high-functional educational software (Vandeyar, 2015).

Influential factors. The DoE in South Africa emphasises computer-assisted teaching (Isaacs, 2007; Fanni, Rega, & Cantoni, 2013). Additionally, the DoE introduced curricula integrating ICT, which demands the students become computer literate and the schools integrate ICT across the curriculum (Cross, & Adam, 2007; Isaacs, 2007; du Plessis, & Webb, 2012). For this purpose, the authority has introduced several plans, programs and projects to introduce technological infrastructure within under-resourced schools, to empower educators to use appropriate and available technology to deliver curricula, and to increase the digital competence of the students (Blignaut, Hinostroza, Els, & Brun, 2010; du Plessis, & Webb, 2012; Fanni, Rega, & Cantoni, 2013). The government also introduced an e-education policy into schools with the intention of 'transforming learning and teaching' (Vandeyar, 2013; Mooketsi, & Chigona, 2014). It places,

> *An obligation on education to use educational technology to deliver on expectations of quality education for economic growth and social development… (Vandeyar, 2013, p. 248)*

Along with the authority, the principals and teachers have a positive attitude towards ICT integration (Isaacs, 2007; du Plessis, & Webb, 2012; Fanni, Rega, & Cantoni, 2013).

Challenges in ICT integration. It is evident that ICT in education is considered a priority by the South African government, but there is no comprehensive policy for integrating ICT with education (Cross, & Adam, 2007; Isaacs, 2007). e-Education at a national level is one major policy that has been introduced, yet the policy has not translated into positive impacts from using ICT at schools (Vandeyar, 2015). Additionally, regardless of the positive view of the DoE towards ICT integration, the majority of the schools in South Africa, especially the township schools, do not have the required ICT facilities, including ICT infrastructure or technical support (Dlodlo, 2009; du Plessis, & Paul, 2012; Herselman, 2003; Jaffer, Ng'ambi, & Czerniewicz, 2007). Moreover, leadership, support and training related to computers are very limited (du Plessis, & Paul, 2012; Gudmundsdottir, 2010). Therefore, the education policy is virtually inactive within the school context (Mooketsi, & Chigona, 2014; Vandeyar, 2013).

The school authorities do not have a vision, or have only a limited vision, for ICT integration with education. Thus far, they have focussed on the initial stages of familiarising the learners with basic *computer literacy* and begun moving to using computers for learning (du Plessis, & Paul, 2012). On the other hand, although the teachers have positive attitudes towards ICT integration, the lack of systematic support and computer skills results in a lack of confidence (du Plessis, & Paul, 2012; Vandeyar, 2013). Students in South Africa tend to have a less positive attitude towards computers, but show interest in computer-related careers. Their future is, of course, then affected by their individual computer access and personal experience (Bovée, Voogt, & Meelissen, 2007).

2.3.4 Case study 4: Kuwait

Kuwait is a developing country in the Arab region, where Islamic culture is dominant. Here the concept of ICT in education is new and it is still in its developmental stages (Al Shemmari, 2015). The Kuwaiti Ministry of Education (MoE) has made an effort to integrate ICT into their educational system beginning in 2002 in order to develop ICT skills, to enhance the learning and teaching process, and to increase the efficiency of the education system in meeting the different social, economic, educational and industrial needs of the Kuwaiti community (Al Shemmari, 2015; Alajmi, 2011).

Status of ICT adoption in education. Many schools in Kuwait now have computer rooms for information technology and their administration offices have Internet access. In government schools, ICT related subjects have been included in the curricula of all educational stages. Some schools have started using SMS as a tool of communication with parents and teachers in relation to their students individually. Some others have established their own websites to serve and communicate with their students and parents. In some cases, teachers use overhead projectors, tape recorders or videos (Alajmi, 2011).

Influential factors. The Kuwaiti Ministry of Education (MoE) are determined to implement ICT in education (Alajmi, 2011). To achieve this, the ministry has made several efforts to integrate ICT into the education system, and to ensure that ICT skills are developed among the students and used to enhance the learning and teaching process. To this end, the number of computers has been increased in all educational administrations and areas; a website has been established to provide teachers, students and employees with important information related to the educational process; ICT has been included in the curriculum for some subjects; and training courses are available for employees and teachers in different administrations and schools (Al Shemmari, 2015; Alajmi, 2011).

Along with the government, the principals, teachers and students are very positive about the integration of ICT into the education system, believing that it offers many attractive educational methods and tools that support the learning and teaching process (Al Sharija, & Watters, 2012; Al Shemmari, 2015; Aldhafeeri, Almulla, & Alraqas, 2006).

Challenges in ICT integration. Although the MoE introduced ICT into the education system, there was actually no clear strategy or guideline for such integration (Al Shemmari, 2015). Additionally, there lies a gap between the policies and implementation of ICT. For example, the schools are not equipped with sufficient ICT infrastructure or resources (e.g., too few computers, limited Internet access, and lack of the latest technology); and the training courses are not useful for the teachers or the administrators (Alajmi, 2011). Despite the decision of the ministry to support ICT in education, many schools have not included ICT as part of their school curriculum (Al Shemmari, 2015). The policy and decision-making processes in the schools lack clear vision and stability; as a result, the school environment is not yet ready for ICT implementation in Kuwait (Alajmi, 2011). The teachers lack computer skills as they are not well prepared by teacher training colleges and ICT training courses in schools are still limited (Alajmi, 2011; Aldhafeeri, Almulla, & Alraqas, 2006; Alharbi, 2012).

Al Shemmari (2015) explored several barriers that hinder the implementation of ICT in Kuwait. According to Al Shemmari's (2015) qualitative findings, one major problem in Kuwait is the lack of ICT equipment, out-of-date equipment and absent Internet connections. Furthermore, administrations are not supportive of ICT implementation and teachers are not trained, echoing the findings of Alajmi, (2011) and Aldhafeeri et al., (2006). Some of the teachers express pedagogical beliefs that do not value ICT, and the idea that ICT contradicts their cultural beliefs. Furthermore, teachers currently lack the time required just to prepare for standard lessons, given their high class loads, meaning that the development of ICT skills is improbable simply because of lack of time. Kuwaiti teachers are not technically trained, and do not have any technical support, and therefore ICT has not been systematically introduced.

Summary of studies from developing countries

Despite being developing nations, South Africa and Kuwait have made progress in ICT adoption. Their governments believe that there would be benefits if ICT and education were integrated, and have taken small policy and practical steps. The major problems for these countries are a failure to implement policies in education, lack of resources devoted to integrating ICT and education, and inadequate numbers of trained and experienced teacher instructors, computer technicians, or Internet experts, a situation relatively similar to Saudi Arabia. Kuwait also has cultural similarities with Saudi Arabia, and information found in a case study set in Kuwait was directly beneficial to assessing factors related to ICT use in Saudi primary schools. A comparative summary of these case studies is listed in Table 2.1. The tables aid our understanding of the major challenges and prospects of integrating ICT into primary education.

Table 2.1 summarises the comparative scenarios of ICT adoption in these countries.

Table 2.1 Summary of case studies

Comparative scenarios	Australia	United kingdom	South Africa	Kuwait
Development status	***Developed country***	***Developed country***	***Less developed country***	***Developing country***
ICT adoption	High ratio of computers to students Access to school network and internet Provision for lab, learning technology resource room, computer classroom or some other technology resource centre Organise ICT oriented educational activities Considered as separate subject in curriculum Use of ICT tools in teaching and learning	High ratio of computers to students Access to broadband internet Excellently equipped with ICT oriented tools Provision for computer room, science lab, or technology room Considered as separate subject in curriculum Use of ICT tools in teaching and learning	Very few schools have ICT infrastructure and resources, which are sufficient Considered as separate subject in curriculum	Provision for computer room Internet access in admin office ICT related subjects included in curriculum ICT for school management
Influential factors	Favourable attitude of government towards ICT integration in education Vision of government: 'educational digital revolution' Provision in policy initiatives for providing *facilitating conditions*, e.g., ICT infrastructures and resources, professional development for teachers Positive attitude of school authorities, principals, teachers, and students	Favourable attitude of government towards ICT integration in education Favourable government initiatives for providing *facilitating conditions*: ICT policy, funding, establishment of agencies Written ICT plan in most of the schools Positive attitude of school authorities, principals, teachers, and students High efficiency of teachers in ICT Positive perception about the usefulness of ICT	Favourable attitude of government towards ICT integration in education Vision of government: 'transforming learning and teaching' Favourable government initiatives for providing *facilitating conditions*: e-education policy, plans, programs, projects Positive perception about usefulness of ICT Positive attitude of school authorities, principals, and teachers	Favourable attitude of government towards ICT integration in education Government initiatives for providing *facilitating conditions*, e.g., ICT infrastructures and resources, professional development for teachers Positive perception about usefulness of ICT Positive attitude of school authorities, principals, teachers, and students

Comparative scenarios	**Australia**	**United kingdom**	**South Africa**	**Kuwait**
Challenging factors	Different interpretation of policies based on socio-cultural aspects Communication gap between teachers and students outside school territory Variation in access to *facilitating conditions* among participants Lack of confidence in principals, teachers and students Lack of time in classroom Doubt of teachers about usefulness Doubt of teachers about social acceptance	More concentration on ICT infrastructure Lack of technical support and professional development initiatives Communication gap between school authorities and teachers Inefficiency of teachers and students to use ICT in teaching and learning Lack of time in classroom	No comprehensive policy for integrating ICT in education Lack of facilitating condition, e.g., infrastructure, resource, support, training, etc. Lack of vision of school authorities for ICT integration in education Lack of confidence in principals, teachers and students Less positive attitude of students Lack of time in classroom	No clear strategies or guideline for integrating ICT in education Gap between initiatives and implementation Lack of facilitating condition, e.g., infrastructure, resource, support, training, etc. ICT not included in curriculum Lack of vision of school authorities for ICT integration in education Lack of time in classroom Unfavourable socio-political condition

2.4 Technology (ICT) acceptance in education: Theoretical framework

To study the factors affecting the adoption of ICT by principals, teachers and students of primary schools in Saudi Arabia, it was necessary to understand the pattern of individual reactions to innovation and the impact factors affecting the adoption of new technologies, specifically ICT. Drawn from different literature and studies, different frameworks and models related to innovation and technology adoption were evaluated. In this research, a theory of innovation diffusion, the unified theory of acceptance and use of technology (UTAUT) was adopted due to its specific focus on technology adoption.

The theories of innovation diffusion can be applied to innovations of all types to understand why and how people access innovations. The most commonly utilised primary theories of innovation diffusion related to technology adoption include:

- theory of reasoned action (TRA); (Ajzen, & Fishbein, 1980)
- theory of planned behaviour (TPB); (Ajzen, 1985, 1991)
- technology acceptance model (TAM); (Davis, 1989)
- technology acceptance model 2 (TAM 2); (Venkatesh, & Davis, 2000)
- technology acceptance model 3 (TAM3); (Venkatesh, & Bala, 2008)
- unified theory of acceptance and use of technology (UTAUT); (Venkatesh, Morris, Davis, & Davis, 2003)

In the following sections, reviews of the individual theory are presented. Table 2.2 shows a summary of the theories.

2.4.1 Theory of reasoned action (TRA) model

The theory of reasoned action (TRA) was developed by Fishbein and Ajzen (1980). It focusses on the prediction of specific behaviours using links between individuals' beliefs, evaluations, motivations, attitudes, subjective norms, intentions, and behaviours (Ajzen, & Fishbein, 1980; Fishbein, 1979; Fishbein, & Ajzen, 1975). The theory relies on the assumption that individuals are rational and objective in the way they process information, and individuals consider the implications of their actions before engaging in specific behaviours (Ajzen, & Fishbein, 1980).

Figure 2.1 shows the model representing the TRA. The diagram illustrates how an individual's behaviour or performance is driven by *behavioural intentions*, which are guided in turn by subjective norms and individual attitudes. Individual attitudes are determined by personal beliefs and evaluations of behaviour, and subjective norms are a combination of normative belief and motivation to comply. Here, normative belief means an individual's perceptions of behaviours that are socially acceptable and motivation to comply means an individual's willingness to operate within the bounds of those perceptions.

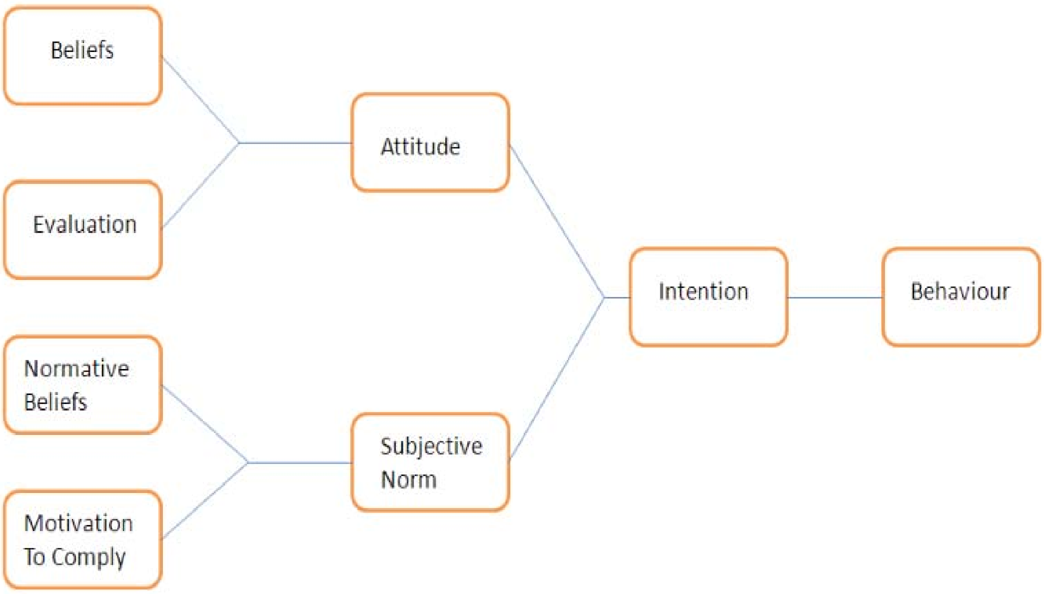


Figure 2.1 Theory of reasoned action (Ajzen, & Fishbein, 1980)

Individual attitudes are defined by personal beliefs and evaluations of behaviour. For example, an individual might believe that ICT is useful for education, that it makes the teaching and learning process effective and interesting. However, the same individual might also believe that ICT is time consuming and requires greater effort. In some cases, *effort expectancy* may outweigh the expected level of interest. Conversely, the effectiveness of the technologies in education may outweigh the time requirement. Thus, while predicting individual attitudes, some beliefs must be weighed against one another, based on the evaluation behaviour of the individuals.

Additionally, subjective norms are a combination of normative belief and motivation to comply, which address the power of the individual's social environment over their *behavioural intention*s. For example, a teacher whose friends use ICT on a regular basis for day-to-day activities and teaching are encouraged continually to do the same. Such encouragement represents a favourable perception of the level of social acceptance for the behaviour. However, the same individual may have a colleague who prefers traditional education. That individual may either choose to use ICT in education or not based on a comparative judgement.

*Behavioural intention*s are guided by subjective norms and individual attitudes. Continuing with the previous example, by weighing the individual's positive attitudes about effectiveness of ICT in education against the perceived shortcomings and then factoring in normative beliefs that result from motivation to comply (i.e., balancing the experiences and attitudes of the friends and colleagues), the individual eventually develops an intention (whether to adopt ICT in education or not). This intention leads to an actual behaviour.

TRA is limited in that attitudes and norms can sometimes be interchangeable, which may create some difficulty when distinguishing between influencing factors within a given predictive model, and it does not account for external limitations, such as barriers to the use of ICT (Ajzen, 1985). Furthermore, TRA is more basic and was developed a long time ago. After the initial use of TRA models, ICT experienced dramatic changes during the 1990s with the widespread uptake of the Internet. Although new software programs have increased the usability of the computers and the Internet, the ways and the purposes for which technology is used have become increasingly complex. Some of the new paradigms of ICT are not integral in initial TRA models, therefore for this study TRA has not been implemented.

2.4.2 Theory of planned behaviour (TPB) model

Ajzen (1985, 1991) developed the theory of planned behaviour (TPB) based on the TRA, which accounts for external influences that are beyond the control of the individual. It is a predictive model that takes into account those situations when individuals do not have complete volitional control over their behavioural choices.

Figure 2.2 illustrates the TPB. From the figure, it can be seen that in the TPB both attitudes and subjective norms are influencers of *behavioural intention*s, which is an idea similar to the concept of the TRA. The TPB is more advanced than the to TRA, however, because the theory includes external factors that could influence behaviour, which has been labelled perceived behavioural control or control beliefs (Ajzen, 1991). Additionally, Ajzen (1991) modified the concepts of behaviours, subjective norms, and perceived control in TPB to account for the role of an individual's beliefs.

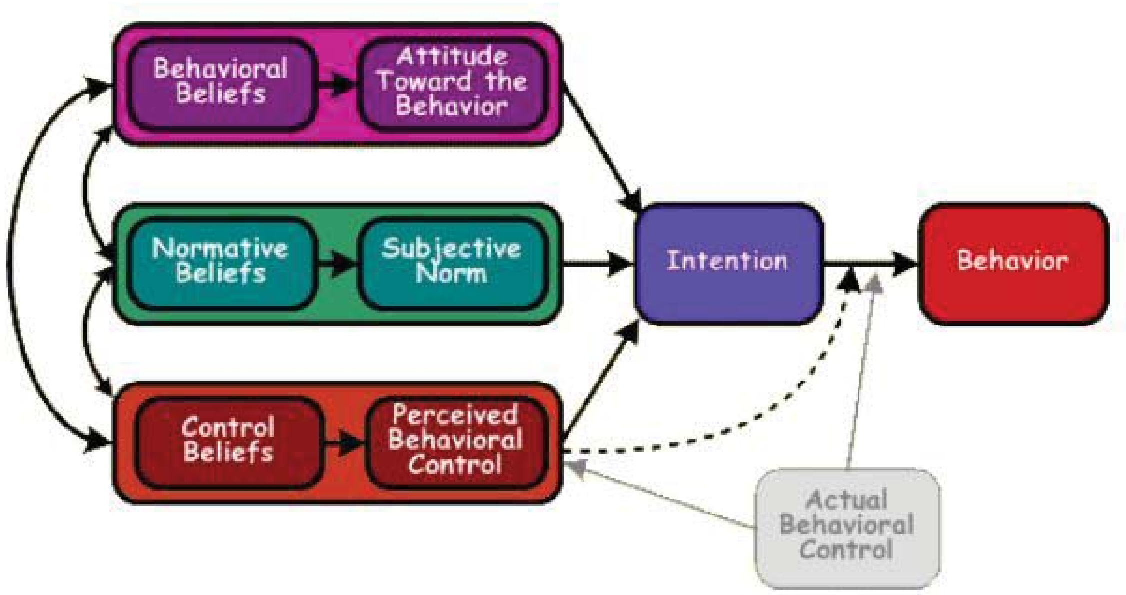


Figure 2.2 Theory of planned behaviour (Ajzen, 2002)

According to the refined concepts of the TPB, behavioural beliefs refer to an individual's views about the probable consequences of the behaviour and the assessments of these outcomes. Normative beliefs refer to expectations of others and the willingness to comply with these expectations, while control beliefs refer to an individual's beliefs about the presence of factors that may facilitate or impede performance of the behaviour and the perceived power of these factors. The TPB makes several assumptions, for example:

- If attitudes toward a behaviour and subjective norms regarding that behaviour are positive, then the individual will be more likely to form an intention to perform the behaviour.
- If an individual feels they have control over a behaviour, then the individual will be more likely to perform the behaviour.
- If an individual can exert enough actual control within a given situation, then the individual will be more likely to fulfil the *behavioural intention*s.

The TPB is not without criticism. The model does not include some specific factors that may predict intentions and behaviour (Eagly, & Chaiken, 1993; Taylor, & Todd, 1995), the assumptions of the model that individuals will be motivated to perform certain behaviour may sometimes prove to be problematic (Taylor, & Todd, 1995).

2.4.3 Technology acceptance model (TAM)

Davis introduced the technology acceptance model (TAM) in three foundational papers (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Davis Jr, 1985). Using the TRA as a base, the TAM was developed to explain and predict behaviour related to technology adoption and use. It seeks to explain the impact of external factors on an individual's personal beliefs, attitudes, intentions, and actions, which are important elements in the model (Figure 2.3).

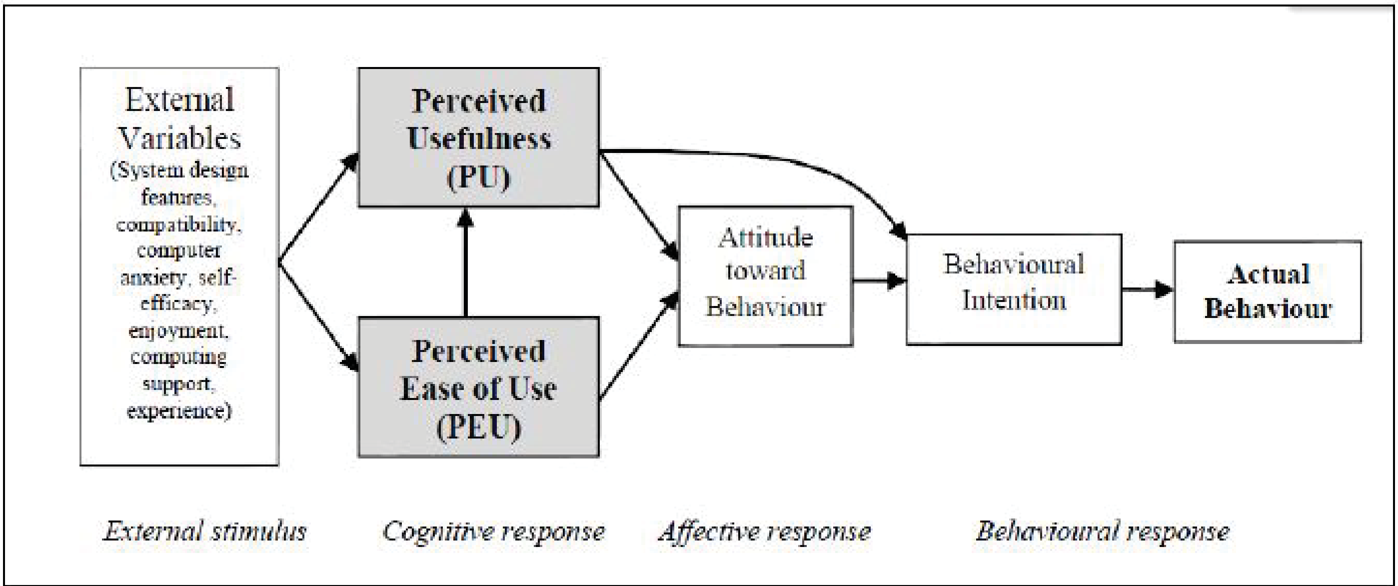


Figure 2.3 Basic elements of the technology acceptance model (TAM) (Venkatesh, & Davis, 2000, pp. 186-204)

According to Davis, Bagozzi, & Warshaw (1989), several assumptions are considered in TAM:

- Individuals will behave in ways that increase their performance.
- Perceived usefulness will influence *behavioural intention*s regardless of whether attitudes toward adopting the new technology are positive or negative.
- The perceived usefulness of a technology positively impacts an individual's attitude toward using that technology and increases the likelihood that the technology will be used by the individual.

Diverse studies have been conducted into different aspects of ICT in education using TAM. Some of the research focused on teachers' attitudes towards adoption of ICT in education and its acceptance. Teo (2009) and Teo, Wong, and Chai (2008) used TAM to investigate the pre-service teachers' self-reported future intentions to use technology in Singapore and Malaysia. Yuen and Ma (2008) used TAM to explore teacher acceptance of e-learning technology. Teo (2010) and Teo, Lee, and Chai (2008), also using TAM, examined pre-service teachers' attitudes to computers, and, using TAM, Prieto, Migueláñez, and García-Peñalvo (2014) studied the acceptance of mobile technologies among primary education teachers of Castilla y León.

Some of the researchers focused on students' attitudes and their acceptance of ICT in education. S. Y. Park (2009) began an analysis of the TAM when attempting to understand university students' *behavioural intention* to use e-learning. Edmunds, Thorpe, and Conole (2012) studied student attitudes towards and use of ICT in course study, work and social activity using TAM. Edmunds et al. (2012) investigated student attitudes towards and use of ICT in course study, work and social activity using TAM, while Al-Adwan, Al-Adwan, and Smedley (2013) explored students' acceptance of e-learning in Jordanian universities the same way. S. Y. Park, Nam, and Cha (2012) used TAM to research university students' *behavioural intention* to use mobile learning.

Other studies to use TAM as a framework for the research considered work-related tasks with e-learning, and used TAM as a basis for hypothesising the effects of such variables on the use of e-learning (Masrom, 2007). N. Park, K.M. Lee, and Cheong (2007) examined the factors that influence instructors' adoption and use of an Internet-based course management system and tested the applicability of the TAM in the context of e-learning practices in higher education. N. Park, Roman, Lee, and Chung (2009) examined the factors that influence people's adoption and use of a digital library system and tested the applicability of the TAM in the context of developing countries.

Using TAM, Teo (2009) built a model to predict the level of technology acceptance by pre-service teachers at a teacher training institute in Singapore, while Padilla-MeléNdez, Del Aguila-Obra, and Garrido-Moreno (2013) examined perceived playfulness in the context of a blended learning setting and revealed existing gender differences. Persico, Manca, and Pozzi (2014) adapted TAM for use in the evaluation of methodological and technological innovations determined by the introduction of a new e-learning system in an Italian online university.

Despite the widespread use of the TAM, the model does have limitations, such as:

- The model is too simple with regard to definitions of usefulness and ease-of-use (Lee, Kozar, & Larsen, 2003).
- The model has limited predictive power (López-Nicolás, Molina-Castillo, & Bouwman, 2008; Sun, & Zhang, 2006).
- There lies inconsistency in the relationships between the major constructs of TAM (Sun, & Zhang, 2006).

- The model is criticised for eliminating social norms as a contributing factor to *behavioural intention*s, because in some cases social norms may exist where there is strong public opinion related to specific technology use (Lee et al., 2003; Susanto, Chang, Zo, & Park, 2012).

Limitations of TAM made it vulnerable to inaccuracies in terms of identifying the current conditions of ICT adoption in Saudi primary schools. More complex factors, such as *facilitating conditions*, *social influence*, and *cultural factors* remain unexplored. Additionally, as discussed in the imitations to this study, the presence of inconsistency in the relationships among major constructs can be critical to the use of technology in education, as education is intrinsically a complex process. Therefore, consistency among factors is highly desirable. Considering the limitations and weaknesses of TAM, the theory was not used for this study. Furthermore, TAM has been improved with two more versions to overcome some of the limitations, and these models are discussed below.

2.4.4 Technology acceptance model 2 (TAM 2)

TAM has always been a popular model and extensively used, which has resulted in further refinements over many years. The model was refined and modified in 2000 by Venkatesh and Davis (2000), and designated TAM 2. TAM 2 is more complex than the original TAM (Figure 2.4). In TAM2 additional constructs, such as image, job relevance, output quality and result demonstrability have included to perceived usefulness. These additional constructs usually influence the perceived usefulness of a new technology that might be adopted by members of an organisation.

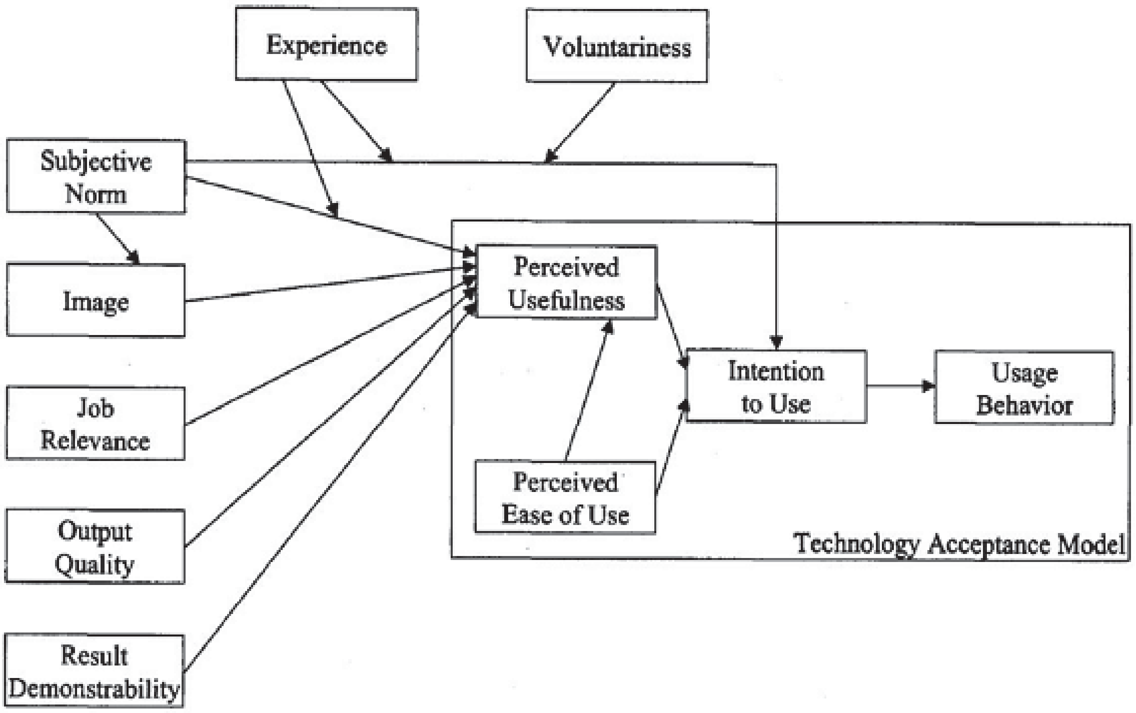


Figure 2.4 The extended technology acceptance model (TAM 2) (Viswanath, Venkatesh, & Davis, 2000, p. 186-204)

Venkatesh and Davis (2000) explored the idea that TAM2 has more predictive power than TAM, and it is able to explain 60% of user adoption of new technology. Güllü, Kuusik, Shogenov, Laanpere, Oysal, Sözcü, & Parlak (2016) have investigated the adoption of e-learning using TAM2 and found this modelling approach can successfully explain the use of e-learning technology among university teachers in Turkey. TAM2 has been implemented in other areas of technology adoption, and found to be meaningful for many cases (Luo, & Remus, 2014).

Like TAM, TAM 2 has several limitations and weaknesses. One major criticism of TAM2 is that this model failed to explore additional contrasts that might influence perceived ease of use, where it only added new constructs for perceived usefulness. Furthermore, yet after modifications, TAM 2 yet missing crucial factors such as *facilitating conditions* (Hillmer, 2009).

2.4.5 Technology acceptance model 3 (TAM 3)

To address the deficiencies in the TAM2 model, Venkatesh and Bala (2008) modified the model again to develop a third version of the model named TAM3. This model aided the understanding of factors influencing technology users' perceptions of a technology's usability.

Figure 2.5 presents the TAM3 model. The illustration shows that the biggest difference between TAM2 and TAM3 is the inclusion of anchors and adjustments. Here, anchors refer to pre-existing personal beliefs regarding computer and technology usage, and adjustments refer to system characteristics that can change over time depending on the experience of an individual.

Through the integration of anchors and adjustments, Venkatesh and Bala (2008) better explained the perceived ease of use, which was previously not elaborated in TAM and TAM2. This model shows overall improvement in considering the complex phenomena of modern technology. Each sub-item of anchor and adjustment are relevant to an individual's use of new technology. Agudo-Peregrina, Hernández-García, & Pascual-Miguel (2014), investigated the use of TAM3 in the e-learning environment, and found the model can explain more than 50% of adoption behaviour.

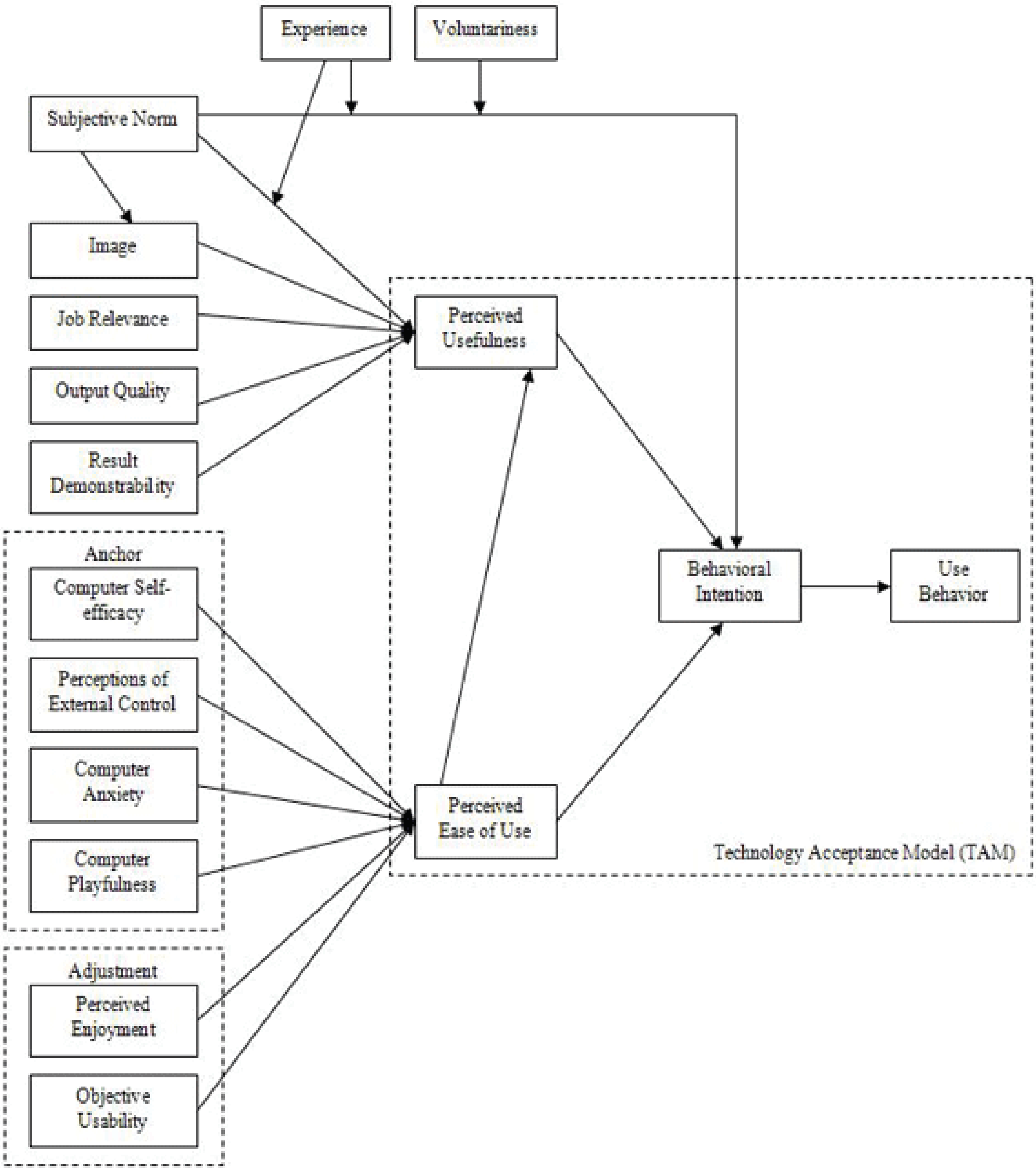


Figure 2.5 The TAM3 [Technology acceptance model 3 (Venkatesh, & Bala, 20133)]

Wook, Yusof, and Nazri, (2017) have investigated educational data mining acceptance, and found, using TAM3, that the acceptance of data mining by undergraduate students can be explained successfully. In line with TAM and TAM2, TAM3 is not comprehensive, despite the fact that more constructs and explanatory variables have been added to the modelling process. Yet this lack issues addressing *social influence*, facelifting conditions, and *cultural factors*, which are critically important and relevant to the adoption of ICT in the educational sector (Lin, Lu, & Liu, 2013; Wrycza, Marcinkowski, & Gajda, 2017; Bervell, & Umar, 2017).

2.4.6 Unified theory of acceptance and use of technology model (UTAUT)

The UTAUT was developed by Venkatesh, Morris, Davis, & Davis (2003) to present a more complete picture of the acceptance process by consolidating and unifying numerous technology adoption models. Elements from eight individual models were unified in the UTAUT:

- TRA, TPB, TAM
- combined model of TAM and TPB (C-TAM-TPB)
- the model of personal computer utilisation (MPCU)
- diffusion of innovation theory (DOI)
- social cognitive theory (SCT)
- motivational model (MM).

UTAUT is a summary of current models regarding the acceptance of new technology. Figure 2.6 illustrates the UTAUT model. Using the figure, individual elements of the model and their directional interaction with one another can be demonstrated. The major constructs in this model are *performance expectancy*, *effort expectancy*, *social influence*, and *facilitating conditions*.

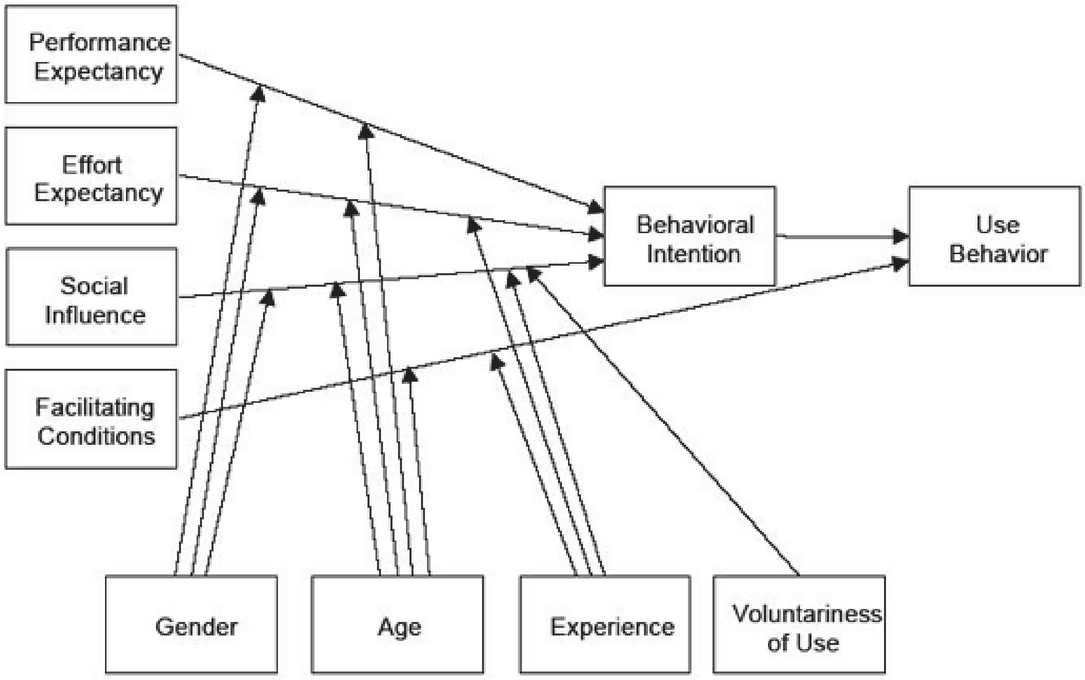


Figure 2.6 Diagrammatic representation of UTAUT (Venkatesh et al., 2003, p. 447)

The UTAUT model has some advantages over other models, in particular where new technology growth is slower than expected. It incorporates other models within the field which enables the investigation of the diverse factors that influence an individual's behaviour compared with other models. This feature of multiple factors to test is critical in the Saudi Arabian context since the behaviour of teachers and students at primary level is influenced by many external factors.

Moreover, UTAUT incorporates additional factors with which to consider dynamic aspects and demographic characteristics of individuals, such as, user experience, age and gender. Such incorporation and addition in UTAUT has increased its comprehensiveness and divergence. Additionally, this model has the scope to add new constructs, such as *external barriers* or *cultural factors*. Thus, this model could also overcome the shortcomings of other models that are not capable of addressing diverse individual and cultural contexts, as seen within the Saudi Arabian primary school sector.

Some researchers focused on the acceptance of ICT in education and its adoption. Birch and Irvine (2009) explored the factors that influence pre-service teachers' acceptance of information and communication technology (ICT) integration in the classroom using UTAUT. Šumak, Polancic, and Hericko (2010) studied the acceptance of e-learning technology or service by students and teachers using UTAUT and found the behaviour of the students and teachers indicative of successful learning and teaching after the adoption of e-learning technology. Dulle and Minishi-Majanja (2011) analysed the acceptance and usage of open access websites within public universities in Tanzania. The researchers were guided by UTAUT, and the model provided valid evidence of the level of usage of open access facilities in public universities.

Pynoo, Devolder, Tondeur, Van Braak, Duyck, & Duyck (2011) investigated secondary school teachers' acceptance of a digital learning environment using UTAUT, while Gögüs, Nistor, and Lerche (2012) used UTAUT to study educational technology acceptance across cultures, and explored the use of UTAUT as a model for testing other cultural factors. Oye, Iahad, and Ab Rahim (2013) applied the UTAUT model in order to understand the acceptance and use of ICT by Nigerian University Academics, Attuquayefio and Addo (2014) studied the acceptance of ICT among students of tertiary institutions in Ghana. Raman, Don, Khalid, and Rizuan (2014) studied the usage of the learning management system (Moodle) among postgraduate students using UTAUT. Raman, Don, Khalid, Hussin, et al. (2014) studied the acceptance of the smart board among teachers in Terengganu using the UTAUT model.

Thus, the use of the UTAUT model has been demonstrated to be applicable in investigating technology acceptance in an education environment (Kocaleva, Stojanovic, & Zdravev, 2014; Wong et al., 2013). Additionally, the literature discussed above confirms the usefulness of this model in research related to the adoption of ICT in education with special emphasis on factors affecting its adoption. Therefore, UTAUT was considered for this study, as it focuses on the uptake of ICT facilities within different cultural contexts and in diverse education systems.

Table 2.2 Summary of the theories of technology acceptance

Theory/ Model	Developer	*Constructs*	Status	Definition
Theory of Reasoned Action (TRA)	Fishbein and Ajzen (Ajzen, & Fishbein, 1980; Fishbein, 1979; Fishbein, & Ajzen, 1975)	*Attitude toward behaviour*	-	An individual's positive or negative feelings (evaluative affect) about performing the target behaviour
		Subjective norm	-	The person's perception that most people who are important to him think he should or should not perform the behaviour in question
		Behavioural intention	-	A measure of the strength of one's intention to perform a specified behaviour
Theory of planned behaviour (TPB)	Ajzen (Ajzen, 1985, 1991)	*Attitude toward behaviour*	Adopted from TRA	Individual's beliefs about the likely outcomes of the behaviour and the evaluations of these outcomes
		Subjective norm	Adopted from TRA	Expectations of others and motivation to comply with these expectations
		Perceived behavioural control or control beliefs	-	An individual's beliefs about the presence of factors that may facilitate or impede performance of the behaviour and the perceived power of these factors
		Behavioural intention	Adopted from TRA	A measure of the strength of one's intention to perform a specified behaviour
Technology acceptance model (TAM)	Davis (Davis, 1989; Davis et al., 1989; Davis Jr, 1985)	*Perceived usefulness*	-	The degree to which a person believes that using a particular system would enhance their job performance
		Perceived ease-of-use	-	The degree to which a person believes that using a particular system would be free of effort
		Attitude toward behaviour	Adopted from TRA	An individual's positive or negative feelings (evaluative affect) about performing the target behaviour
		Behavioural intention	Adopted from TRA	A measure of the strength of one's intention to perform a specified behaviour
Technology acceptance model 2 (TAM 2)	Venkatesh and Davis (Viswanath Venkatesh, & Davis, 2000)	*Perceived usefulness*	Adopted from TAM	The degree to which a person believes that using a particular system would enhance their job performance
		Perceived ease-of-use	Adopted from TAM	The degree to which a person believes that using a particular system would be free of effort
		Subjective norm	Adopted from TRA	The person's perception that most people who are important to him think he should or should not perform the behaviour in question
		Voluntariness	-	A moderating variable to distinguish between mandatory versus voluntary compliance with organisational settings
		Experience	-	The person's experience of use
		Image	-	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system
		Job relevance	-	The degree to which the target system is applicable to their job
		Output quality	-	The degree to which an individual believes how well the system performs their tasks
		Result demonstrability	-	The tangibility of the results of using the innovation
		Behavioural intention	Adopted from TRA	A measure of the strength of one's intention to perform a specified behaviour

Theory/ Model	Developer	*Constructs*	Status	Definition
Technology acceptance model 3 (TAM 3)	Venkatesh and Bala (Venkatesh, & Bala, 2008)	*Perceived usefulness*	Adopted from TAM	The degree to which a person believes that using a particular system would enhance their job performance
		Perceived ease-of-use	Adopted from TAM	The degree to which a person believes that using a particular system would be free of effort
		Subjective norms	Adopted from TRA	The person's perception that most people who are important to him think he should or should not perform the behaviour in question
		Voluntariness	Adopted from TAM 2	A moderating variable to distinguish between mandatory versus voluntary compliance with organisational settings
		Experience	Adopted from TAM 2	The person's experience of use
		Image	Adopted from TAM 2	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system
		Job relevance	Adopted from TAM 2	The degree to which the target system is applicable to their job
		Output quality	Adopted from TAM 2	The degree to which an individual believes how well the system performs their tasks
		Result demonstrability	Adopted from TAM 2	The tangibility of the results of using the innovation
		Computer literacy	-	The degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer
		Perception of external control	-	The degree to which an individual believes that organisational and technical resources exist to support the use of the system
		Computer anxiety	-	The degree of 'an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers
		Computer playfulness	-	The degree of cognitive spontaneity in microcomputer interactions
		Perceived enjoyment	-	The extent to which 'the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use
		Objective usability	-	Comparison of systems based on the actual level (rather than perceptions) of effort required to completing specific tasks
		Behavioural intention	Adopted from TRA	A measure of the strength of one's intention to perform a specified behaviour
Unified theory of acceptance and use of Technology (UTAUT)	Venkatesh, Morris, Davis and Davis (Viswanath Venkatesh et al., 2003)	*Performance expectancy*	Adopted from perceived usefulness in TAM	The degree to which an individual believes that using the system will help him/her to attain gains in job performance
		Effort expectancy	Adopted from perceived ease-of-use in TAM	The degree of ease associated with the use of the systems
		Social influence	Adopted from social norm in TRA	The degree to which an individual perceives that important others believe he or she should use the new system

Theory/ Model	Developer	*Constructs*	Status	Definition
		Facilitating conditions	Adopted from perceived behavioural control in TPB and DTPB	The degree to which an individual perceives that important others believe he or she should use the new system
		Behavioural intention	Adopted from TRA	A measure of the strength of one's intention to perform a specified behaviour

2.5 Summary of the chapter

This chapter presented a review of the literature related to this research. Firstly, the chapter provided a context for understanding ICT in education within the present study by defining ICT and its evolution. Then ICT in education was discussed to understand the effectiveness of ICT in learning and teaching different subjects at different levels. Next the potential of and barriers to ICT integration into education for principals, teachers and students were discussed.

Case studies of ICT adoption in primary and secondary schools in four countries – Australia, the United kingdom, South Africa, and Kuwait – were used to illustrate how ICT is being brought into the classroom in different countries, economies and cultural contexts. These discussions and case studies helped to form a foundation for understanding the development of this research's concepts regarding ICT in education. The chapter also identified and discussed the main theories related to innovation and technology adoption that helped to select the best model for this research.

Several initiatives, including plans, programs and projects (NTP 2020) to ensure the successful integration of ICT with teaching and learning processes have been discussed. Regardless of massive spending and support by the Saudi government to incorporate ICT in education, there is still a real gap between the availability of ICT technology in Saudi schools and methods of implementation. To find out the factors affecting the adoption of ICT in education in Saudi Arabia, several studies have been undertaken from which it can be understood that a number of barriers are making it difficult to integrate ICT into the Saudi education system. Most of these studies have focussed on secondary and higher education, leaving primary education unexplored. Thus, in this current research, through some conceptual models, issues related to the adoption of ICT in primary education have been investigated.

Chapter 3 describes the conceptual research models representing adoption of ICT by principals, teachers and students in Saudi Arabian primary schools proposed on the basis of UTAUT, as well as the related hypotheses developed to test the modelled relationships.

Chapter 3

Research model and hypotheses development

This chapter introduces the research model and the related hypotheses that were formulated to address the research questions. Initially a brief discussion addresses the unified theory of acceptance and use of technology (UTAUT) model and its relevance to ICT use in primary school. The later sections of the chapter describe the possible hypotheses in relation to the UTAUT model for ICT adoption in the primary schools of Saudi Arabia. Additional constructs were added to the proposed models to address the unique context of Saudi Arabia. Twenty-nine hypotheses were proposed for three models, one model for the principals, one for the teachers and one for the students.

3.1 Research model

A rigorous search of the existing literature indicated that there are no established models relating to the successful adoption of ICT in Saudi Arabian primary schools. While several studies have been conducted using qualitative and quantitative analyses (as discussed in section 2.7.7 and 2.7.9), they have not used multilevel structural equation modelling (SEM) for data related to primary schools in Saudi Arabia (More discussion on reasons for selecting SEM model are presented in the Methodology chapter). Therefore, in order to address this gap in the body of knowledge new models were developed and are presented here. These models were subsequently tested for principals (head of school), teachers and students.

The UTAUT model, developed by Venkatesh, Morris, Davis, and Davis (2003) (Figure 3.1) was proposed as a starting point for this investigation. Combined with the basic elements of this model, new variables associated with the Saudi context and education were introduced. It was expected that the model would examine the relationships between different variables and find factors essential for the improvement of ICT use in primary schools in Saudi Arabia.

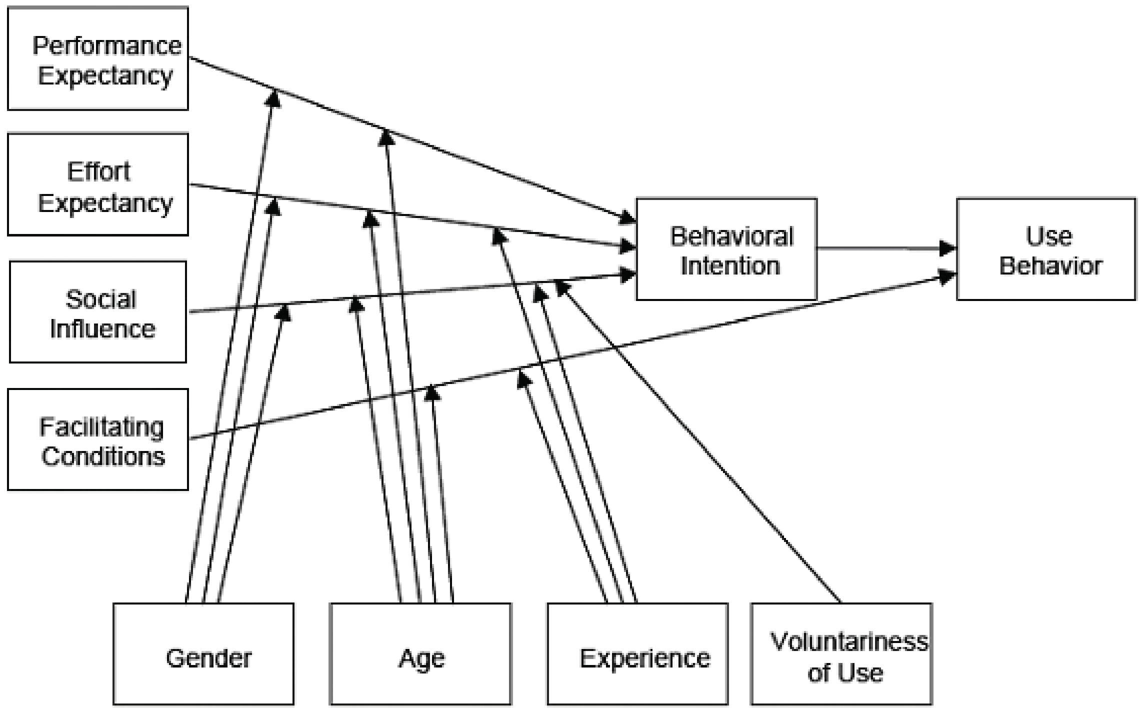


Figure 3.1 UTAUT model developed by Venkatesh et al. (2003)

As presented in Figure 3.1, the basic model variables (represented by the rectangles on the left side of the image) are:

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

In this model, gender, age, experience and voluntariness of use are often seen as moderator variables based on different situations. While the UTAUT model accommodated various situations, it could not express all the factors affecting ICT integration in a Saudi Arabian context, including culture (i.e., Islamic values) and barriers external to the school institution, which play a vital role in ICT use in primary schools in Saudi Arabia. External barriers naturally vary between the stakeholders of such a model (i.e., principals, teachers and students). Considering the culture, *external barriers* and the basic constructs of the UTAUT model, new hypotheses and models have been proposed for principals, teachers and students. It was these hypotheses and augmented models that were tested during the course of this study.

3.1.1 Major constructs of the model

In this section, brief definitions and the inferences of the four core constructs (*performance expectancy*, *effort expectancy*, *social influence* and *facilitating conditions*) of the model regarding ICT acceptance for primary school principals, teachers and students are discussed. These core constructs were common for all stakeholders in the study. Additionally, the theoretical concepts were the same, yet each core construct had variations in definition and functionality based on the particular group under consideration, i.e., principal, teacher, student, and their activities.

Performance expectancy of ICT use. *Performance expectancy* describes the individual belief that using the system will help an individual attain gains in job performance. As identified with the UTAUT model, *performance expectancy* has a significant effect on users' *behavioural intention* to use the technology (Attuquayefio, & Addo, 2014; Fathema, Shannon, & Ross, 2015; Park, 2009). *Performance expectancy* is the function, in this case, that indicates the anticipated improvement of performance (Venkatesh et al., 2003) in school activities as a result of using ICT facilities in administrative and teaching processes. ICT can contribute in delivering more effective teaching in terms of lesson delivery and student understanding. Other sources available via the Internet, for example, can be used to augment their understanding of important concepts, ideas and facts: interactive websites such as BBC Schools (http://www.bbc.co.uk/education/highlights) or Educational YouTube videos (Goundar, 2011; Jones, & Cuthrell, 2011; Bingimlas, 2017). In general, given the lack of technical support and the difficulties faced by the principals and teachers in the use of ICT in Saudi Arabia, *performance expectancy* is likely to still be aspirational in the short term, but for students ICT adoption in the classroom would be a new way to explore their potential and gradually improve their performances (Al Mulhim, 2014; Alhawiti, 2013; Alwani, & Soomro, 2010).

Therefore, it can be assumed that for all groups (principals, teachers and students) the perception of improved performance through the use of ICT would lead to a positive attitude toward the use of ICT in academic, administrative, teaching and learning processes.

***Effort expectancy* of ICT use.** *Effort expectancy* represents the amount of effort the users expect it will take to use a technology (Bingimlas, 2009; Teo, 2011). *Effort expectancy* will either match the expected degree of difficulty or users will find the use of the technology more or less difficult than they expected. The easier the technology is to use, the more the user will use it (Park, 2009; Teo, 2011).

The *effort expectancy* for principals refers to the perception of effort required for principals to use the technology in their daily school activities (Bingimlas, 2009). The UTAUT model and related research have demonstrated that *effort expectancy* has a significant effect on users' *behavioural intention* and acceptance of ICT and its extended and sustained usage (Fathema, Shannon, & Ross, 2015; Park, 2009; Venkatesh et al., 2003).

In the Saudi Arabian school system, a lack of technical support and the low level of ICT competence among primary school principals makes the implementation of ICT difficult (Bingimlas, 2017; Alwani, & Soomro, 2010). In addition, for teachers, the lack of access to technology, the lack of training and the lack of time, all lead to a discouraging *effort expectancy* (Al Mulhim, 2014; Alhawiti, 2013). Nevertheless, it was anticipated that this study might show that if the perceived difficulties involved in using ICT at the primary level proved unwarranted, *effort expectancy* could change. While the existing difficulties in Saudi Arabia might lead to a perception that it is hard to use ICT at primary school level, if the primary school principals could experience ICT and find it easy to use, they would be likely to find the technology useful and develop a positive *behavioural intention* to expand ICT in their schools. The same would be expected to hold true for the teachers.

The same expectation would apply to students. The easier it was to use the technology, especially if the students had anticipated that the effort would be greater, the more effective student learning would be. In Saudi Arabia, it has been observed that students at different levels of studies (i.e., higher study, secondary study) have been influenced by the ease of use of the technology. Their attitude toward the use of ICT could possibly lower the *effort expectancy* of primary school students (Nassuora, 2012).

***Social influence* on ICT use.** *Social influence* describes the explicit or inherent belief that the individual's behaviour is influenced by the way in which they consider others will view them as a result of using the technology (Venkatesh et al., 2003). The influence groups or influencing environment would be different for different stakeholders. In case of primary school principals, they could be a leader in introducing ICT in the schools and encouraging the teachers to use it in class. However, their acceptance of ICT would be influenced by their colleagues, other schools' principals, and perhaps even the students. Additionally, they would be influenced by the management committee members of their school, as well as the parents. Therefore, *social influence* would be a very important consideration in understanding a principal's intention to use ICT. Their surroundings are complex, and the people influencing their choices would be critical.

In contrast, primary school teachers have different *social influence* groups, and are linked directly with the students and the environment in the school. It is the teachers who are responsible for the use of ICT in their classes. Teachers' *social influence* includes the ICT uses of their colleagues (including the intense, often official, influence of the principals), and also their family and friends (Kreijns, Van Acker, Vermeulen, & Van Buuren, 2013). If the environment in the school is technology oriented, it is highly possible that the teachers would like to use technology in the classroom to make study more attractive and easy (Birch, & Irvine, 2009; Teo, 2011).

The third stakeholder group is the student group, and students are the target of ICT use in the primary schools. Therefore, the surrounding people/peers influence them the most (Blatchford et al., 2015; Šumak, Polancic, & Hericko, 2010; Wong, Teo, & Russo, 2013). The *social influence* on the students includes the ICT activities of their friends and family members mostly. However, teachers also play a vital role in influencing the attitude of the students. If the students are surrounded by friends who are technology savvy, it is highly possible that technology in the classes will be accepted. Even for homework, the students would probably like to have ICT software such as MS *Word* or *PowerPoint* and the devices on which they could be run (Blatchford, Pellegrini, & Baines, 2015).

The evidence is, therefore, that if there is positive attitude associated with the use of ICT in the school among some of stakeholders, such as respected teachers, it is likely that this positive attitude and their promotion of ICT would positively influence the attitude of teachers, students or principals who have not used ICT.

***Facilitating conditions* and their influence on ICT use.** The integration of ICT in primary school by the principals very much depends on the resources and technical assistance (or *facilitating conditions*) that schools have, e.g., the provision of ICT resources, including hardware and software, and continued technical support (Bingimlas, 2009; Kidombo, Gakuu, & Ndiritu, 2009; Papaioannou, & Charalambous, 2011). Previous studies have concluded that *facilitating conditions* greatly influence user adoption of technology, in this case, principals, teachers and students (Pajo, & Wallace, 2001; Panda, & Mishra, 2007; Teo, Lee, & Chai, 2008).

Pelgrum (2001) has indicated that lack of both hardware and software result in low adoption rates of the Internet and ICT in different countries around the world. Lack of dedicated ICT facilities is one of the major barriers to the adoption of ICT, as poor facilities, poorly maintained hinder access to ICT and prevent the learning that comes from regular usage (Buabeng-Andoh, 2012). Many other studies have also concluded that proper and functional provision of ICT facilities ensures access to ICT by teachers and students, and overcomes resistance to their use. Afshari, Bakar, Luan, Samah, & Fooi (2009) has noted that teachers with computer facilities in their schools and class are more likely to use computers, than teachers who do not have computer facilities. It has also been found that the facilitation of technology adoption and use also has a significant effect on users' *effort expectancy* (Fathema et al., 2015; Teo, 2010; Teo et al., 2008) and their *behavioural intention* (Fathema et al., 2015; Ngai, Poon, & Chan, 2007; Teo, 2010).

In Saudi Arabia, current use of technology by principals, teachers and students is very low due to inadequate *facilitating conditions*. Al Mulhim (2013) conducted a survey of 135 Saudi teachers and found the 68.1% of the respondents indicated they did not have adequate access to digital technologies in the school, which had resulted in low ICT use in their teaching. It is telling that Al Mulhim's 2013 study supported a study conducted by Al-Rashed (2002) 11 years earlier. Al-Rashed conducted a survey on 652 Saudi teachers to explore the reasons for low ICT usage in their classes, and found more than 70% of the teachers reported that they did not use ICT in their classes, as facilities such as the Internet, computers, and educational software were not available.

Lack of access to technology, including computers and the Internet (Al Mulhim, 2013; Alhawiti, 2013), and the lack of ICT resources, including maintenance and technical assistance, have been identified as the main barriers preventing the deployment of ICT for students in Saudi Arabia (Albugami, & Ahmed, 2015; Nassuora, 2012; Šumak, Polancic, & Hericko, 2010). The majority of the literature discussed in this section argued that the provision of adequate and proper ICT facilities is the prerequisite for successful ICT integration at any level of education. Thus, it was expected for this study that the relation between *facilitating condition* and *behavioural intention* to use ICT would be interesting to explore using the proposed models discussed in the following sections.

3.2 Hypotheses and model development for school principals

In this section, the hypotheses related to the intention to use ICT and *actual use* by the principals are presented, along with the proposed conceptual model for the primary school principals.

3.2.1 Hypotheses related to core constructs of the UTAUT model

Based on the core constructs discussed in the previous section and the investigation of adoption strategies discussed throughout Chapter 2, four related hypotheses have been formulated in relation to the principals.

These were:

H_1: Primary school principals' performance expectancy of ICT has a significant positive relation with behavioural intention to use ICT.

H_2: Primary school principals' effort expectancy of ICT use has a significant positive effect on their behavioural intention to use ICT.

H_3: Positive social influence on the primary school principals has a significant positive effect on their behavioural intention to use ICT.

H_4: ICT facilitating conditions have a significant positive relation with primary school principals' behavioural intention to use ICT.

3.2.2 Additional constructs for principals

In addition to the core constructs of the UTAUT model, some other constructs were identified based on the literature and study area, and the related hypotheses for them are discussed in the following sections.

Cultural factors. Islamic culture is dominant in Saudi Arabia; it is embedded in political, public and private life for the majority of Saudi citizens and therefore has an impact on education and the institutions that provide education. As a result, *cultural factors*, such as *power exercise, social collectiveness, uncertainty avoidance,* and *masculinity/femininity*, influence the behaviour of the principals, as they are a major part of the social system (Al-Gahtani, 2004; Aldraehim, Edwards, Watson, & Chan, 2013; Lee, Trimi, & Kim, 2013).

In this case, *power exercise (*also termed as *power-distance)* implies how the principals operate and make decisions in the institution. A position of power enables principals in Saudi schools to act without the need to provide any justification to peers or colleagues. They follow administrative guidelines and act based on their personal motivation, which may be influenced by Saudi law and culture as it relates to such issues as respect for authority, justice and accountability. It is not common to find in Saudi institutions a culture open to new ideas or the power distance more equally distributed within and outside the organisation (as would be common in many developed countries, where people in power still have to justify their decisions). In Saudi Arabia, power distance among individuals in the hierarchy is far greater and the difference is generally keenly felt (Hofstede, 1984; Cassell, & Blake, 2012).

Social collectiveness indicates whether a principal wants ICT implementation to be conducted as a top down exercise or whether they feel that all of the members of the school committee and the teachers should collectively be active in the implementation process (Ringov, & Zollo, 2007; Obeidat, Shannak, Masa'deh, & Al-Jarrah, 2012). Cassell and Blake (2012) indicated that Saudi culture promotes more social collectiveness, and that Saudis are more focused on tradition, collaborative work, and tend to believe that fate determines results. Given these cultural attitudes, it is likely that principals would also like to integrate ICT in their school with the collaboration of all teachers and management authority, with whom they experience a power distance themselves.

Uncertainty avoidance is the degree to which the members of a society feel uncomfortable with uncertainty and ambiguity' (Hofstede, 1984, p. 83). In the case of this study, it includes issues related to uncertainty and a structured or non-structured working environment when implementing and using ICT facilities in primary schools. As the results are untested in primary schools in Saudi Arabia, the principals would not be sure about what they might face, which could influence their decisions regarding the introduction of ICT in their schools. This is important, because, as previously explained by Cassell and Blake (2012), the Saudi people are uncomfortable with uncertainty in their activities, thus there are in place strong laws, rules and police enforcement.

Masculinity/femininity is one important aspect of cultural effects on behaviour. As described by Hofstede (1984),

> *Masculinity versus its opposite, femininity refers to the distribution of emotional roles between the genders which is another fundamental issue for any society to which a range of solutions are found. This fundamental issue addressed by this dimension is the way in which a society allocates social (as opposed to biological) roles to the sexes. (p. 84)*

In the case of Saudi Arabia, the society is more feminist in nature, where people value good relations with supervisors, value cooperation and try to keep good relations as a whole (Cassell, & Blake, 2012). In this study, this feminine/bonding element in the society might influence the behaviour of the principals and teachers when implementing ICT in their schools, as the principals may take more initiatives if they get more support from their colleagues.

Apart from the cultural influence of the *masculinity/femininity* elements of Saudi society, Saudi Arabia is unique in terms of male-female activities, operation and social mixing. Given the background of Islamic law and order, the role of females in society is circumscribed, which could affect the strategy for ICT adoption, given that males and females are taught separately. This means that *masculinity/femininity* is likely to be a critical factor in ICT adoption.

On the whole, principals are responsible for several school and related social activities; therefore they have to make a variety of decisions, and cultural considerations play a vital role in these decisions. Additionally, these cultural influences may have connections to the *external barriers* the principal faces. Thus, the following hypotheses were formulated:

H_5: *There is a significant relationship between culture and behavioural intention to use ICT in school for the principals.*

H_6: *There is a significant relationship between culture and external barriers to use ICT in school for the principals.*

External barriers. External barriers are common for principals in a school; they are directly connected with the school management committee, Ministry of Education and the parents. Additionally, they are very often in a position to make decisions regarding the use of ICT in schools. Conversely, they are also accountable should anything go wrong. However, the major *external barriers* they face are mostly concentrated on a lack of policy support, lack of funds, a lack of a technology-integration plan, lack of support from parents, and very often lack of ICT awareness among teachers, parents, the committee and even students (Vandeya, 2015; Alkahtani, 2017; Fu, 2013). Such a wide range of *external barriers* surely affects the extent of ICT usage in a school.

H_7: *External barriers have a significant effect on behavioural intention to use ICT in primary schools by the principals.*

Computer literacy of the principals. Without doubt, when an individual is computer literate, their skill and experience influences their intention to use any technology related to computers (Bingimlas, 2009; Fathema et al., 2015). If they are skilled and confident they can effectively operate the technology, they are highly likely to endorse or encourage the adoption of ICT in their school (Bandura, 1986; Bingimlas, 2009; Fathema et al., 2015). Such a construct would have a significant influence on the principals' *performance expectancy* (Fathema, & Sutton, 2013; Ong, & Lai, 2006; Park, Nam, & Cha, 2012;) and *effort expectancy* (Fathema et al., 2015; Ong, Lai, & Wang, 2004; Park, 2009). Al-Rashed (2002) suggested that lack of technological competence among educational practitioners caused lower adoption of ICT usage in Saudi Schools. These observations resulted in the following hypotheses to be proposed for this study:

H_8: Primary school principals' computer literacy has a significant positive effect on their performance expectancy of ICT use.

H_9: Primary school principals' computer literacy has a significant positive effect on their effort expectancy of ICT.

***System quality* for the principals**. *System quality* refers to the desired characteristics of the technology, its usability, availability, reliability, adaptability, and response time, which are related to the functions, speed, features, contents, and interaction capability of the technology (Bingimlas, 2009; Fathema et al., 2015). The quality of the system is one of the most important features of the technology if principals are going to adopt it. Without quality and flexibility in terms of using the facilities, users would not accept the technology in their day-to-day lives (Chen, & Yao, 2016). In this study, therefore, it has been assumed that for the principals of Saudi primary schools, *system quality* and flexibility would influence the intention to use ICT. Thus, the following hypothesis was developed:

H_{10}: System quality and flexibility has significant influence on behavioural intention to use ICT in primary schools by the principals.

3.2.3 *Behavioural intention* and *actual use* of ICT by the principals

According to the UTAUT, users' *behavioural intention* to use a technology influences their *actual use* (Venkatesh et al., 2003). In Saudi Arabia, principals do not demonstrate the intention to use ICT in general for school affairs. This prohibits the integration of ICT into the teaching environment (Alwani, & Soomro, 2010). Therefore, if the primary school principals were to develop a positive attitude towards ICT technology, then they would work to integrate ICT into the school system. Thus, the following hypotheses were developed:

H_{11}: *Principals' behavioural intention to use ICT has a significant relation to their actual use of ICT in school administration and academic activities.*

Considering all these hypotheses and constructs, a new model of ICT adoption for the principals has been proposed in Figure 3.2.

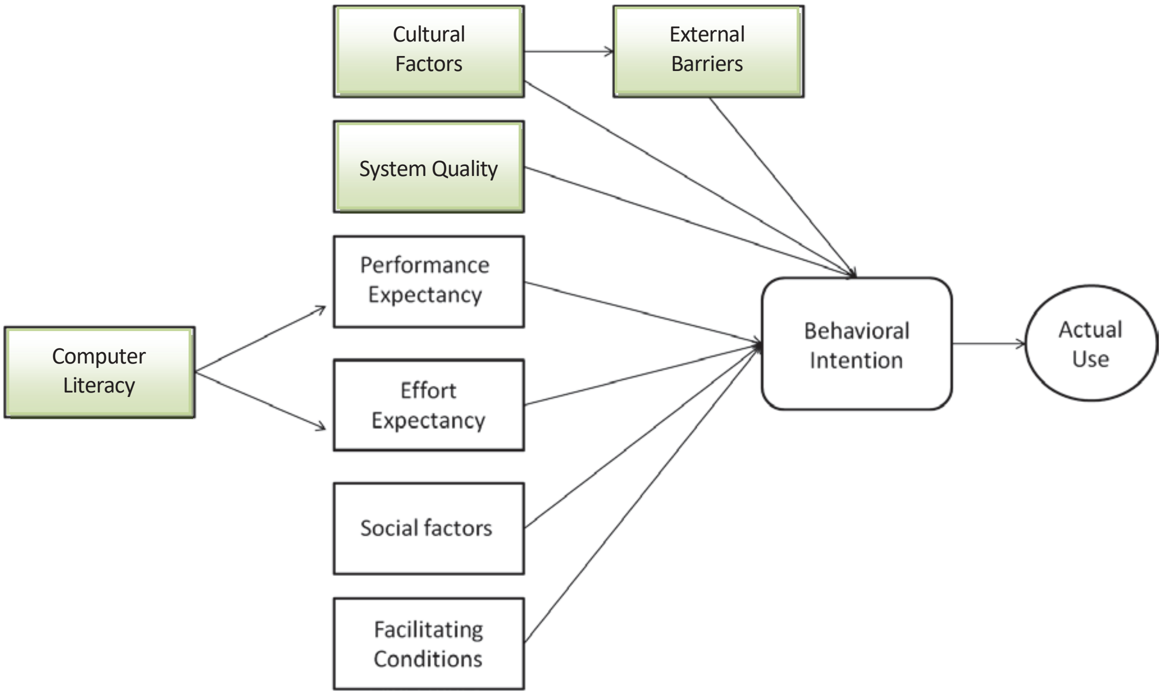


Figure 3.2 **Proposed ICT behaviour model for the principals of primary schools in Saudi Arabia [The sample had limitations regarding the number of female students and principals, thus the moderating factors have not been included in the main models.]**

Figure 3.2 illustrates the relations that have been hypothesised to determine the *behavioural intention* to use and adopt ICT facilities in primary schools by principals in Saudi Arabia. In this case, the proposed model also indicates additional variables that might influence the *behavioural intention* of the principals. Finally, the model assumes a direct relationship between *behavioural intention* and *actual use* behaviour on the part of the principals in terms of using ICT in Saudi primary schools.

3.3 Hypotheses and model development for primary school teachers

In this section, brief definitions and the inferences of the factors and related hypotheses regarding ICT acceptance amongst primary school teachers are presented. These ideas are related to one another, and the hypotheses only present the possible scenarios for the teachers.

3.3.1 Hypotheses related to core constructs of the UTAUT model

Based on the core constructs of the UTAUT model, four related hypotheses were formulated for teachers:

H_{12}: *Primary school teachers' performance expectancy of ICT has a significant positive effect on their attitude towards ICT.*

H_{13}: *Primary school teachers' effort expectancy of using ICT has a significant positive effect on their behavioural intention to use ICT.*

H_{14}: *Positive social influence on the primary school teachers has a significant positive effect on their behavioural intention to use ICT.*

H_{15}: *Facilitating conditions of ICT has a significant positive effect on primary school teachers' perceived ease of use of ICT.*

3.3.2 Additional constructs for teachers' conceptual model

In order to provide a better understanding of the exploration of ICT acceptance amongst primary school teachers, additional constructs, such as culture, *external barriers*, *computer literacy* and ICT *system quality*, were incorporated into the original UTAUT.

Cultural factors for the teachers. Given Islamic culture and Saudi administration, the social structure of the Saudi people is completely different from that of the Western nations considered by most ICT research. Saudi versions of *cultural factors* such as power distance, social collectiveness, uncertainty avoidance, and gender (greater details about these dimensions have been provided in 3.2.2) directly affect how teachers behave in the schools and how they like to use ICT in the class. Considering the social structure and cultural norms, teachers would be motivated to use ICT in classes, although the use would reflect Saudi culture.

H_{16}: *There is a significant positive relationship between culture and behavioural intention to use ICT in classes by the teachers.*

H_{17}: There is a significant relationship between culture and external barriers to use ICT in class by the teachers.

External barriers for teachers. Lack of professional training, lack of access to the Internet, and having insufficient time to use ICT are common barriers among the teachers (Al Mulhim, 2013; Almalki, & Williams, 2012; Al-Rashed, 2002). Additionally, they have to manage the students and also prepare the lessons; therefore without proper external support, it would be hard to use ICT on a regular basis. These *external barriers* would surely affect the extent of ICT use in the schools they are assigned to manage.

H_{18}: External barriers have a negative and direct effect on behavioural intention to use ICT in primary schools by the teachers.

The computer literacy of the teachers. *Computer literacy* is the individual's judgment of his or her capacity to use the computer efficiently, which is not only concerned with the skills one has, but with the judgments of what one can do with whatever skills one possesses (Bandura, 1986; Bingimlas, 2009; Fathema et al., 2015). In the case of teachers, this is their competence in using ICT facilities in preparing and delivering lessons, using the technology for school related communication and doing administrative tasks (Vitanova, Atanasova-Pachemska, Iliev, & Pachemska, 2015).

Computer literacy has a significant effect on users' *performance expectancy* (Fathema et al., 2015; Fathema, & Sutton, 2013; Park, 2009; Park et al., 2012; Yuen, & Ma, 2008) and *effort expectancy* (Compeau, Higgins, & Huff, 1999; Fathema et al., 2015; Park, 2009). Due to lack of access to technology, lack of training and lack of time, the teachers in Saudi Arabia find themselves inefficient in their use of ICT in teaching (Al Mulhim, 2013). Thus, if primary school teachers become computer literate and perceive that they are efficient in ICT, then they will find the technology easy and useful.

H_{19}: Primary school teachers' computer literacy has a significant positive effect on primary school teachers' performance expectancy of ICT use.

H_{20}: Primary school teachers' computer literacy has a significant positive effect on their effort expectancy of ICT.

***System quality* for the teachers.** *System quality* indicates the quality of the ICT systems available in primary schools for teaching and learning activities. The quality, in other words, functionality of ICT facilities effectively influences the perceived usefulness of using ICT, and if the facilities are not working properly or not easy to operate, it is highly likely that the teachers would be unwilling to use them on a regular basis (Bingimlas, 2009; Condie, & Livingston, 2007; Park, Nam, & Cha, 2012; Pituch, & Lee, 2006; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Efficient and smooth operation of ICT facilities can influence the users' attitudes toward using the technology (Venkatesh et al., 2003; Fathema et al., 2015; Shin, 2009), as well as modify the *behavioural intention*s to use technologies. Therefore, *system quality*, functionality, and operative capacity are crucial enablers of ICT adoption in education.

Unfortunately, in Saudi Arabia, teachers suffer from limited knowledge of the use and maintenance of ICT, as well as lacking the basic technical and pedagogical skills for using technology in teaching, both of which negatively influence their current use of ICT (Al Mulhim, 2013; Alhawiti, 2013). Alkahtani (2017) showed that, at the secondary education level in Saudi Arabia, the teachers have limited knowledge regarding *how the equipment functions*, and they found the systems hard to operate. Moreover, he found that lack of maintenance and recovery, once the facilities crash, was the most important reason for the unsuccessful adoption and use of ICT by teachers, since system unreliability and unavailability make the facilities unviable for learning and teaching or administrative work. It is highly likely that at the primary level, inadequate facilities would have the same effect on the teacher. Despite this, if the ICT system in a primary school possessed all the expected characteristics, such as ease of operation, regular maintenance, and proper technical support to run the system smoothly, then the teachers would probably find the system useful, effective, and efficient; and would develop a positive intention to use the system. Thus, the following hypothesis was developed.

H_{21}: System quality and flexibility has significant influence on behavioural intention to use ICT in primary schools by the teachers.

3.3.3 *Behavioural intention* to use ICT and *actual use* by the teachers

In Saudi Arabia, difficulties in using ICT in classrooms restricts the use of ICT in teaching (Al Mulhim, 2014; Alhawiti, 2013). If a primary school teacher develops a positive intention to use

ICT facilities, then they may attempt to use them to teach students as much as possible. Their positive *behavioural intention* to use ICT would increase the ICT uses in primary schools in Saudi Arabia, as long as the teachers were supported. Therefore, the following hypothesis was formulated:

H_{22}: Teachers' behavioural intention to use ICT has significant and direct relation with their actual use of ICT in their classes and teaching.

Considering all these hypotheses and constructs, a combined model of ICT adoption for the teachers was proposed (Figure 3.3). Although the model resembles the model for the principals in form, the items and questions under each construct are often slightly different from principals' model (discussed in details in the methodology chapter, Chapter 4). The items in the model differ according to the different levels of administration in the school and different responsibilities of the teachers and principals. There are, therefore, critical differences in measurements.

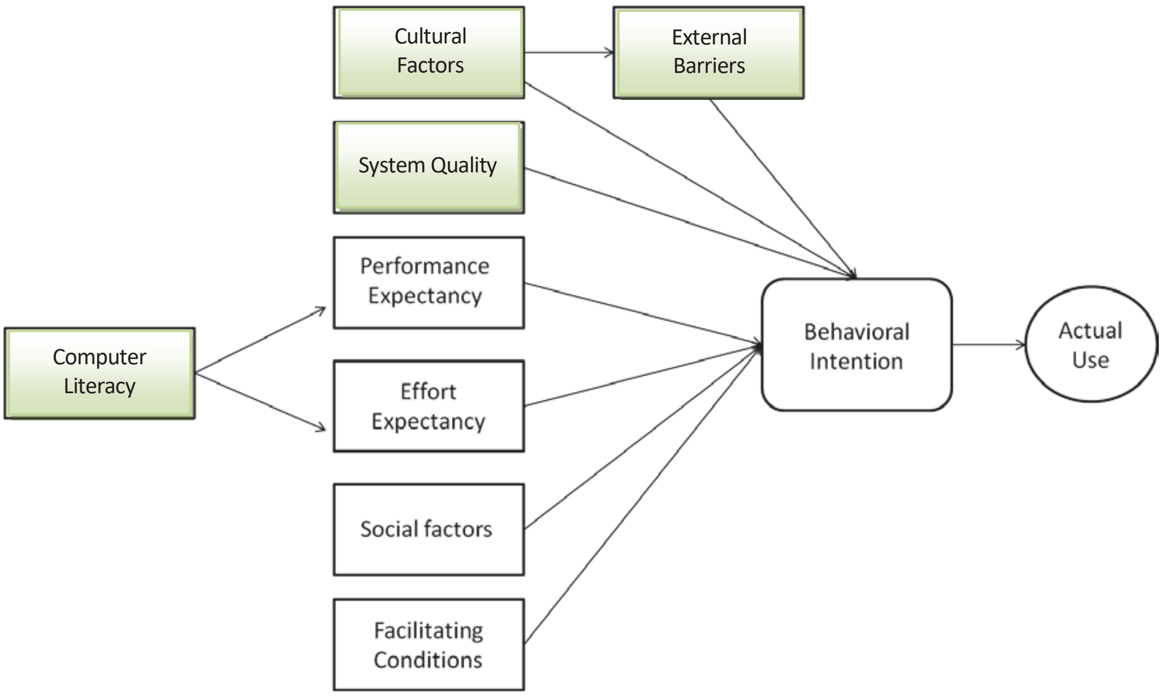


Figure 3.3 Proposed ICT behaviour model for the teachers of primary schools in Saudi Arabia

Like the principals' model, the teachers' conceptual model also demonstrates the relationships between *behavioural intention* and other independent constructs of the model.

3.4 Hypotheses and model development for primary school students

In the previous sections, the hypotheses and conceptual models have been proposed for principals and teachers. The following sections provide brief definitions and the inferences of the factors and related hypotheses regarding ICT acceptance amongst primary school students.

3.4.1 Hypotheses related to core constructs of the UTAUT model

Based on the core constructs (*performance expectancy, effort expectancy, social influence and facilitating conditions*) of the UTAUT model, several hypotheses for students' use and acceptance of ICT in primary schools were formulated:

H_{23}: Primary school students' performance expectancy of ICT has a significant positive effect on their behavioural intention to use ICT.

H_{24}: Primary school students' effort expectancy of use of ICT has a significant positive effect on their behavioural intention to use ICT.

H_{25}: Positive social influence on the primary school students has a significant positive effect on their behavioural intention to use ICT.

H_{26}: Facilitating conditions of ICT have a significant positive effect on primary school students' behavioural intention to use ICT

3.4.2 Additional constructs for students' conceptual model

Apart from the core constructs of the UTAUT model, additional constructs of *computer literacy* were included in the students' model in order to understand if the perception of the self-confidence of the students influences the performance and *effort expectancy* of the students. This section discusses these concepts and related hypotheses have been provided.

Computer literacy. *Computer literacy* relates to the computer knowledge of the students and their perception of their own competency in using the technologies. However, *computer literacy* is not only connected with the skills, but also with the judgments of what one can do with whatever skills one possesses (Bandura, 1986; Fathema et al., 2015). With better knowledge of the technology and its possible applications, the students could have formed the impression of increased performance and efficiency due to the use of ICT facilities.

In Saudi Arabia, computer literacy among the students significantly influences their intention to use technology (Alenezi, Karim, & Veloo, 2010). Thus, if the primary school students perceive that they are effective in the use of ICT and they are knowledgeable about using ICT for their class and homework, then they will find the technology easy and useful. This observation resulted in these two hypotheses:

H_{27}: *Computer literacy has a significant positive effect on primary school students' performance expectancy of use of ICT.*

H_{28}: *Computer literacy has a significant positive effect on primary school students' effort expectancy of use of ICT.*

***Behavioural intention* to use ICT and *actual use* by students.** The UTAUT model suggests that, users' *behavioural intention* to use a technology influences its *actual use* (Šumak et al., 2010; Venkatesh et al., 2003; Wong et al., 2013). In Saudi Arabia, the *actual use* of ICT by the students has been critically determined by their *behavioural intention* to use ICT (Al-Harbi, 2011). Thus, if the primary school students develop a positive *behavioural intention* to use ICT facilities, then they will actually use them in their studies.

H_{29}: *Primary school students' behavioural intention to use ICT has a significant positive effect on their actual use of ICT in learning.*

Considering all these hypotheses and constructs, a new model of ICT adoption for the teachers has been proposed in Figure 3.4.

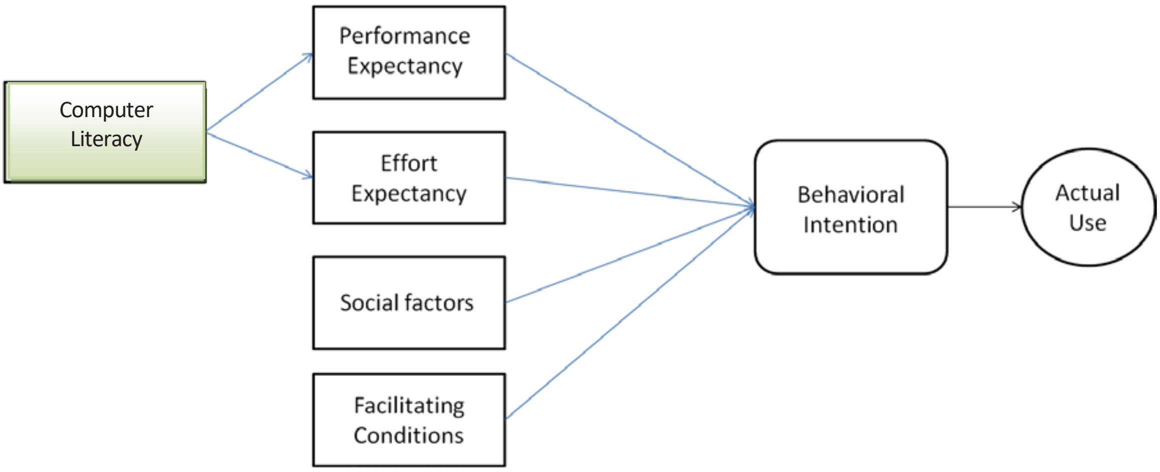


Figure 3.4 Proposed ICT behaviour model for the primary schools students in Saudi Arabia

3.5 Summary of the chapter

This chapter presented the conceptual model formulated for this study looking at which factors positively or negatively affect the intention to use ICT in primary schools by the principals, teachers and students. Therefore, models related to factors contributing to ICT adoption were necessary. In this case, the UTAUT model has been selected for this research due to its comprehensiveness, modern outlook, and applicability in the area of ICT adoption.

A conceptual model for principals was developed, including a variety of constructs, and similar approaches were applied for teachers and students leading to the development of suitable hypothetical models. All the related hypotheses regarding the constructs of the models were presented and the reasons behind their presence in the models justified in this chapter (Table 3.1 provides a summary of the various hypotheses). The chapter discussed the hypotheses that would be tested, based on the structural equation modeling technique, discussed in the next chapter.

Table 3.1 Table of hypotheses relating to the developed models

Primary school principals	
H1:	*Primary school principals' performance expectancy of ICT has a significant positive relation with behavioural intention to use ICT.*
H2:	*Primary school principals' effort expectancy of ICT use has a significant positive effect on their behavioural intention to use ICT.*
H3:	*Positive social influence on the primary school principals has a significant positive effect on their behavioural intention to use ICT.*
H4:	*ICT facilitating conditions have a significant positive relation with primary school principals' behavioural intention to use ICT.*
H5:	*There is a significant relationship between culture and behavioural intention to use ICT in school for the principals.*
H6:	*There is a significant relationship between culture and external barriers to use ICT in school for the principals.*
H7:	*External barriers have a significant effect on behavioural intention to use ICT in primary schools by the principals.*
H8:	*Primary school principals' computer literacy has a significant positive effect on their performance expectancy of ICT use.*
H9:	*Primary school principals' computer literacy has a significant positive effect on their effort expectancy of ICT.*

H10:	*System quality and flexibility has significant influence on behavioural intention to use ICT in primary schools by the principals.*
H11:	*Principals' behavioural intention to use ICT has a significant relation to their actual use of ICT in school administration and academic activities.*
Primary school teachers	
H12:	*Primary school teachers' performance expectancy of ICT has a significant positive effect on their attitude towards ICT.*
H13:	*Primary school teachers' effort expectancy of using ICT has a significant positive effect on their behavioural intention to use ICT.*
H14:	*Positive social influence on the primary school teachers has a significant positive effect on their behavioural intention to use ICT.*
H15:	*Facilitating conditions of ICT has a significant positive effect on primary school teachers' perceived ease of use of ICT.*
H16:	*There is a positive relationship between culture and behavioural intention to use ICT in classes by the teachers.*
H17:	*There is a significant relationship between culture and external barriers to use ICT in class by the teachers.*
H18:	*External barriers have a negative and direct effect on behavioural intention to use ICT in primary schools by the teachers.*
H19:	*Primary school teachers' computer literacy in ICT has a significant positive effect on primary school teachers' performance expectancy of ICT use.*
H20:	*Primary school teachers' computer literacy in ICT has a significant positive effect on their effort expectancy of ICT.*
H21:	*System quality and flexibility has significant influence on behavioural intention to use ICT in primary schools by the teachers.*
H22:	*Teachers' behavioural intention to use ICT has significant and direct relation with their actual use of ICT in their classes and teaching.*
Primary school students	
H23:	*Primary school students' performance expectancy of ICT has a significant positive effect on their behavioural intention to use ICT.*
H24:	*Primary school students' effort expectancy of use of ICT has a significant positive effect on their behavioural intention to use ICT.*
H25:	*Positive social influence on the primary school students has a significant positive effect on their behavioural intention to use ICT.*
H26:	*Facilitating conditions of ICT have a significant positive effect on primary school students' behavioural intention to use ICT*

H27: Computer literacy has a significant positive effect on primary school students' performance expectancy of use of ICT.
H28: Computer literacy has a significant positive effect on primary school students' effort expectancy of use of ICT.
H29: Primary school students' behavioural intention to use ICT has a significant positive effect on their actual use of ICT in learning.

Chapter 4

Methodology

This chapter discusses in detail the research approaches, research design, sampling for data collection, and data collection methods, along with the methods of data analysis utilised in this research. Extensive discussion about the practices and the decisions made for particular approaches have been included here to justify the research approach and to demonstrate the rigor conducted in developing the apparatus to support the research presented here. These methods were used to answer the research questions regarding the adoption of ICT in primary schools in Saudi Arabia from the perspective of primary school principals, teachers, and students, and to investigate the model relationships proposed in this research.

4.1 Research approach

For designing this research, a combination of quantitative and qualitative methods was adopted, referred to as mixed methods research (Creswell, 2013; Brannen, 2004). Mixed methods research generally assumes a conceptual framework that incorporates both *deductive* and *inductive* approaches.

4.1.1 Mixed methods

The mixed method approach involves collecting data either simultaneously or sequentially to best understand research problems, and gathering both numeric information as well as text information so that the final database represents both quantitative and qualitative information (Creswell, 2013; Brannen, 2004).

The utility of mixed methods approaches over single method approaches are that mixed methods can simultaneously address a range of confirmatory and exploratory questions with both qualitative and quantitative approaches, provide better inferences, and opportunities for a greater assortment of divergent views (Teddlie, & Tashakkori, 2009). Figure 4.1 depicts the mixed process.

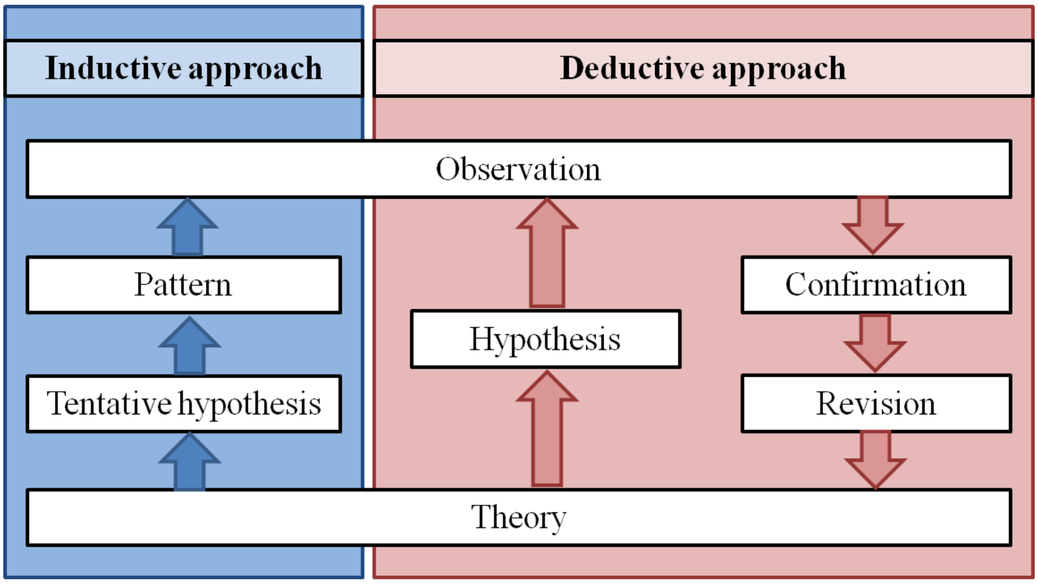


Figure 4.1 **Mixed method approach of the study (Teddlie, & Tashakkori, 2009)**

In this research a mixed method design, combining both inductive and deductive approaches, was used in order to collect the most comprehensive data regarding the research questions.

The inductive approach. The inductive approach collects evidence about a topic and gathers facts that may or may not support gradually forming hypotheses about the data (Bloomberg, Cooper, & Schindler, 2008; Soiferman, 2010). This approach relies on observations of research subjects in a natural setting, which allows the researcher to analyse a phenomenon using the subjects' experiences and perceptions of the phenomena (Brannen, 2004). Figure 4.2 depicts the bottom-up induction process.

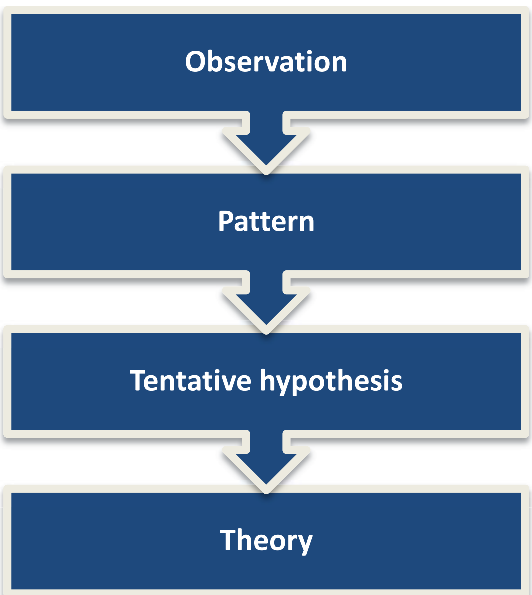


Figure 4.2 **Inductive approach of the study (Bryman, 2014)**

The inductive approach is more open-ended and exploratory than the deductive, especially at the beginning. Knowledge is based primarily in constructivist perspectives and the principal interest is in narrative data and analysis (Teddlie, &Tashakkori, 2009; Soiferman, 2010; Creswell, 2013). It is sometimes called a 'bottom up' approach, in which researchers begin with specific observations and measures, begin to detect patterns and regularities, formulate some tentative hypotheses that can be explored, and finally end up developing some general conclusions or theories (Deutsch, Bronold, & Becker, 2014; Bryman, 2014).

Deductive approach. Working deductively, an investigator primarily uses post-positivist claims for developing knowledge and is principally interested in numerical data and analysis (Teddlie, & Tashakkori, 2009; Soiferman, 2010; Creswell, 2013). It works from the more general to the more specific, sometimes informally called a 'top-down' approach (Deutsch, Bronold, & Becker, 2014). In this approach, the researcher begins with a theory about the research topic. This theory is then narrowed down into more specific hypotheses that can be tested. Observations are collected to address the hypotheses to narrow down their possibility even further. This ultimately leads to testing the hypotheses with specific data, i.e., a confirmation (or not) of the original theories (Bryman, 2014).

The deductive approach is narrower in nature than the inductive, and is concerned with testing or confirming the developed hypotheses (Creswell, 2013; Soiferman, 2010). This approach translates to the use of statistical analysis to make the connection between what is known and what can be learned through research (Brannen, 2004). Figure 4.3 depicts the top-down deduction process.

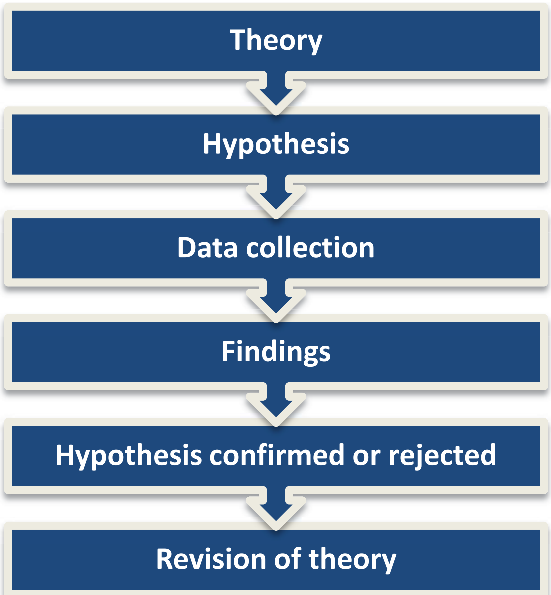


Figure 4.3 Deductive approach of the study (Bryman, 2015)

Based on theories, general ideas and literature, a deductive approach was adopted in this research for formulating research problems, questions and hypotheses. Additionally, the deductive process was important in the formulation of the theoretical model to be tested. In the context of this research, ICT adoption patterns in primary schools, the factors and the constructs, were identified from the literature. For this research, information was sourced from interviews with principals, teachers and students from Saudi primary schools. Based on the collected information, patterns of ICT use preferences and adoption, behaviour was identified, from which some tentative ideas regarding ICT use in Saudi primary schools were drawn.

4.1.2 Mixed methods summary

Mixed methods research opens the door to multiple methods, different worldviews, and different assumptions, as well as to different forms of data collection and analysis (Creswell, 2013). In this approach, the researcher tends to be quite pragmatic about gathering knowledge, and is interested in both narrative and numeric data and their analysis (Teddlie, & Tashakkori, 2009). The researcher nests one form of data within another larger data collection in order to analyse different questions from a number of viewpoints (Creswell, 2013; Brannen, 2005). The combination of these two approaches overcomes their individual shortcomings; the two approaches are structured into a single circular one that continually cycles from theories down to observations and back up again to theories, providing a complete picture (Creswell, & Clark, 2007; Teddlie, & Tashakkori, 2009; Bryman, 2015; Bryman, & Bell, 2015).

4.2 Research design

Research design refers to the overall strategy that is chosen to integrate the different components of the study in a coherent and logical way, thereby ensuring the research problem is effectively addressed. It constitutes the blueprint for the collection, measurement, and analysis of data, which is determined by the research problems (De Vaus, 2001; Trochim, 2006). The research design articulates what data are required, what methods are going to be used to collect and analyse this data, and how all of this is going to answer the research question logically and as unambiguously as possible (De Vaus, 2001; van Wyk, 2012). This indicates that the research design consists of sequential steps that enable the researcher to elaborate and expand the findings of one method with another method (Creswell, 2013). Well defined research design increases the accuracy of the research and ensures reproduction by other researchers. According to Trochim (2006), *Research design provides the glue that holds the research project together. A design is used to structure the research, to show how all of the major parts of the research project work together to try to address the central research questions….*

The steps of research design and work have been presented in Figure 4.4.

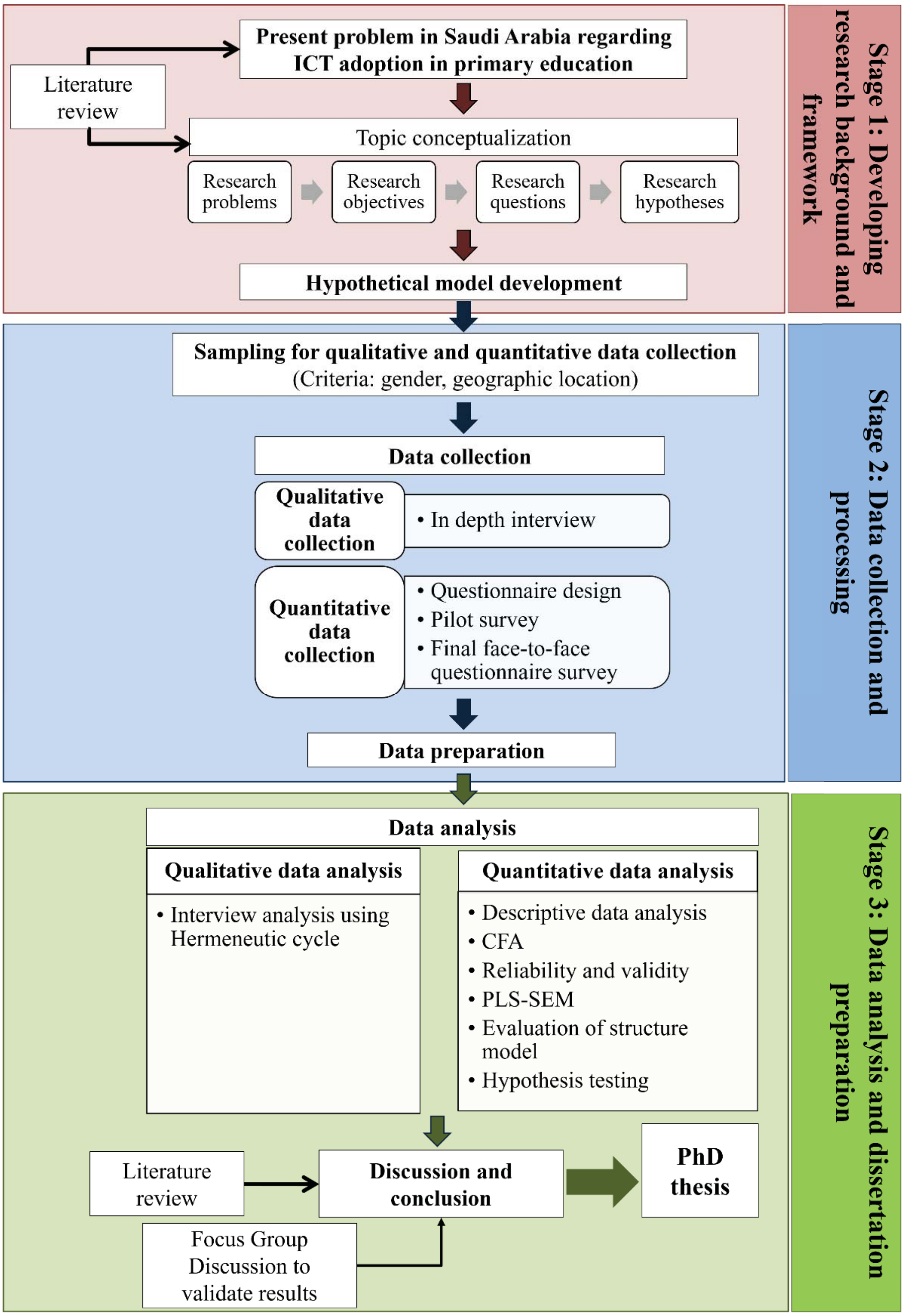


Figure 4.4 Research framework (author's work)

4.2.1 Ethics approval

Prior to the commencement of the research data collection, ethics approval was obtained from the Flinders University Social and Behavioural Research Ethics Committee for this study (Appendix A). The potential participants were contacted and informed about the purpose and aims of the research. It was made clear that participation was voluntary and that their responses would be kept anonymous (Appendix A).

4.2.2 Stage 1: Developing research background and framework

At the initial stage of this research, the idea of ICT usage and adoption in Saudi Arabian primary schools was considered and the research topic was conceptualised. Literature related to ICT in primary school education was collected and reviewed to understand the important issues related to the topic both globally and specifically in Saudi Arabia.

After a review of the related literature, the research problems were identified and the research questions formulated by combining the research concepts developed from the literature review and real world observation. The research hypotheses were developed in relation to the research problems in order to answer the research questions in a reasonable and rational manner. After that, hypothetical models were developed for this research to be analysed and investigated to assess the hypotheses and address the research questions. This was done on the basis of the ideas found in the literature, and the research questions and hypotheses developed for this research. Simultaneously, the major objectives of the research were formulated. All these processes are discussed from Chapter 1 to Chapter 4 in this dissertation.

4.2.3 Stage 2: Data collection and processing

During the second stage of this research, qualitative and quantitative data were collected in order to answer the research questions and achieve the research objectives outlined during the first stage. Qualitative data were collected through face-to-face interviews with the sample population after consent was obtained. For quantitative data collection, a sample population was identified and a questionnaire was designed based on the variables and constructs identified in the research literature. The questionnaire was tested through pilot surveys and necessary adjustments were made. After the adjustment and validation of the questionnaire, it was used for the primary quantitative survey.

4.2.4 Stage 3: Data analysis and dissertation preparation

During this stage, the data were analysed. For quantitative data analysis, descriptive statistics, inferential statistics (hypothesis testing), conformity factor analysis, structural equation modelling, and goodness of fit tests were used. The interviews were analysed using qualitative analysis techniques (i.e., hermeneutic analysis).

The interpretation and understanding of the research outcomes were demonstrated by combining and comparing the results from the quantitative and qualitative analyses. Triangulation of the data was undertaken by holding focus group discussions. Three focus groups, each composed of individuals from one of the participating sample populations were presented with the results of the combined qualitative and quantitative analyses. These results were then discussed among the group in order to validate the accuracy and relevance of the findings.

The processed and confirmed data provided answers to the research hypotheses and questions, as well as insight into the motivations and underlying behaviour of principals, teachers and students in primary schools. Furthermore, the research allowed for a greater understanding of both negative and positive forces acting on ICT adoption by primary school principals, teachers and students in Saudi Arabia. As a by-product of the study, many general details about the condition of ICT adoption in Saudi Arabian primary schools emerged. Finally, the discussion of the study was developed by combining these results.

4.3 Sampling for data collection

Population is the entire set of individuals considered in a study. For a large target group or population, it becomes very difficult to undertake a study selecting all individuals in the population. In this circumstance, analysis of a subset of the population is considered effective to achieve reduced cost and greater speed. Sampling is the process of selecting a subset from a population of interest to generalise findings for the entire population from which the subset was chosen.

Thus, the selection of an appropriate sample is very important because the validity and reliability of the findings for the entire population depends on it (Levy, & Lemeshow, 2013; Palinkas, Horwitz, Green, Wisdom, Duan, & Hoagwood, 2013). The selection of a sample varies depending on the level of accuracy required, which involves identifying a population, a sampling method, sample size and sample selection (Zikmund et al., 2012). Various sub-groups of the population (e.g., age, sex, race) must be considered (Levy, & Lemeshow, 2013).

In this research, the target populations consisted of principals, teachers and students of primary schools in the Kingdom of Saudi Arabia. Studying the entire population was not feasible; therefore, a sample of the population was selected carefully. To make sure appropriate sampling for proper representation of the population, high statistical accuracy and significance were ensured. The sampling process was random and ensured a statistically accepted size.

4.3.1 Sample size for qualitative data

In qualitative analysis, careful sampling with a clear rationale is required to fulfil a specific purpose related to the research question (Cleary, Horsfall, & Hayter, 2014). According to Cleary, Horsfall, and Hayter (2014), principles to select samples for qualitative analysis are as follows:

- Small numbers are studied intensively.
- Participants are chosen purposefully to generate rich, dense, focused information on the research question.
- Selection is conceptually driven by the theoretical framework.
- It is commonly sequential rather than pre-determined.
- A rationale for selection is necessary.

In this research, for qualitative analysis, the interviews were conducted to provide a comparison with the quantitative surveys and to add depth to the responses to the questionnaire. The sample population for the qualitative data collection was selected from principals, teachers and students of primary schools in Saudi Arabia. The sample selection and scrutiny were very thorough, based on gender and geographic location to represent the population as a whole. For the interviews, materials were provided in both English and Arabic (Appendix B).

Though the adequacy of participant numbers differs based on the research context, in qualitative research sample size is generally kept to a reasonably small scale (Ritchie, Lewis, & El am, 2013). Too few may risk adequate depth, but too many may produce superficial or unwieldy volumes of data (Cleary, Horsfall, & Hayter, 2014). The sample size can range from four to 40 respondents, while for some studies a sample size of less than 10 participants can be considered (Holloway, & Wheeler, 2013). Additionally, some studies may consider 20 or more samples but close inspection data may actually be presented from less than half of the sample (Cleary, Horsfall, & Hayter, 2014). According to Ritchie, Lewis, and El am (2013), issues determining sample size for qualitative analysis are: heterogeneity of population, number of selection criteria, extent to which nesting of criteria is needed, groups of special interest requiring intensive study, multiple samples within one study, type of data collection method, and budget and resource availability. In addition, previous research has indicated the need for random selection of interviewees matching the selection criteria, which has been followed in this study. In this case, the interview participants were selected randomly from schools also selected randomly from the list of all primary schools in the three targeted cities (Jeddah, Riyadh and Dammam).

Considering these issues for determining sample size for qualitative analysis, and the suitable range of sample size suggested in the various literature (Holloway, & Wheeler, 2013; Cleary, Horsfall, & Hayter, 2014), a sample of 30 individuals was identified, which is considered adequate for standard qualitative analysis (Mason, 2010; Horsfall, & Hayter, 2014; Lewis, & El am, 2013). The final sample consisted of 10 principals, 10 teachers and 10 students. Once participants were recruited, semi-structured interviews related to computer and internet services were conducted. The samples achieved saturation during the qualitative data collection (Mason, 2010).

4.3.2 Sample size for quantitative data collection

For quantitative data collection and analysis, sample size is very important. Many researchers have suggested different sample sizes based on the types of research and statistical methods to be used. In this research, PLS-SEM (partial least squares-structural equation modelling) was used to model the adoption of ICT in primary schools by principals, teachers and students in Saudi Arabia using the guiding principles of the UTAUT model framework. When using PLS-SEM, the overall complexity of a structural model has little influence on the sample size requirements because the algorithm does not compute all relationships in the structural model at the same time (Hair Jr, Sarstedt, Hopkins, & Kuppelwieser, 2014). Nevertheless, the rule of thumb for determination of minimum sample size is,

> *10 times the maximum number of arrowheads pointing at a latent variable anywhere in the PLS path. (Hair Jr et al., 2014, p. 20)*

Arrows indicate the path of relations among the constructs, and for each arrow or path relation, it is suggested that there be at least 10 samples in the data; however, larger sample sizes would increase the precision of the model outputs (Figure 4.5) (Hair Jr et al., 2014, p. 20).

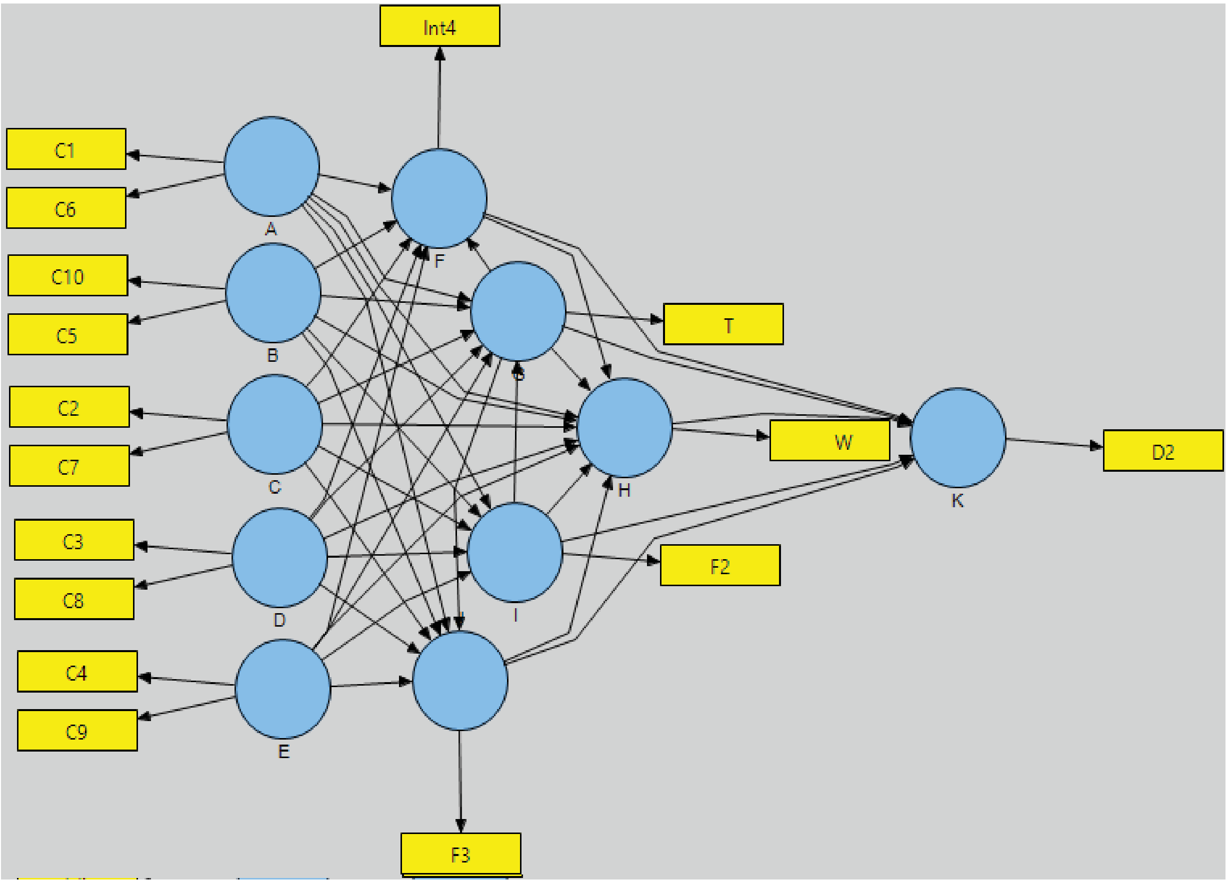


Figure 4.5 **A typical format of PLS-SEM model. The rectangular yellow boxes indicate items of each construct represented by the circles. Here, the arrows between construct and items shows these items reflect the construct, while the arrows among the constructs shows the path relations (Hair Jr et al., 2014, p. 20).**

Though the 10 times rule offers a rough guideline for minimum sample size requirements, it is required to be considered against the background of the model and data characteristics, specifically by means of power analyses based on the part of the model with the largest number of predictors (Goodhue, Lewis, & Thompson, 2006; Hair Jr et al., 2014).

For three research models for the target population (i.e., principals, teachers and students), three sample groups were selected and the sample sizes were determined based on the size required to use PLS-SEM models with acceptable accuracy. According to the models proposed and developed for understanding the adoption of ICT in primary schools by principals, teachers, and students in Saudi Arabia, the maximum number of independent variables for principals, teachers, and students was six, eight, and six respectively (Figures 3.2, 3.3, 3.4 in the model development chapter).

Table 4.1 shows sample size recommendations when using PLS-SEM with the statistical power of 80%. The sample sizes for different population groups were calculated using the data in Table 4.1. According to this table, 75, 84, and 75 observations were required from principals, teachers, and students correspondingly to achieve a statistical power of 80% for detecting R^2 values of at least 0.25 (with a 5% level of significance for probability of error).

Table 4.1 Sample size recommendation in PLS-SEM (Hair Jr et al., 2014, p. 21)

Maximum Number of Arrows Pointing at a Construct	Significance Level											
	1%				5%				10%			
	Minimum R^2				Minimum R^2				Minimum R^2			
	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75
2	158	75	47	38	110	52	33	26	88	41	26	21
3	176	84	53	42	124	59	38	30	100	48	30	25
4	191	91	58	46	137	65	42	33	111	53	34	27
5	205	98	62	50	147	70	45	36	120	58	37	30
6	217	103	66	53	157	75	48	39	128	62	40	32
7	228	109	69	56	166	80	51	41	136	66	42	35
8	238	114	73	59	174	84	54	44	143	69	45	37
9	247	119	76	62	181	88	57	46	150	73	47	39
10	256	123	79	64	189	91	59	48	156	76	49	41

However, the total number of primary school principals in the study area was considerably smaller than the total number of primary school teachers, and the total numbers of primary school students was very large. Therefore, three different sample sizes were considered for three different SEM models to be measured with PLS-SEM. These SEM models were hierarchical models, consisting of multilevel constructs. Thus, the selection of an adequate sample had to be considered carefully.

From the list of schools within the three chosen cities, 50 schools were randomly chosen. From those schools, 50 principals, 200 teachers, and 600 students were targeted.

4.3.3 Criteria for sample selection

In this research considering cultural variation, two criteria were considered when selecting the samples for qualitative and quantitative data collection. They were:

a) Gender

Although it would have been desirable to have a balance of genders for the study, in the KSA, because of social norms and culture, most of the female schools were not accessible, so female students were largely not involved in the sampling process. Therefore, the major portion of the sample was collected from male principals and teachers, and the survey was conducted only with male students; no female students were surveyed in this study. A few female teachers were involved in the qualitative interviews, but within KSA the social structure is not as supportive for female principals in schools, contrary to other nations throughout the Western world. Communication with female principals, teachers, and students was very difficult for the purposes of the survey, which is why it was confined to men.

b) Geographic location

It was important that the participants in the study were not all concentrated in one area of Saudi Arabia and should represent the majority of Saudi Arabia. Unfortunately, however, it was not possible to reach all the areas in KSA for sample collection. According to World Bank statistics, 83% of the Saudi population is urbanised (year 2015) and 80% of the whole population lives in three cities, namely Jeddah, Riyadh and Dammam (House, 2012). Considering the concentration of the nation's population living in these three cities, several studies have considered these cities as representative of Saudi Arabia (Alheezan, 2016; Al-Sadan, 2010; Alrashidi, 2014). Based on the uniformity of economic conditions and education, along with large populations and major schools, the study sample was selected from these cities.

Among these cities, Riyadh (the capital city) and Jeddah are the two most populous and administratively important, with most of the government's administrative offices and ministries located in them. Dammam is a key city in the eastern region. The cities represent a diversity of geographic location, and given the large percentage of KSA's population located in them, it can be assumed that this study represents the conditions of the majority of primary students.

4.4 Data collection

Data collection is the process by which opinions and information are collected from different authorities and study participants, or through observation. In this research, before collecting any data from the participants, several methods were evaluated among the commonly used methods for qualitative and quantitative data collection. In general, in-depth interviews, focus group discussions and case studies are common for qualitative data collection and for quantitative data collection suitable methods are questionnaire and surveys (Brannen, 2005; Teddlie, & Tashakkori, 2009; Soiferman, 2010; Creswell, 2013; Bryman, 2015).

The researcher considered the advantages and limitations of the different methods, with the evaluation summarised in Table 4.2. Based on this evaluation of the methods, the final data collection methods were selected. To ensure ethics in data collection, it was carried out with the permission of the participants, confirming that their personal information would not be disclosed and would only be used for academic purposes (De Vaus, 2013; Denscombe, 2014).

Table 4.2 Advantages and disadvantages of qualitative and quantitative research methods

Advantages and disadvantages of <u>qualitative</u> research methods		
Mode of data collation	***Advantages***	***Disadvantages***
In-depth Interviews (Cooper, Schindler, & Sun, 2003; Doody, & Noonan, 2013; Legard, Keegan, & Ward, 2013; Bryman, 2015; Bryman, & Bell, 2015)	Useful to gain insight and context flexible and interactive nature which help participants describe what is important to them Able to achieve depth Data collected are natural and generative	Expensive and time-consuming not only in terms of conducting them but also in relation to arranging them, travelling to the venue, post-interview transcription and analysis of the data, May seem intrusive to the participant Flexibility can result in inconsistencies Susceptible to bias Requires skilled researcher to achieve breadth and depth Personal and/or intimate subject can evoke strong feelings and these feelings need to be handled with great sensitivity
Focus group discussions (Cooper, Schindler, & Sun, 2003; Finch, & Lewis, 2013; Bryman, 2015; Bryman, & Bell, 2015)	Participants' contributions are refined by what they hear others say The group is synergistic in the sense that it works together Aids spontaneity and creates a more naturalistic and socially contextualised environment	Time-consuming not only in terms of conducting them but also in relation to arranging them travelling to the venue, post-interview transcription and analysis of the data Requires skilled researcher to achieve breadth and depth Difference between participants and their lack of interaction may result in unsuccessful survey and fail to bring out actual scenario Diversity in group composition enriches the discussion, but may become difficult to be managed by the researchers

Case studies (Cooper, Schindler, & Sun, 2003; Baxter, & Jack, 2008; Holloway, & Wheeler, 2013)	Exploratory in nature Behaviour of the participants cannot be manipulated Contextual conditions are covered Suitable for the studies in which boundaries are not clear between the phenomenon and context Can illustrate the specific element of a research Make the research more lively and interesting	A pilot study for large projects Less readily generalisable Not enough for a research requiring multiple methods alongside
Advantages and disadvantages of quantitative research methods		
Mode of data collation	***Advantages***	***Disadvantages***
Personally administered questionnaire survey (Cooper, Schindler, & Sun, 2003; Dörnyei, & Taguchi, 2009; De Vaus, 2013; Bryman, 2015; Bryman, & Bell, 2015)	For well constructed questionnaire data processing becomes fast and relatively straight forward Effective with variety of people in a variety of situations targeting variety of topics Able to achieve depth Reduce bias of interviewer effects and thus increase the consistency and reliability of results	Need much time to get proper of sample respondents expensive method and time consuming for larger sample Sometimes produce unreliable and invalid data
Electronic questionnaire survey (Ilieva, Baron, & Healey, 2002; De Vaus, 2013; McPeake, Bateson, & O'Neill, 2014)	Very low financial resource implications Short response time Researchers have control of the sample and no involvement in the survey Data can be directly loaded in the data analysis software thus saving time and resources associated with the data entry process Easy to administrate Respondents become more comfortable considering anonymity No interviewer effects increase the consistency and reliability of results	Entire population may not have access to computer or internet which results in exclusion of some groups from sample Complication in web surfing and downloading may discourage the responders Sometimes produce unreliable and invalid data Response rate depends on the willingness of the respondents to complete survey

4.4.1 Qualitative data collection

There were three groups of participants from whom data was required in face-to-face meetings – primary school principals, teachers and students. To understand the details and to achieve an in-depth understanding of ideas regarding adoption of ICT in primary schools in Saudi Arabia, data from all of these groups were necessary. Data were collected from these three groups using different sets of questions.

In-depth interviews. In qualitative research, in-depth interviews are one of the main methods of data collection (Legard, Keegan, & Ward, 2013; Bryman, 2015; Bryman, & Bell, 2015). In this research, in depth interviews were conducted since they allow participants to talk broadly, with more interaction between the researcher and interviewees. With more diverse, open ended, semi-structured questions, this process allowed the research questions to be answered in detail. Previously, Creswell (2013) and Denscombe (2014) proved that in-depth interviews help answer research questions because they collect the views of the interviewee in some detail. However, the interviews should have several key attributes to capture the detailed answers of the interviewees. In this regard, Legard, Keegan, and Ward (2013) stated that,

> *The key features of the in-depth interview are: combine structure with flexibility; interactive in nature; using a range of probes and other techniques depth of answers can be achieved in terms of penetration, exploration and explanation; generative in the sense that new knowledge or thoughts are likely to be created; data can be captured in its natural form by emphasising on depth, nuance and the interviewee's own language; and almost always are conducted face-to-face. (p. 141)*

The interviewees were very experienced with the phenomena of interest. Atieno (2010) and Bryman (2015) have explained that using informed interviews, with the correct sets of questions and prompts, while making use of participants' interests would enhance the quality of the outcome. Keeping this in mind, in-depth interview questions were prepared for this study.

The behaviour, mindset, perceptions and general acceptability of ICT in primary education formed the basis of the questions. These interviews were complementary to the quantitative analysis, helping to develop insight and a detailed understanding of participants' attitudes toward ICT in primary education in Saudi Arabia. The outcome of these interviews additionally allowed the researcher to triangulate the qualitative, quantitative and literature findings, as demonstrated by Hussein (2015), for example.

Structure of qualitative data collection. In this research, semi structured interviews were used to obtain the in-depth ideas of primary school principals, teachers and students regarding ICT in primary education. To extract the most in-depth viewpoints of the interviewees, each interview was structured and conducted very carefully. Each interview was on an average half an hour to one hour long. All interviews were conducted in Arabic, which were later transcribed and translated into English before analysis. Such translation may result in nuances of language, which, to overcome, required the assistance of linguistic specialists to ensure accuracy of content (as noted in the work of Brown, & Al-Khayal, 2006; and MacLeod, & Fraser, 2010). The questions for the interviews are included in Appendix B.

During the interviews, all target groups (i.e., principals, teachers and students) were asked some common questions; these were related to the basics of ICT use and understanding of ICT, their level of competency (in terms of self-judgment), their perception about the uses of ICT in a school environment. Apart from common questions, some specific questions were asked of each group. For principals, questions were asked regarding:

- the existing ICT infrastructure in their schools
- their strategy for ICT in their schools
- barriers stopping them from implementing or using ICT
- ICT training they provide for teachers and students for classroom use
- their perception about how ICT makes their role or tasks easier
- the ICT training they have received
- requirements to make the use of ICT easy in the classroom.
- how they negotiate with parents and school committees
- their existing problems related to the management of ICT facilities.

In the case of teachers, most questions were the same or similar to those asked of the principal, but in the context of being a teacher. Specific questions about teaching with ICT as an aid related to preparing and delivering lectures. Furthermore, they were asked about the influence of their surroundings on their use of ICT facilities in their teaching activities.

Few specific questions were asked of the students, and those were the same or similar to those posed to the principals and staff. However, the questions were skewed toward the student context and the use of ICT in their learning process.

They sought to find out about:

- restrictions or access to the internet at home and school
- how the older people in their families use ICT facilities
- whether the ICT use of their elders has any influence on their perception of ICT use
- how they expect ICT can change their way of learning from what they are doing at present.

4.4.2 Quantitative data collection

Based on the understanding developed from the qualitative data, quantitative data collection was carried out in this research. Quantitative data were collected from primary school principals, teachers and students in Saudi Arabia using different sets of questions to test the developed hypotheses.

Using the structured survey. For quantitative data collection, the most widely used and the most popular method (Creswell, 2013) is the administration of the structured questionnaire survey. A survey is particularly effective when it is necessary to collect data from large groups of respondents, and standardisation is essential for overall data collection.

There are several methods of conducting questionnaire surveys, such as, administering them personally, distributing them electronically by email, using an online survey tool (i.e. *SurveyMonkey*; *Qualtrics statistics; Google Survey*), or even distributing them in hard copy. All these methods have their own advantages and disadvantages. Feasibility of the method, time, cost, research scope, and kinds of data required, along with target group are some of the factors that influence what methods or combinations of methods are chosen by any given researcher (Denscombe, 2014).

In this research, the survey was conducted in person, given the context of the research and the benefits noted in Table 4.2:

- Data processing is fast and relatively straight forward.
- Face-to-face administration is effective with variety of people in a variety of situations targeting variety of topics.

- Depth can be achieved in the answers.
- The bias of interviewer is reduced by using a questionnaire, adding to the consistency and reliability of the results.

In the context of schools in Saudi Arabia, it was felt that an online survey would not have achieved the desired results due to the inconsistent use of the internet by staff and students. Although personal administration of the survey was time consuming and more expensive than online, it was also going to provide greater feedback and generate more data. However, to make things easy, the researcher not have done all interviews of the students one by one, rather students randomly selected from one class were surveyed at a time in their class room.

Development of the survey instrument. One of the major aspects of quantitative data collection is the effective development of the survey instrument or questionnaire because a well-structured questionnaire consisting of only the most relevant questions enables a researcher to bring out the required data (De Vaus, 2013; Denscombe, 2014). The questionnaire development process was completed in a series of steps:

Step 1	template development for designing the questionnaire
Step 2	designing the questionnaire
Step 3	development of a measurement scale
Step 4	developing the layout
Step 5	validation of the developed questionnaire.

Step 1 Template development for designing the questionnaire

Different sources and previous research were consulted to help guide the questionnaire design. Denscombe's (2014) *The good research guide: for small-scale social research projects*; and De Vaus' (2013) *Surveys in social research*, were considered as the basic guides for developing the questionnaires. Additionally, Al-Sulaimani (2010) *The importance of teachers in integrating ICT into science teaching in intermediate schools in Saudi Arabia: A mixed methods study* was also consulted during the development of the questionnaire. As Al-Sulaimani's study was only focused on science teaching, some questions were adapted for use by all teachers. Studies by Alharbi (2012) and Alshemmari (2015) were also explored to understand the ways of developing a questionnaire for surveying primary school teachers.

All these studies provided templates for producing relevant questions according to the proposed research model and research context through modification and adaptation.

During development of the questionnaire, the researcher followed the practice of De Vaus (2013) and Denscombe (2014) with regard to background information, instructions to the respondents, the wording of questions, selecting question types, response format or level of measurement, answering procedures, instructions, use of space, coding, questionnaire length, and pilot testing. All of these attributes helped to focus on the issues of the research and enabled the collection of the most accurate information. The questionnaire was developed both in English and Arabic (Appendix C).

Step 2 Designing the questionnaire

To clearly understand the ICT adoption condition and factors affecting the adoption of ICTs in Saudi primary schools, a series of structured questions were developed for each user group. The questionnaire followed the principles of the designs used in the earlier interviews and previous literature.

For principals, the questions related to:

- personal information (e.g., location, gender, age, and education level)
- school information (e.g., total number of students, ICT devices used for educational purposes along with their functionality and maintenance, use of computers in the school)
- information about their personal electronic devices and usage (e.g., device, duration, purpose, experience of computer use at home and at school).

For teachers, the structured questions related to:

- personal information (e.g., location, gender, age, education level, subject/s they teach)
- school information (e.g., ICT devices provided and used in their classroom, whether the students are provided with ICT devices or allowed to use their personally owned devices in the classroom, and whether their vision about integrating ICT in teaching and learning at their school matches their colleagues, head and other staff)
- information about their personal electronic devices and usage (e.g., device, duration, frequency, purpose, experience of computer use at home and at school).

For students, the structured questions related to:

- personal information (e.g., location, gender, age, school year)
- information about their personal electronic devices and usage (e.g., device, duration, frequency, purpose, experience of ICT use at home and at school).

Then, operational definitions for each of the constructs in the proposed models were developed after reviewing related researches. Additionally, the meaning of the constructs in the measurement terms was determined by specifying the activities or operations necessary to measure the related items (Hair, Jr., Black, Babin, & Anderson, 2010). Through the selection of scale items and scale type, each construct under investigation was defined and identified (Hinkin, 1995). The questions designed to measure each concept were established, improved and accepted from earlier investigations of different literature, with special attention paid to the assembly of the measurement and scaling processes of the questions. Tables 4.3, 4.4 and 4.5 show the exogenous and endogenous constructs along with their respective questions and sources for primary school principals, teachers and students respectively.

Based on these constructs, definitions and questions, this study used the closed interrogation style in which participants were prompted to choose the opinion which most matched their judgement. Such closed interrogation avoids reaction bias (participants reply to questions influenced due to their approach or disposition) caused by the survey environment and encourages contribution (Alreck, & Settle, 1994, Emory et al., 1991). Moreover it ensures uniform replies; rapid responses; produces responses that are easier to code, computerise and examine; no differentiation against the less conversational and less communicative participants; and better understanding by the participants (Foddy, 1994).

Table 4.3 Construct items developed for questionnaire for primary school principals

Endogenous constructs (Independent constructs of the model)			
Construct	***Item Code***	***Measurement instrument***	***Adapted from***
***Effort expectancy* (EE)**	EE1	My interaction with the ICT system (i.e. Class room software, projector) would be clear and understandable	Venkatesh et al., 2003; Bingimlas, 2009; Park, 2009; Alwani, & Soomro, 2010; Albugami , & Ahmed, 2015; Fathema, Shannon, and Ross, 2015;
	EE2	It would be easy for me and the teachers to become skilful at using the ICT for teaching	
	EE3	I would find the ICT easy to use in school administration	
	EE4	Learning how to use ICT system does not require a lot effort	
	EE5	Using ICT systems in school does not involve too much time doing mechanical operations (e.g. school management works, admission works)	
***Performance expectancy* (PE)**	PE1	ICT technologies are useful in increasing the efficiency of the teacher and the officials	Park, 2009; Alwani, & Soomro, 2010; Attuquayefio and Addo, 2014; Albugami , & Ahmed, 2015; Fathema, Shannon, and Ross, 2015
	PE2	ICT technology enables me to accomplish my tasks more quickly	
	PE3	Using the ICT increases my productivity (i.e. communication, processing school activities)	
	PE4	If I use and encourage the system, I will increase my chances of getting a raise (i.e. Would give better salary)	
	PE5	ICT in class would enable teacher to make the lesson interesting and increase their acceptance in the class	
	PE6	ICT would help me to work actively in different matters using internet and school software	
***Social influence* (SI)**	SI1	People who influence my behaviour (i.e. Friends, Family) think that I should use the system	Venkatesh et al. 2003; Al-Khalifa, 2010; Alwani, & Soomro, 2010; Al-Harbi, 2011
	SI2	People who are important (i.e. Parents, teachers, students) to me think that I should use and adapt more ICT system in the school	
	SI3	In general, the school authority has supported the use of ICT	
	SI4	My colleagues are frequently using ICT for the classes and school related activities	
	SI5	Educational authority (i.e. Ministry of education) encouraged me to use ICT in school	
***Facilitating conditions* (FC)**	FC1	The school has enough ICT resources including hardware and software for officials and teachers	Bingimlas, 2009; Kidombo, Gakuu, and Ndiritu, 2009; Al-Khalifa, 2010; Alwani, & Soomro, 2010; Al-Harbi, 2011; Papaioannou, & Charalambous, 2011; Albugami , & Ahmed, 2015
	FC2	The ICT system get continued technical support from school management and educational authorities	
	FC3	The ICT system in class room is compatible with other systems we use (in office)	
	FC4	I get trainings to use ICT in primary school teaching purpose as per requirement	
	FC5	A specific person/group is available for assistance with any difficulties related with ICT use	

Endogenous constructs (Independent constructs of the model)			
Construct	***Item Code***	***Measurement instrument***	***Adapted from***
	FC6	In general, I am satisfied with the *facilitating conditions*	
***System flexibility* (SQ)**	SQ1	The ICT system of the school is easily available	Fathema, Shannon, & Ross, 2015; Bingimlas, 2009; Strudler, & Hearrington, 2008; Tondeur et al., 2008
	SQ2	The ICT system of the school is reliable	
	SQ3	The ICT system of the school is adaptable	
	SQ4	Response time of ICT system of the school is acceptable due to the functions, speed, features, contents, interaction capability of the technology	
	SQ5	In general, I am satisfied with the *system quality* of ICT of this school	
***Cultural factors* (CF)**	Cul1	Managers should be careful not to ask the opinions of subordinates too frequently; otherwise, the manager might appear to be weak and incompetent	Venkatesh et al. 2003; Al-Khalifa, 2010; Alwani, & Soomro, 2010; Al-Harbi, 2011
	Cul2	Managers should make most decisions without consulting subordinates	
	Cul3	Employees should not question their manager's decisions	
	Cul4	Managers should not ask subordinates for advice, because they might appear less powerful	
	Cul5	Individual rewards are not as important as group welfare	
	Cul6	Group success is more important than individual success	
	Cul7	Working within a team is better than working alone	
	Cul8	It is preferable to have a man in a high-level position rather than a woman	
	Cul9	Men usually solve problems with logical analysis	
	Cul10	Women usually solve problems with intuition	
	Cul11	Solving organisational problems usually requires an active forcible approach that is typical of men	
	Cul12	It is important to have job requirements and instructions spelt out in detail so that people always know what they are expected to do	
	Cul13	Rules and regulation are important because they inform workers what the organisation expects of them	
	Cul14	Order and structure are very important in a work environment.	
	Cul15	Working in a structured environment is better than working (rules and regulations) in an unstructured work environment.	

		Endogenous constructs (Independent constructs of the model)	
Construct	***Item Code***	***Measurement instrument***	***Adapted from***
***External barriers* (EB)/ Obstacles**	Lac_r	Lack of resources (educational software)	Kidombo, Gakuu, & Ndiritu, 2009; Alwani, & Soomro, 2010; Al-Harbi, 2011; Albugami , & Ahmed, 2015
	Lac_p	Lack of policy support and funds from the ministry of education	
	Lac_i	Lack of access to the Internet	
	Lac_training	Lack of professional development opportunities on using ICT in teaching	
	Lac_support	Lack of support from parents	
	Lac_leader	Lack of leadership	
	Lac_awar	Lack of awareness among teachers, parents, committee and even students	
	Lac_tec	Lack of technical support in and outside the class	
***Computer literacy* (CS)**	CS1	I feel confident that I can use computer for my daily office activities	Higgins, & Huff., 1999; Ong, Lai, &Wang, 2004; Grandon, Alshare, & Kwan, 2005; Ong, & Lai, 2006; Pituch, & Lee, 2006; Roca, Chiu, & Martinez, 2006; Yuen, & Ma, 2008; Bingimlas, 2009; Park, 2009; Park, Nam, & Cha, 2012; Al Mulhim, 2014; Albugami , & Ahmed, 2015
	CS2	I feel confident that I can select and use educational software for a defined task	
	CS3	I feel confident that I can coordinate several administrative and academic tasks of the schools using proper software and hardware	
	CS4	I feel confident that I can handle minor problems in using the system and can solve problems to run the system efficiently	
		Exogenous construct (Dependent construct of the model)	
Construct		***Measurement instrument***	***Adapted from***
***Behavioural intention* to use (BIU)**	BI1	I intend to use ICT in primary school teaching in my school when it becomes available in my school	Alwani, and Soomro, 2010; Papaioannou, & Charalambous, 2011; Albugami , & Ahmed, 2015; Fathema, Shannon, & Ross, 2015
	BI2	I intend to use ICT in teaching as often as possible	
	BI3	I intend to use ICT in teaching on a regular basis in upcoming time	
	BI4	I intend to recommend strongly to others to use ICT in teaching	
***Actual use* (AU)**	AU1	On an average how many lessons did you use ICT in your teaching in a month?	Papaioannou, & Charalambous, 2011; Albugami , & Ahmed, 2015
	AU2	On an average how many hours you work in ICT system of the school to perform your activities?	

Table 4.4 Construct items developed for questionnaire for primary school teachers

		Endogenous constructs (Independent constructs of the model)	
Construct	***Item Code***	***Measurement instrument***	***Adapted from***
***Effort expectancy* (EE)**	EE1	My interaction with the ICT system (i.e. Class room software, projector) would be clear and understandable	Bingimlas, 2009; Park, 2009; Alhawiti, 2013; Al Mulhim, 2014; Albugami , & Ahmed, 2015; Fathema, Shannon, and Ross, 2015
	EE2	It would be easy for me to become skillful at using the ICT for teaching	
	EE3	I would find the ICT easy to use	
	EE4	Learning how to use ICT system does not require a lot effort	
	EE5	Using ICT systems in class does not involve too much time doing mechanical operations (e.g. Digital lecture preparation, class projector adjustment)	
***Performance expectancy* (PE)**	PE1	ICT technologies are useful in my teaching	Park, 2009; Alhawiti, 2013; Al Mulhim, 2014; Albugami , & Ahmed, 2015; Fathema, Shannon, & Ross, 2015
	PE2	ICT technology enables me to accomplish my tasks more quickly	
	PE3	Using the ICT increases my productivity (i.e. collect information quickly, make multimedia presentation)	
	PE4	If I use the system, I will increase my chances of getting a raise (i.e. Would give better salary)	
	PE5	ICT in class would enable me to make the lesson interesting and increase my acceptance in the class	
	PE6	ICT would help me to give and take homework and examination more efficiently using internet and school software	
***Social influence* (SI)**	SI1	People who influence my behaviour (i.e. Friends, Family) think that I should use the system	Russell et al., 2003; Albugami , & Ahmed, 2015
	SI2	People who are important (i.e. Parents, students) to me think that I should use the system	
	SI3	In general, the school authority has supported the use of ICT	
	SI4	My colleagues are frequently using ICT for the classes and school related activities	
	SI5	My principle encouraged me to use ICT in class	
***Facilitating conditions* (FC)**	FC1	The school has enough ICT resources including hardware and software for me	Pajo, & Wallace, 2001; Ngai, Poon, & Chan, 2007; Panda, & Mishra, 2007; Teo, Lee, & Chai, 2008; Venkatesh, & Bala, 2008; Bingimlas, 2009; Park, 2009; Teo, 2010; Alhawiti, 2013; Al Mulhim, 2014; Albugami , & Ahmed, 2015; Fathema, Shannon, and Ross, 2015
	FC2	I am provided with continued technical support	
	FC3	The ICT system in class room is compatible with other systems I use (in home or office)	
	FC4	I get trainings to use ICT in primary school teaching purpose as per requirement	
	FC5	A specific person/group is available for assistance with any difficulties related with ICT use	
	FC6	In general, I am satisfied with the *facilitating conditions*	

		Endogenous constructs (Independent constructs of the model)	
Construct	***Item Code***	***Measurement instrument***	***Adapted from***
***System flexibility* (SQ)**	SQ1	The ICT system of the school is easily available	Fathema, Shannon, & Ross, 2015; Bingimlas, 2009; Strudler, & Hearrington, 2008; Tondeur et al., 2008
	SQ2	The ICT system of the school is reliable	
	SQ3	The ICT system of the school is adaptable	
	SQ4	Response time of ICT system of the school is acceptable due to the functions, speed, features, contents, interaction capability of the technology	
	SQ5	In general, I am satisfied with the *system quality* of ICT of this school	
***External barriers* (EB)/ Obstacles (Obs)**	LA1_r	Lack of resources (educational software)	Venkatesh et al. 2003; Grandon, Alshare, & Kwan, 2005; Al-Khalifa, 2010; Alwani, & Soomro, 2010; Al-Harbi, 2011
	LA2_t	There is not enough time in class to implement technology-based lessons	
	LA3_i	Lack of access to the Internet	
	LA4_t_s	Lack of professional development opportunities on using ICT in teaching	
	LA5_s	Lack of support from school administrators, parents, or other teachers	
	LA6_led	Lack of leadership	
	LA7	Lack of using ICT to measure student learning through high-stakes examinations	
	LA8	Lack of technical support in and outside the class	
***Cultural factors* (CF)**	Cul1	Managers should be careful not to ask the opinions of subordinates too frequently; otherwise, the manager might appear to be weak and incompetent	Kidombo, Gakuu, and Ndiritu, 2009; Alwani, & Soomro, 2010; Al-Harbi, 2011; Albugami , & Ahmed, 2015
	Cul2	Managers should make most decisions without consulting subordinates	
	Cul3	Employees should not question their manager's decisions	
	Cul4	Managers should not ask subordinates for advice, because they might appear less powerful	
	Cul5	Individual rewards are not as important as group welfare	
	Cul6	Group success is more important than individual success	
	Cul7	Working within a team is better than working alone	
	Cul8	It is preferable to have a man in a high-level position rather than a woman	
	Cul9	Men usually solve problems with logical analysis	
	Cul10	Women usually solve problems with intuition	
	Cul11	Solving organisational problems usually requires an active forcible approach that is typical of men	

		Endogenous constructs (Independent constructs of the model)	
Construct	***Item Code***	***Measurement instrument***	***Adapted from***
	Cul12	It is important to have job requirements and instructions spelt out in detail so that people always know what they are expected to do	
	Cul13	Rules and regulation are important because they inform workers what the organisation expects of them	
	Cul14	Order and structure are very important in a work environment.	
	Cul15	Working in a structured environment is better than working (rules and regulations) in an unstructured work environment.	
***Computer literacy* (CS)**	CS1	I feel confident that I can evaluate appropriately students' activities and tasks using ICT systems	Bandura, 1986; Compeau, Higgins, & Huff., 1999; Ong, Lai, &Wang, 2004; Grandon, Alshare, & Kwan, 2005; Ong, & Lai, 2006; Pituch, & Lee, 2006; Roca, Chiu, & Martinez, 2006; Yuen, & Ma, 2008; Bingimlas, 2009; Park, 2009; Park, Nam, & Cha, 2012; Al Mulhim, 2014; Albugami , & Ahmed, 2015; Fathema, Shannon, & Ross, 2015
	CS2	I feel confident that I can select and use educational software for a defined task	
	CS3	I feel confident that I can teach students how to locate, retrieve, and retain content-related information from different sources	
	CS4	I feel confident that I can handle minor problems in using the system and can solve problems to run the system efficiently	
		Exogenous construct (Dependent construct of the model)	
Construct		***Measurement instrument***	***Adapted from***
***Behavioural intention to use* (BIU)**	BI1	I intend to use ICT in primary school teaching in my school when it becomes available in my school	Alhawiti, 2013; Al Mulhim, 2014; Albugami , & Ahmed, 2015; Fathema, Shannon, and Ross, 2015
	BI2	I intend to use ICT in teaching as often as possible	
	BI3	I intend to use ICT in teaching on a regular basis in upcoming time	
	BI4	I intend to recommend strongly to others to use ICT in teaching	
***Actual use* (AU)**	AU1	How many lessons did you use ICT in your teaching in the week 1&2 of the last month?	Russell et al., 2003; Albugami , & Ahmed, 2015
	AU2	How many lessons did you use ICT in your teaching in the week 3&4 of the last month?	
		On an average how many lessons did you use ICT in your teaching in a month?	

Table 4.5 Construct items developed for questionnaire for primary school students

		Endogenous constructs (Independent constructs of the model)	
Construct	***Item Code***	***Measurement instrument***	***Adapted from***
***Effort expectancy* (EE)**	EE1	My interaction with the ICT system (i.e. Class room software, computers) would be clear and understandable	Grandon, Alshare, & Kwan, 2005; Park, 2009; Al-Khalifa, 2010; Alenezi et al., 2010; Albugami , & Ahmed, 2015; Fathema, Shannon, and Ross, 2015
	EE2	It would be easy for me to become skilful at using the ICT for learning	
	EE3	I would find the ICT easy to use	
	EE4	Learning how to use ICT system does not require a lot effort	
	EE5	Using ICT systems in class does not involve too much time doing mechanical operations	
***Performance expectancy* (PE)**	PE1	ICT technologies are useful for the courses	Park, 2009; Nassuora, 2012; Albugami , & Ahmed, 2015; Fathema, Shannon, and Ross, 2015
	PE2	I could improve my learning performance and productivity by using ICT (i.e. Computer, Internet)	
	PE3	Using the system will enable me to accomplish tasks (i.e. Home work, quiz, exams) more quickly	
	PE4	If I use the system, I will increase my chances of getting a high grade	
	PE5	ICT in class would help to make lesson interesting	
	PE6	ICT would help me to get connected with the teachers and friends efficiently to work as group for studies	
***Social influence* (SI)**	SI1	People who influence my behaviour (i.e. Friends, Family) think that I should learn and use ICT for my learning process	Grandon, Alshare, & Kwan, 2005; Oyaid, 2010
	SI2	People who are important (i.e. teachers, principles) to me think that I should know to use ICT for self understanding and better learning	
	SI3	In general, the school authority (i.e. teachers, principles) has supported the use of ICT for my study	
	SI4	My school friends, students from other schools are frequently using ICT for their studies and courses	
	SI5	My teachers encouraged me to use ICT for my study	
***Facilitating conditions* (FC)**	FC1	The school has enough ICT resources including hardware and software for the students	Nassuora, 2012; Albugami , & Ahmed, 2015
	FC2	The students are provided with continued technical supports in and outside class	
	FC3	The ICT system in class room is compatible with other systems I use (in home)	
	FC4	I get general ideas how to use ICT for my studies at class and home (i.e. Familiarity with educational software, searching internet)	

		Endogenous constructs (Independent constructs of the model)	
Construct	***Item Code***	***Measurement instrument***	***Adapted from***
	FC5	A specific person/group is available for assistance with any difficulties related with ICT use	
	FC6	In general, I am satisfied with the *facilitating conditions*	
***Computer literacy* (CS)**	CS1	I feel confident while learning through ICT in classroom	Bandura, 1986; Alenezi et al., 2010; Albugami , & Ahmed, 2015; Fathema, Shannon, & Ross, 2015
	CS2	I feel confident that I can select and use educational software for my study and would understand when the teacher use them	
	CS3	I feel confident that I would learn the use of ICT in my studies quickly due to my basic knowledge of computer	
	CS4	I feel confident that I can handle minor problems in using the system and can solve problems to run the system efficiently	
		Exogenous construct (Dependent construct of the model)	
Construct		**Measurement instrument**	**Adapted from**
***Behavioural intention to use* (BIU)**	BI1	I intend to use ICT for my courses to learn at home and school	Grandon, Alshare, & Kwan, 2005; Oyaid, 2010; Albugami , & Ahmed, 2015
	BI2	I intend to use ICT in learning as often as possible	
	BI3	I intend to use ICT in learning on a regular basis in upcoming time	
	BI4	I intend to recommend strongly to others classmates to use ICT for studies	
***Actual use* (AU)**	AU1	How many lessons did you use ICT in your learning in the week 1&2of the last month?	Oyaid, 2010; Albugami , & Ahmed, 2015
	AU2	How many lessons did you use ICT in your learning in the week 3&4of the last month?	
	AU3	On an average how many lessons you get help to learn using ICT in a month?	

Step 3 Development of a measurement scale

In closed interrogation, a measurement scale is commonly used to reveal the participants' opinions regarding the study variables (Denscombe, 2014; De Vaus, 2013). Among different measurement scales, rating methods developed by Rensis Likert are most commonly used in research (Likert, 1932, Likert, 1974). According to Hair Jr. et al. (2010), Likert scales are ideal for use with self-administered or online survey methods, which are commonly used when respondents are asked to indicate their strength of feeling on a particular issue. Furthermore, the use of a Likert scale with closed questions facilitates statistical measurements of people's attitudes and opinions towards different issues in social and scientific research (Churchill Jr, 1979).

Such scales ensure easy management and coding of data, which in turn facilitates effective analysis of collected data using different statistical techniques (Luck and Rubin, 1987). Three-point, five-point and seven-point rating scales are frequently used in research for opinion measurement (Elmore, & Beggs, 1975; Zikmund, & Babin, 1997). Considering these factors, a five point rating scale was used in this research, ranging from 1 (strongly disagree) to 5 (strongly agree) to reveal the participants' opinions regarding the study variables.

Step 4 Developing the questionnaire layout

To ensure success in quantitative data collection, the questionnaire should be arranged according to practices that are known to increase the rate of survey completion. These are that the questionnaire should:

- be brief, neat, attractive and easy to follow
- minimise respondent exhaustion and avoid frustration
- should remain interesting for the participants throughout
  (Salant et al., 1994; Malhotra et al., 1996; Zikmund and Babin, 1997; De Vaus, 2013; Denscombe, 2014).

In this research, some features were also used in the questionnaire layout to encourage participants and put them at ease throughout the investigation. Important features included were:

- **Cover page**: To ensure data collection ethics and authenticity, and to inspire participants to answer, a cover page was developed to explain the purpose and significance of the research, and provide the names of the university sponsoring the survey and the researcher's academic advisors, as well as the confidentiality measures for the survey. Both a greeting and a thank you were printed on the front and back cover pages.

- **Continuity:** The questions developed gradually in terms of points of interest and complexity. For principals and teachers, the questions followed the order of: personal information; school information; information about their personal electronic devices and usage; factors affecting ICT use in primary school; and finally the *cultural factors* and barriers affecting their present and future use of the ICT in primary school.

  For students, the order of the questions was: personal information; information about their personal electronic devices and usage; and factors affecting ICT use in primary school.

- **Layout of the questions:** If the number of questions appears to be fewer in a questionnaire than it actually is, it encourages higher completion rates (Grossnickle, & Raskin, 2000). For principals and teachers, there were four sections in the questionnaire. The sections were identified as A (personal information); B (school information); C (information about their personal electronic devices and usage); and D (ICT use in Saudi primary schools). For students, there were three sections in the questionnaire; each section was identified as A (personal information); B (information about their personal electronic devices and usage); and C (ICT use in Saudi primary schools). In each section, questions were identified alpha-numerically. That is, questions were identified by the question and the section number (e.g., A1, A2, A3, A4 and A5; B1, B2, B3, and so on).

- **Less time to complete the questionnaire**: The questionnaires were designed to be concise, continuous, and easy to understand by avoiding technical terms, thereby encouraging accurate responses in the least amount of time in order to avoid the respondent's fatigue or boredom.

Step 5 Validation of the developed questionnaires

To ensure the questionnaire effectively measured a particular concept in relation to the context of the study, it was essential to determine the validity of the questionnaire before the pilot test and final survey. For such validation, usually people with more experience or expertise in the field are asked to judge the questionnaire and advise accordingly, based on which the questionnaires are then refined (De Vaus, 2013; Denscombe, 2014).

Ten participants were consulted to evaluate the validity of the questionnaire, including three PhD students conducting research in the area of ICT and online services, three education coordinators from Saudi Arabia, two teachers using ICT in their classrooms, and two principals. They were consulted to avoid contradictions or vagueness in the questions and to check the measurement scale of the responses and the potential of the collected data for possible statistical analysis and modelling. They were asked to give feedback about the clarity of the questions, the items of the constructs and more appropriate wording for the questions if required.

Based on their comments and feedback, some of the terminology and phrasing used were modified to improve the clarity of the questions, and the overall questionnaires were modified to optimise both its efficiency and validity for the pilot test and final survey of the study. Some major recommendations were related to changing some words and sentence structure for some questions, for smooth reading.

Pilot test of the questionnaire. A pilot test is a smaller version of the main survey and analysis to check the acceptability of the questionnaire in terms of the instrument, clarity, measurement, validity, as well as its reliability (Denscombe, 2014). In this study, a pilot test was carried out through a face-to-face survey of 55 participants, including five principles, 20 teachers and 30 students. Participants were requested to assist in instrument improvement by identifying any unclear wording or ambiguity in the questionnaire. After the survey, the collected data were examined for reliability, completeness of responses and construct validity utilising *SPSS* version 20.

After the tests, the questionnaires were found to be acceptable with some minor modifications. Consequently, the pilot test confirmed the reliability of the questionnaires.

Additionally, the test provided the researcher with some idea about the time needed to complete the survey. It was found that, based on the capability and understanding of the respondents, it took approximately 10-20 minutes, which was considered reasonable for such research, given the nature of the questions and responses. The pilot test also provided an indication of the amount work that would be required by the researcher. Finally, the test provided valid as well as reliable grounds for including confirmatory factor analysis in the structural equation modelling of the final collected data.

Administration of the final survey. After testing the questionnaire and making necessary adjustments, the final survey was carried out in February, 2016 and lasted for nine weeks, where face-to-face structured questionnaire survey was carried out for primary school principals, teachers and students. The steps involved in conducting personal questionnaire survey are provided briefly in Table 4.6. They were followed with each school to carry out the survey systematically, increase the interest of the participants.

Table 4.6 Personal questionnaire survey administration procedure for this research

Step	Timing	Process
1	1 week	Contact the KSA Ministry of Education to obtain the list of primary schools in Riyadh, Jeddah and Dammam to make a list of schools to start the survey process.
2	1 week	From the list, a random selection of the schools was generated, after that the researcher contacted the school principals to explain to them the purpose, importance and process of this study.
3	3 weeks	With a short and concise cover letter, complete questionnaires for principals, teachers and students; the researcher visited all the selected schools and surveyed the principals and teachers. As well as helped the teachers to guide the students to fill the questionnaire in their classes.
4	1 week	The teachers collected the responses of the students and the researcher sent notification email and SMS to all the teachers and principals, regarding the progress of the students' data collection.
5	2 weeks	Collect the filled questionnaire of the students from the teachers. All the responses of the students collected from the respective schools.

4.5 Data analysis methods

In order to achieve the desired goals and objectives of the study, to answer the research questions effectively, to determine the validity of the research model, and most importantly to guarantee the best and most relevant results, efficient analysis of the qualitative and quantitative data was essential. This section describes the strategies and operations used for analysis of the data.

4.5.1 Qualitative data analysis process

In this research the qualitative data (interviews) analysis was grounded in the inductive approach. For analysis and interpretation of the interview data, a 'hermeneutical' analysis process was used in this research. Hermeneutics is known as the 'art of interpretation', which is concerned with the process of the creation of interpretive understanding of participants' experiences (Packer, 1989; Boell, & Cecez-Kecmanovic, 2010; Grbich, 2012; Rennie, 2012; Kafle, 2013; Tuohy et al., 2013; Pietkiewicz, & Smith, 2014). It involves the interpretation of text based on iterations of the researcher's own experience and existing literature and research, as well as one's own contextual ideas (Boell, & Cecez-Kecmanovic, 2010). Figure 4.5 shows the Hermeneutic cycle for qualitative data analysis.

According to Rapport and Wainwight (2006), the ‘hermeneutic cycle‘ is,

> *The manner in which interpretation through understanding is achieved by the circular process of continuous re-examination of propositions. (p. 233)*

Erlingsson, & Brysiewicz (2013) described the ‘hermeneutical’ analysis (Figure 4.6) process as,

> *The analysis typically includes immersion in the data, coding sections of text and then combining codes into categories/themes. The process swings back and forth between the text, the researcher's knowledge/experience and theories and previous research in a spiraling process that builds new understandings. This is often referred to as the hermeneutic circle or spiral. (p. 96)*

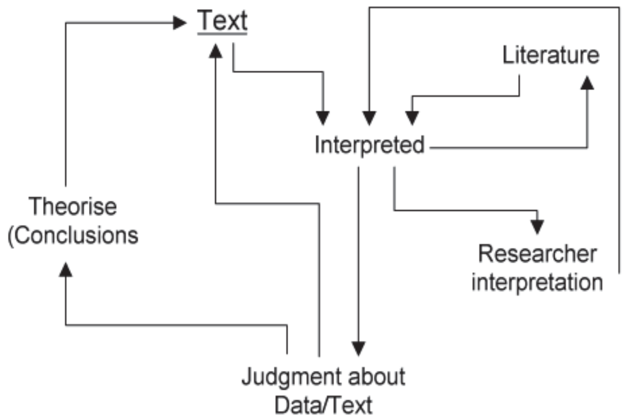


Figure 4.6 Hermeneutic cycle (adapted from Boell, & Cecez-Kecmanovic, 2010; Jensen, 2013)

The cycle starts from searching data, then making a connection with the literature, then making a judgment based on the researcher's interpretation and the literature. After judgment, conclusions are drawn and the final text or writing is done. The interpretations provide support for making judgements about the text, research hypotheses, and other findings of the research, which additionally help to finalise the conclusions, suggesting further interpretation or reinterpretation. Modern hermeneutics deal with the question of human understanding in general, where the question of leaving the hermeneutic circle when a clear meaning is reached is affected by the way the hermeneutic circle is entered (Boell, & Cecez-Kecmanovic, 2010).

In this research, qualitative data were collected from the target groups through in-depth interviews, which were then checked for authenticity and reliability of analysis, including confirmation of the accuracy of the translation and transcripts, and cross checking of the transcripts against the categories to ensure that they were free from major errors. After that the collected data were interpreted using content analysis and searching for words and concepts that matched the categories developed from the research or research questions and proposed models. The interpretations were then matched with the background literature and insight of the researcher about the contexts to determine whether the findings addressed the research problem or answered the research questions.

4.5.2 Quantitative data analysis process

Quantitative data analysis followed the deductive approach. For this analysis, a wide range of statistical tools and techniques was employed to answer the research questions and to assess the proposed research models using collected data.

This analysis was carried out in two steps – descriptive data analysis, and assessment of the proposed models to verify the relationship between variables of this study. For descriptive data analysis, a statistical tool, such as a frequency table, was utilised (Royston, 1983; Razali, & Wah, 2011; Ghasemi, & Zahediasl, 2012; Kim, 2013).

Following the descriptive data analysis, confirmatory factor analysis (CFA) was undertaken for assessing the structural stability of the model with data collected by means of a questionnaire to guide the way for developing the final model. Then the measurement (outer) models in the proposed models were evaluated to test for reliability and validity. Ensuring conformity, reliability and validity, the hypothetical models were investigated using partial least square structural equation modelling. The investigated models were then evaluated. Finally, the model relationship analysis was carried out through hypothesis testing. In the following sections these strategies have been described in more detail.

Explanatory data analysis. Statistical software (*SPSS, Version 22*) was used for descriptive data analysis. These analyses involve describing the participants' profiles and the general characteristics of different variables, the measurement of central tendencies, test data characteristics, and a test for the normality of the data acquired. For these analyses, the statistical tool used was *frequency distribution*.

Test for structural stability of the models: Confirmatory factor analysis (CFA). In this research, CFA was conducted to test how an adequate *a priori factor* structure and its relevant model of loadings matched the actual data (Schwartz, & Boehnke, 2004; Hair Jr. et al., 2010; Carvalho, Ready, Malloy, & Grace, J., 2013; Duane, Humphris, Richards, Okeefe, Gordon, & Freeman, 2014; Sepulveda, Parks, de Pellegrin, Anastasiadou, & Blanco, 2016). CFA requires both the number of factors and the specific pattern of loadings of each of the measured variables on the underlying set of factors, where each measured variable is hypothesised to load on only one factor, and positive, negative, or zero (orthogonal) correlations are specified between the factors (Curran, West, & Finch, 1996). CFA was undertaken to ensure that all the ideas in the model influenced convergent legitimacy, construct cogency, discriminant authority and factorial validity (Curran, West, & Finch, 1996; Byrne, 2013).

In this research the proposed factors of the models were entered for CFA, where it was assumed that the factors or items having outer factor loading greater than 0.5 predict the corresponding constructs effectively (Husain et al., 2014). This analysis helped the researcher assess the structural stability of data collected through the questionnaire in order to develop a better understanding of the model, and pave the way for developing the final model.

Evaluation of measurement (outer) models. Evaluation of the measurement model (outer model specifying the relationship between the indicators or manifest variables) was done through a test for reliability, and a test for validity. The methods followed for the evaluation in this research are described below.

Test for reliability

Reliability is important for research while establishing the validity of the inferences based on scores from tests and measures, which represents the extent of error, stability and consistency (Gadermann, Guhn, & Zumbo, 2012; Eisinga, Grotenhuis, & Pelzer, 2013). According to Santos (1999), reliability is tested 'when variables developed from summated scales are used as predictor components in objective models'. In order to judge the reliability of the constructs in this research, both Cronbach's alpha, and composite reliability statistics were measured for the principals', teachers' and students' responses. Cronbach's alpha was used to measure the reliability through an index associated with the variation found within the items of the construct (Santos, 1999).

Cronbach's alpha is referred to as a measure of 'internal consistency' reliability, which is observed when the questions are asked differently but the respondents gave the same answers (Eisinga, Grotenhuis, & Pelzer, 2013; Bonett, & Wright, 2015). Cronbach's alpha values range from 0 to 1, which is classified into four categories based on reliability. Very high values are from 0.90-1.00; 0.70-0.89 is high; 0.30-0.69 is moderate; and 0.00-0.30 is low; where generally values greater than

0.7 are considered to show good reliability (Santos, 1999; Husain et al., 2014; Li et al., 2014). However, Cronbach's alpha may overestimate or underestimate reliability (Raykov, 1997, 1998a; Tavakol, & Dennick, 2011). Therefore, in addition to Cronbach's alpha, composite reliability statistics were also measured, where higher composite reliability value (greater than 0.7) represents acceptable reliability.

Test for validity

Validity refers to the effectiveness of the factors to affect the constructs. In this research, the convergent and discriminant legitimacy of the constructs of the measurement models were utilised to test the validity of the constructs. Convergent legitimacy shows how well the latent constructs are explained by the observed variables. The measure used in this research for testing convergent legitimacy was average variance extracted (AVE), where AVE values greater than 0.5 demonstrated that the construct, as a whole, shared more variance with its indicators than with the error variance (Hair Jr. et al., 2010; Li, Chen, Liu, & Peng, 2014; Henseler, Ringle, & Sarstedt, 2015).

In addition to convergent legitimacy, the discriminant validity of the constructs was also checked. Discriminant validity was used to check for the possibility of finding significant variance among different variables for the same reasons (Ghadi, Alwi, Bakar, & Talib, 2012).

In this case, the Fornell-Larcker measurement value was considered, which discloses collinearity problems in the inner model earlier in the model evaluation process (Hair Jr et al., 2014). In this measurement, if the diagonal values of the matrix have greater than other correlation values, it establishes discriminant validity between two reflective constructs in the models (Fornell, & Larcker, 1981; Urbach, & Ahlemann, 2010; Wong, 2013; Henseler, Ringle, & Sarstedt, 2015; Henseler, Hubona, & Ray, 2016).

Investigation of the hypothetical models: Partial least square structural equation modelling (PLS-SEM). Structural equation modelling (SEM) was utilised in this research to investigate the hypothetical relationships of the models after testing the structural stability of the models through the CFA analysis. SEM has the ability to evaluate the measurement of latent variables, as well as test relationships between latent variables (Wong, 2013; Hair Jr. et al., 2014; Henseler, Hubona, & Ray, 2016). It was used in this research because of its illuminating aptitude, complete figures of model analysis, general practice as a trial and error model that can be tested several times, and capacity to progress stronger models by analysing philosophies on the quantified associations (Byrne, 2013; Hair Jr. et al., 2010; Hair Jr. et al., 2014). Thus, in this modelling approach, the strongest model is accepted after different tests showing the relationships with validity and reliability.

There are two branches of statistical techniques within SEM: covariance base SEM modelling and variance based modelling (Figure 4.7). In recent years, variance-based structural equation modelling (SEM) has been growing in popularity (Wong, 2013; Henseler, Ringle, & Sarstedt, 2015; Henseler, Hubona, & Ray, 2016). Among different variance-based SEM methods, use of partial least squares path modelling (PLS) has increased substantially (Henseler, Ringle, & Sinkovics, 2009; Monecke, & Leisch, 2012; Wong, 2013; Hair Jr. et al., 2014; Hair Jr., Hult, Ringle, & Sarstedt, 2016; Henseler, Hubona, & Ray, 2016). Figure 4.6 shows the PLS-SEM modelling process.

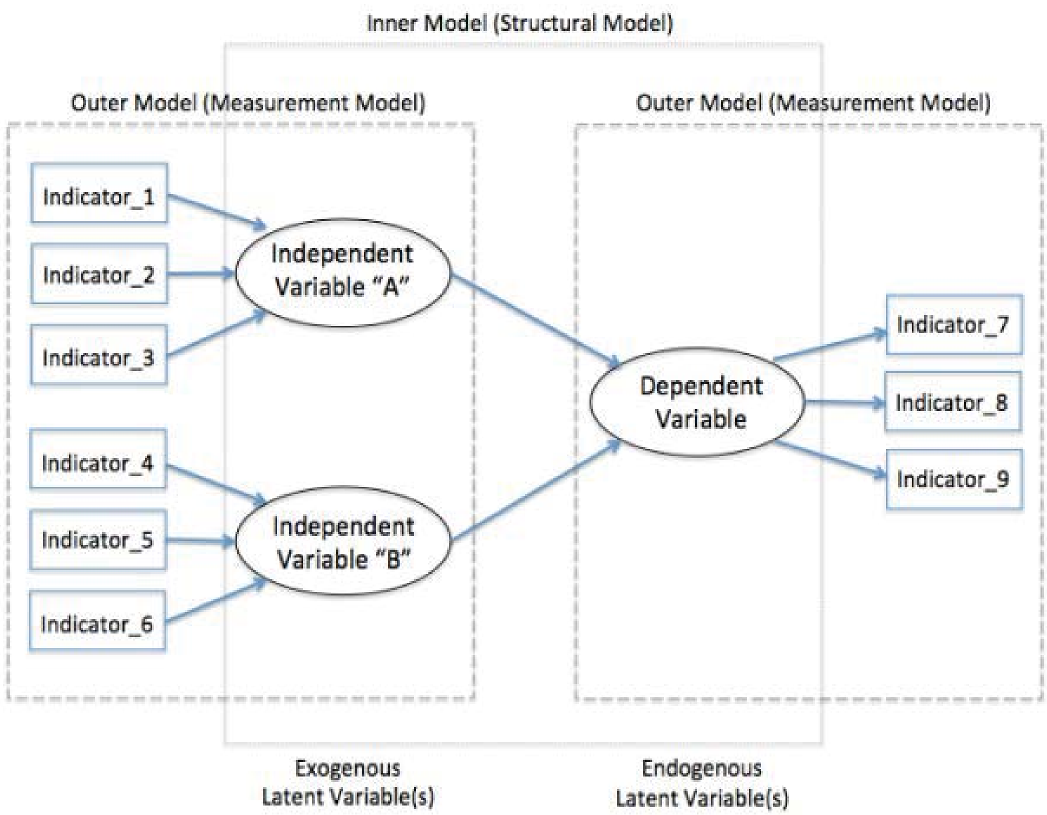


Figure 4.7 PLS-SEM modelling process (Wong, 2013)

PLS-SEM is an iterative approach that maximises the variance of endogenous constructs employing linear composites of observed variables as proxies for latent variables, in order to estimate model relationships, given that construct validity was established (Hair Jr. et al., 2014; Hair Jr et al., 2016; Henseler, Hubona, & Ray, 2016). PLS-SEM is particularly suitable for use in research due to its:

- suitability for non-normal data
- small sample sizes
- formatively measured constructs
- delivery of latent variable scores
- estimation of very complex models with many latent and manifest variables
- less stringent assumptions about the distribution of variables and error terms
- ability to handle both reflective and formative measurement models.

(Henseler, Ringle, & Sinkovics, 2009; Goodhue, Lewis, & Thompson, 2006; Hair Jr. et al., 2014;
Wong, 2013).

In PLS-SEM, the path models are formally defined by two sets of linear equations: the measurement model (also called outer model specifying the relations between a construct and its observed indicators) and the structural model (also called inner model specifying the relationships between the constructs) (Hair Jr et al., 2014; Henseler, Hubona, & Ray, 2016).

In this research, PLS-SEM was utilised to develop final models representing ICT adoption by primary school principals, teachers and students in primary school education in Saudi Arabia, considering the suitability of the model with respect to research problems, questions, and objectives. For the purpose of modelling, *SmartPLS* software (a standalone software specialised for PLS path models) was utilised in this research. It had been developed by Ringle, Wende and Will (2005) (Monecke, & Leisch, 2012; Wong, 2013).

Firstly, for PLS-SEM, the path models of the proposed models connecting the variables and constructs were considered for running the PLS-SEM algorithm in *SmartPLS* software. The estimation of path model parameters involved four steps:

1 determination of an iterative algorithm that determines composite scores for each construct
2 correction for attenuation for those constructs that are modelled as factors

3 parameter estimation

4 bootstrapping for inference testing.

(Henseler, Hubona, & Ray, 2016)

Figure 4.8 is a diagram depicting a flowchart for the PLS algorithm. The significance of each parameter and the strength of the relationships between the predicator (exogenous) and the dependent (endogenous) construct were determined using critical ratio or t-values. Based on the weights of the indicators, the relevance of the indicators was assessed to determine their relative contribution to forming the construct (Wong, 2013; Hair Jr et al., 2014; Hair Jr et al., 2016).

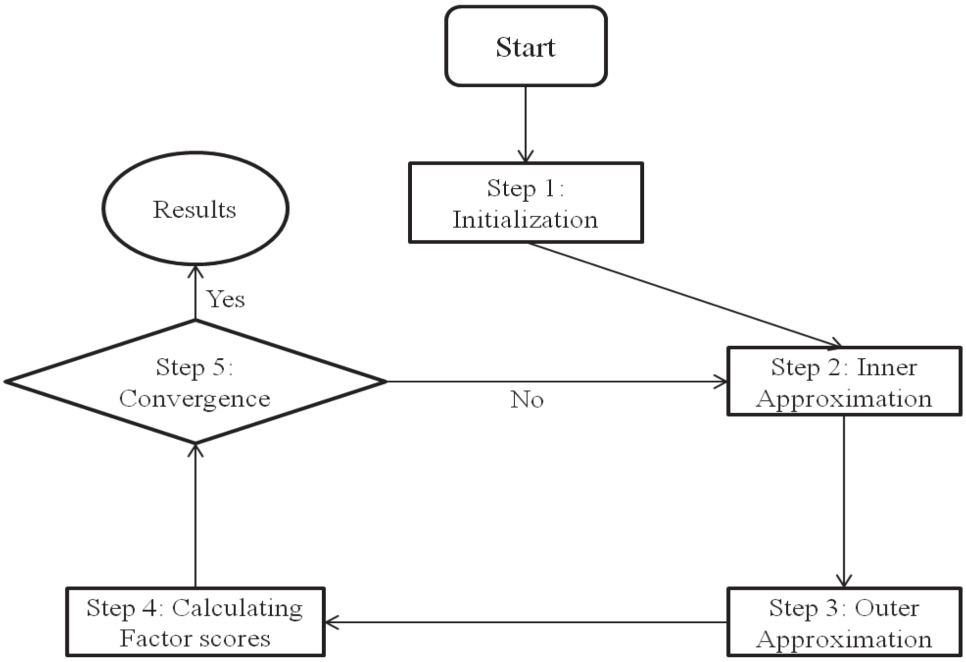


Figure 4.8 Diagram depicting the flowchart for the PLS algorithm

Evaluation of structural model. In this research, evaluation of structural model (inner model specifying the relationship among constructs) was done using estimation of path coefficients (β),co-efficient of determination (R^2), and prediction relevance (Q^2). The methods followed for the evaluation in this research are described below.

Estimation of path coefficients (β)

Estimation of path coefficients measures the magnitude effect of one variable on another and their strength of correlation, where the values are evaluated in terms of its sign, magnitude and significance. Path coefficient values are standardised on a range from -1 to +1, where coefficients closer to +1 represent strong positive relationships and coefficients closer to -1 indicate strong negative relationships (Hair Jr et al., 2014; Hair Jr et al., 2016). The significance of a coefficient ultimately depends on its standard error, which is obtained by means of bootstrapping (Hair Jr et al., 2014).

Coefficient of determination (R^2)

R^2 measures and represents a model's predictive accuracy showing how much variance in a variable is explained by other variables, i.e., the exogenous variable's combined effect on the endogenous variable(s) (Hair Jr et al., 2014). This value ranges from 0 to 1 where, 1, 0.75, 0.50, and 0.25, represent complete, substantial, moderate, or weak levels of predictive accuracy respectively (Hair Jr et al., 2014; Hair Jr et al., 2016).

Prediction relevance (Q^2)

Prediction relevance is a blindfolded analysis which allows the researcher to examine whether the model is really reflecting the data or not. In the structural model, a Q^2 value larger than zero for a certain reflective endogenous latent variable indicates the path model's predictive relevance for this particular construct (Hair Jr et al., 2014; Hair Jr et al., 2016).

Model relationship analysis. Based on the research problem, questions and corresponding objectives (Chapter 1), hypotheses were developed (Chapter 3) appropriate to the research to analyse the relation among the constructs in the proposed models. In this research, 29 hypotheses were tested, among which 11 hypotheses represent relations in a model for primary school principals; 11 hypotheses represent relations in a model for primary school teachers; and seven hypotheses represent relations in a model for primary school students.

These hypotheses were tested based on the collected quantitative data using the p-values. In the case of the hypotheses with the p-values greater than a significance level of 0.05, the hypotheses were rejected. On the other hand, where the p-values were less than 0.05, the hypotheses were accepted (Wainer, & Robinson, 2003; Lehmann & Romano, 2006).

4.6 Test of the factors after analysis

Validation of the research outcome was a major step in this study. Based on the significant factors (identified in models and interviews) predicting *behavioural intention* and *actual use* of ICT in Saudi primary schools, focus group discussion (FGD) sessions were conducted with the principals, teachers, and students from different schools (Appendix D). The group discussions sought to find the level of agreement or disagreement of the groups with the research outcomes.

Focus group discussion is a qualitative approach widely used in *participatory learning and action* (PLA). These processes would not only allow the validation of the results obtained in the earlier analysis of the research, but also permit the ranking of the most important factors using a priority matrix (Gill et al., 2008; Narayanasamy, 2009). In a priority matrix, factors are compared pair by pair (e.g., *performance expectancy* vs *effort expectancy*), and the group decides which factor they prefer of those two factors (Kesby, 2000; Cavestro, 2003; Narayanasamy, 2009). This process continues throughout the discussion sessions, and comparisons of factors varies according to the groups.

The discussion groups explored the problems caused by not using ICT, or any difficulties caused by using ICT in primary schools from principals', teachers', and students' points of view, in relation to the research findings. There were three different focus groups – one for principals, one for teachers and one for students. Each group was presented with the findings of the model and other analysis relevant to that group. For different groups, the discussions took the following form:

Principals

- Everyone expressed their opinion of the results.
- Semi-structured questions were asked.
- The group would make a priority matrix identifying the most important issues for the principals regarding the ICT facilities in schools.

Teachers

- The teachers were asked to indicate how much they agreed with the findings.
- They were asked about other difficulties they found due to the lack of ICT facilities.
- Semi-structured questions were used to elicit information about ICT usage in their daily activities.
- A priority matrix was developed of the factors identified in the model as significant and the factors ranked according to influence.

Students

- The student session was suited to their ages, and there was a multimedia presentation.
- ICT facilities that could be introduced to the school were demonstrated.
- The students also ranked their preferences and the problems they faced.

Use of discussion groups is a new approach for this kind of research, as it is usually used for qualitative studies, and mostly for PLA (Cavestro, 2003; Narayanasamy, 2009). However, this method was selected because of its ability to capture collective views from different groups. Focus groups are particularly effective for non-technical persons, which is the case for students' group in this study. The final outcome of the study group validated the results found in the rest of the study. Therefore, this process added strength and confidence to the research outcomes, allowing the researcher to claim the research findings with greater confidence.

4.7 Summary

This chapter detailed the research methodology and the methods used in this research. Deductive, inductive and mixed approaches were chosen for data collection and analysis. The research methodology framework was designed based on its relevance. Sampling for data collection from three groups (i.e., principals, teachers and students) was decided considering gender and geographical location. Qualitative data were collected through in-depth interviews, which included forming the structure for the interview. The qualitative data were analysed using the hermeneutic cycle.

Surveys were used to collect quantitative data, which included a series of activities, e.g., questionnaire design, pilot test of the questionnaire, and final survey. Quantitative data were analysed in two steps – descriptive data analysis, and assessment of the proposed models. Descriptive data analysis was completed using statistical tools, which have been explained in some detail. The steps followed for assessment of the proposed models were:

- confirmatory factor analysis (CFA)
- evaluation of the measurement (outer) models for reliability and validity
- investigation of the hypothetical models using partial least square structural equation modelling (PLS-SEM)
- evaluation of structure model
- finally, analysis of the model relationship through hypothesis testing.

In the following chapters these operations have been described in more detail.

Chapter 5

Qualitative analysis

This chapter discusses the analysis of findings from the interviews with principals, teachers and students to understand the factors affecting the use of ICT in primary schools in Saudi Arabia. At the beginning of the chapter, a brief overview of the nature of the participants is provided. Thereafter, the results of the interviews are reviewed and the perceptions of the principals, teachers and students discussed in relation to the factors inhibiting the adoption of ICT in primary schools. This discussion is based on the various stakeholder categories and around the constructs that define the suggested models. The chapter concludes with a summary of the findings from the interview analyses.

5.1 The interviewees and their schools

The participants. The number of participants interviewed was 30. There were 10 principals, 10 teachers, and 10 students. At first ten primary schools were randomly selected, both boys' and girls' schools. Although girls' schools have been sampled before by academics, such as Alabbasi (2016), it must be noted that she was a female researcher able to access female schools (investigating the use of *WhatsApp*) without causing offense. Ultimately, no girls' schools were included in this study for reasons of cultural and social sensitivity, and principals, teachers and students of 10 boys' schools were eventually recruited to participate in the research.

Nevertheless, female perspectives were still sought in order to reduce bias in the study, and four female teachers from four other primary schools were eventually interviewed and their responses reported. There were, therefore, 10 male principals in the sample and 10 male students, while for the teacher sample, six participants were male and four female. The interviews were originally conducted in Arabic due to the language preference of the interviewees, and later translated to English.

As discussed in Chapter 4, the interviews were used to determine the participants' thoughts on computer and internet usage as it related to the primary classroom. Through the interviews, key issues of ICT usage motivation, and hindrance in Saudi primary schools were identified, which aided the preparation of the questionnaire used for quantitative data collection and modelling.

ICT available to the participants. From the interviews with the principals from ten primary schools in Saudi Arabia, it emerged that five of the schools had a single computer lab while the other five schools had one computer in each class. Each of the schools had a projector. The principals used ICT in the form of a desktop computer in their office or a personal smartphone. The teachers used ICT in their homes in the form of desktop computers. The main uses of ICT in these schools were to store student and employee data, and to monitor attendance and grades. Thus, *actual use* of ICT in classrooms for teaching and learning purposes was very limited or non-existent.

5.2 Factors affecting the use of ICT in primary schools: The principals

To identify the factors that influence the use of ICT in primary schools, 10 principals from 10 different schools were interviewed. Among these schools, five were located in Jeddah, three from Riyadh, and two from Dammam. These schools were standard primary schools in Saudi Arabia, with the number of students ranging between 450-500 students. There are five levels, class 1-class 5, and each level has approximately 80-100 students. However, not all the students at a particular level study together. Usually there are three or four groups of students at each level, referred to as sections. For class 5, for example, there are Sections A, B and C, each with around 20-35 students. The students were 6-12 years of age, and the average teacher to student ratio was 1:10. All schools followed the national curriculum of primary education, including basic subjects, such as mathematics, Arabic, English, and additional subjects, such as Islamic studies, and *Tafsir* (better understanding of the Holy Book *Al'Quran*).

The principals were in charge of the administrative management of the school, but also took classes. They were directly involved in making decisions, managing resources and leading in different activities. Thus, their ideas and attitudes towards ICT had a major impact in the process of ICT integration and implementation. In the following sections, factors related to ICT use and the preferences of the principals as revealed by the data analysis are explained.

5.2.1 Performance expectancy

Performance expectancy refers to the individual's beliefs regarding the usefulness of ICT in the primary school teaching and learning process; that is, will the use of ICT improve the principal's job performance (increasing their efficiency), hinder it or make no difference at all? In response, eight out of 10 principals indicated that ICT could be used for communication and information dissemination. However, one of them mentioned in particular that ICT had changed the way they communicated.

> *I was using letters previously to communicate with education ministry offices. Now I can email them easily; this gives me more frequent communication with them. (Interview#3, Principal)*

Two principals, however, disagreed with the statement that ICT provided easier communication mechanisms. They noted that they were comfortable with traditional paper-based ways and thought using paper was better, especially for official work.

The majority (70%) of the principals agreed that ICT is important for teaching in the classroom. Among them, one principal said,

> *Use of ICT in classrooms improves primary school teachers' teaching performance and increases learning productivity of primary school students. (Interviewee #6, Principal)*

In addition, another principal explained that,

> *For the office work, use of computers has changed the pace of the work. Now I can do complex budgeting, grade preparation and information dissemination work more efficiently. Sometimes I just send emails to all teachers to invite them for meetings rather than printing a page and circulating it. I like the way it reduces some burdens and I am positive about using it more. (Interviewee #4, Principal)*

However, not all of the principals found the use of ICT advantageous for their work. One of them explained that ICT training was not widely available, and the Ministry of Education does not have enough training programs to help them become proficient, in his own words,

> *I have no training in using ICT for school work, and yet I have not got any invitation for ICT training. The things I know are all down to myself. I believe that I can operate the computers well, but not to the level that can change my efficiency to a new level. But I am confident that with proper training it would be an effective tool. (Interviewee #7, Principal)*

Despite some disagreement and some dissatisfaction about current ICT training, the general consensus of the principals about ICT was positive. They acknowledged that now is the era of ICT and the internet, and the use of these technologies has the potential to improve their performance. During the interviews, many words were repeated by the interviewees, such as 'positive', 'increased potential', 'help reduce pressure', which suggested that the principals think ICT is effective in improving their performance. The positive attitude found among most of the principals, and their willingness to use ICT for their correspondence and administrative work, was considered as a benefit, increasing their performance levels which increased usage and satisfaction.

Overall, the *performance expectancy* of the principals was positive, and their positive perceptions about the usefulness of ICT would encourage them to adopt it for administrative, teaching and learning purposes in their schools.

5.2.2 Effort expectancy

The qualitative analysis revealed that *effort expectancy* for ICT use among the principals depended on their perceived level of proficiency and the ease of using ICT in their day-to-day activities. The qualitative analyses of the principals' responses revealed their levels of ICT proficiency. (Greater detail about the personal use patterns of the principals is explored further in Chapter 7 Quantitative analysis.)

Two of the ten principals expressed high levels of confidence in their ICT proficiency. Another five claimed to be moderately proficient, while three reported low levels of skill. Seven of the principals explained that they use a computer for preparing lessons and doing administrative work, indicating that they have a familiarity with computers and software and find ICT systems easy to use. In addition, the principals stated that learning to use the computer for preparing lessons did not require a lot of effort. But using ICT in classrooms at an advanced level, as well as doing complex administrative work, requires some effort, for which training may be required.

Some principals had not attended any professional development courses that discussed the importance of using ICT in schools, although others had. Interviewee #7 said regarding his level of proficiency,

> *I did not get any training for the computer programs that I am able to use and able to employ in education. I just can use Word Office. (Interviewee #7, Principal)*

The most common computer program in use was Microsoft Office *Word*. Some also used Microsoft Office *PowerPoint* and Microsoft Office *Excel*. It was revealed in the interviews that eight principals out of 10 encouraged teachers in their primary schools to use computers, but due to a lack of ICT skills, staff rarely attempted to use them.

We encourage teachers to use computers, but a lot of them do not want to use them. (Interviewee #3, Principal)

Many of the teachers fear using ICT in the classroom because they do not know how to use them. (Interviewee #6, Principal)

Moreover, all the principals reported that their schools had no policies for motivating the teachers to use ICT in the classroom. They did not reward the teachers who used ICT in the classroom, nor did the principals report holding any discussion with teaching staff about ICT use for pedagogical purposes. Interviewee #8 said,

We do not have ICT training for the teachers and students; however we hope to do some training courses to let the teachers know about the important modern teaching aids using ICT. (Interviewee #8, Principal)

Review of the interviews revealed a shared view among the principals that using ICT was not too difficult for general tasks; however all of them indicated the need for additional training for specialised activities. Their current experiences were limited to Microsoft Office applications, which generally require only basic operating knowledge and are typically easy to learn. In contrast, for high functionally, the principals felt they were not prepared.

Common key words identified in the interviews were 'not difficult', 'easy', 'less effort' 'little training', when the principals were discussing their general activities. It can be suggested that primary school principals' *effort expectancy* for ICT use influences their *behavioural intention* to use ICT in primary education. The most important factors affecting the perception of the principals regarding *effort expectancy* for ICT were: perceived level of proficiency; level of ICT use required in classrooms; purpose of using ICT; lack of ICT skills of the teachers; participation in training programs; computer programs they commonly use, and lack of policy measures to encourage teachers to use ICT in classrooms.

5.2.3 Computer facilities for principals

The facilities for computer use in the schools greatly influenced the use of ICT in primary education. Facilities included the availability of computers in classrooms, computer labs, and for teacher use at their desk, along with access to the internet at schools for administration and teaching purposes. Furthermore, the principals were aware of the benefits of integrated audio-visual teaching aids, such as projectors, computers and internet services for teaching and lesson preparation, and were concerned about their ability to use ICTs without these infrastructure items. Most of the principals said that they did not use ICT in their schools due to poor infrastructure.

Interviewee #2 said,

> *I am not ready for using ICT in my classroom because the poor infrastructure for the use of modern technology in my school and the lack of availability of devices in the school. (Interviewee #2, Principal)*

Six of the 10 principals said that while they encouraged teachers to use the computers, they did not have enough devices in their schools. Five of the principals said that they did not have computers in all the classrooms, but that they had one laboratory classroom with 15 computers purchased with funds allocated by the education office of their regions.

However, they also noted that there were just two projectors at each of their schools, one in the computer lab room and one in a separate seminar room, also allocated by the regional educational office. Principals from the remaining schools explained that there was one computer in a few classrooms at their schools, instead of a dedicated computer laboratory, and there were just two projectors at each school for seminar rooms/ common rooms. The schools do not have their own discretionary funds for the purchase of hardware resources, so they could not provide students individually with a device, such as laptop, tablet PC, netbook, or notebook for their own use. One of the principals explained,

> *The resources we got from the government seemed often to adorn our schools with ICT rather than actual use. We take some lab classes to make the children familiar with the facilities, but they are not actually used in the teaching purpose. (Interviewee #7, Principal)*

The responses indicated that the Ministry of Education has not invested adequate funds in providing effective ICT facilities for primary schools. However, even if the funding is insufficient, the funds that are provided to the regional office are being spent poorly, without proper planning, or adequate training for teachers to enable them to use computers effectively. Therefore, it can be argued that funds for the primary schools are shared and insufficient, inhibiting policy decisions and actual projects involving the use of ICT in primary schools. Principal #4 provided a critical response in this regard, *The main problem is having ICT policies integrated into overall primary education. If the government takes a centralised decision to provide a computer in every class, it is only then possible to integrate it in teaching and learning. School authority [school management committee] is not strong enough to formulate and implement ICT policies of their own, due to their limited control over the school budget. (Interviewee #4, Principal)*

Responses from the interviews suggest that the present conditions of ICT facilities are not positive and the supply is inadequate compared to the demand. This has a great influence on primary school principals' *behavioural intention* to use ICT. With low availability and access to ICT infrastructure, their intended behaviour to use ICT remains unexplored. Responses from the interviewees suggested that the most important barriers to the use of ICT in terms of infrastructure were the limited school budget, lack of computers in the classroom, lack of internet and computer labs, and lack of policy measures for the use of ICT in classrooms.

5.2.4 Cultural factors

Islamic culture is dominant in Saudi Arabia, and therefore, the education culture of Saudi Arabia can be different from many other countries. The principal's work mostly as managers in the schools and they are visibly and officially the leaders. However, due to different cultural conditions, the principals' perceptions of collective work, their attitudes towards the capabilities of female workers, and their uncertainty regarding the use of ICT is likely to be different from principals from many Western nations. Nearly all (nine out of 10) of the respondents indicated that they thought that a united approach by teachers, principals and school committees would improve the perception of ICT in schools and the classroom. Half of the principals believed they needed to be careful in using ICT, as it should not contradict Islamic belief and laws. They felt that they needed to avoid the uncertainty and potential conflicts with Islam related to the use of ICT. One of the principals remarked that,

Due to the cultural beliefs in our country regarding restrictions on using any internet materials in contradiction with Islamic law, and understanding the use of ICT for education purposes only, it is difficult to make the parents of the students understand the usefulness of ICT. (Interviewee #5, Principal)

Another principal mentioned the views of school committees, and pointed out that the majority of the committee members did not think about the positive effect of ICT usage, and were more concerned about the uncertainty of specific use cases, in his words,

> *Our school committee is not yet convinced that we need a computer for each class. Collectively, they are very uncertain about what negative effects may happen if we introduce internet in class. (Interviewee #3, Principal)*

In addition, maintaining status and corresponding power is a very important factor in Saudi Arabian behaviour. Analysis of the interviews found that despite all principals indicating respect for females in general, they did not feel confident that the use of ICT would be very effective in an all-girls school. This is quite an interesting observation on the part of the principals, who often referred to their doubts about ICT usage in a girls' school. Their comments suggested that females were less capable of managing ICT facilities, although some suggested that a female could use ICT facilities with proper training. One of the principals remarked that,

> *Use of ICT at the male primary schools would be easier to achieve compared to the primary schools where everything is operated by females, maybe due to men being more proficient in handling ICT facilities. (Interviewee #7, Principal)*

Although the principal's comment suggests a strongly male-oriented bias against females in education, it is also a reflection of the fact that females are often treated with extra care and support in Saudi society. Thus, the male often does what is considered the heavy work, such as outdoor maintenance and managing family services like electricity, computers and other utilities, which is reflected in the male principal's comment.

As principals are responsible for several school-related social activities, they must constantly consider the culture within and surrounding the school, and are responsible for convincing the parents that they are not teaching anything unconventional. These considerations hinder the promotion of ICT. While there are these perceived social constraints, the principals themselves generally demonstrated flexible attitudes regarding the use of ICT. One of the principals added,

> *I know what Islam tells; it tells us to adopt new things, but keep in mind the laws and restrictions Allah gave us. I assume we can adopt ICT in education, with proper monitoring, collaboration and social awareness. (Interviewee #10, Principal)*

Further analysis from the interviews indicated that cultural norms and beliefs influenced primary school principals' *behavioural intention* to use ICT and their leadership, in particular their influence on the other teachers. The principals are yet to be given sufficient power to introduce ICT into their schools unilaterally. They have to convince school committees and parents, and collectively these groups are not helping the principals. Nevertheless, some of the principals are trying to introduce ICT into their schools. Principals often face the resistance from different groups influenced by Saudi culture. Out of the discussions with the principal, the critical *cultural factors* influencing the implementation or usage of ICT emerged. These were: authority and power distance, social collaboration, avoiding uncertainty; Islamic laws and rules.

5.2.5 External barriers for the principals

As understood from the interviews, the principals thought barriers to the use of ICT were often external to the school, and they felt that they had no control over them. Form the interviews, these barriers were commonly identified as:

- lack of support from the parents
- lack of leadership among the school committees
- lack of support from the ministry for ICT use
- lack of related training
- lack of resources.

The list of barriers have been summarised from the comments made by all the principals. Many of them indicated resources constraints, lack of peer support and inadequate personal abilities to use ICT. In this regard, two principals stated,

> *I often feel unwelcome when I talk about ICT in the school committee meetings, and even some parents do not want us to encourage the students to use ICT for their learning. They tell us, the children would be more inclined to other uses of computers and internet, such as games and social media. (Interviewee #1, Principal)*

> *The main issues I found with ICT integration in primary education are; lack of facilities, funding, and support from higher authorities. Our positive attitude is not everything, we would need support from others, with proper facilities. In future, we would need training for the teachers and also a clear strategy to integrate ICT facilities in our primary education system. (Interviewee #3, Principal)*

Other statements of the principals indicated that the policy setup was inadequate. In their view, in addition to local pressure, the principals agreed that to make the use of ICT easier in the classroom, the policy interventions required included the:

- creation of a special budget for ICT development
- preparation of an integrated plan to provide ICT within the school
- maintenance of the ICT infrastructure
- provision of devices adequate and appropriate for the large number of students per class
- allocation of enough time for the use of ICT in the classroom

- education of the teachers and students of the importance of using ICT at school
- usage of multimedia (photos, audio and videos) that can increase the attention of the students
- development of materials to help motivate and educate schools, students, teachers and families about the use of ICT at school.

The above policy recommendations came from the interviews, where the principals recommended what could be done to improve ICT use in their schools. According to the principals, though policy and action are important for effectively using ICT in schools, none of the schools had a specific policy in place directing the use of ICT for teaching and learning in specific subjects. Interviewee #6 said,

> *Our school does not have a specific policy or program to prepare students for responsible internet behaviour but we try to do it and always mention it some time when we talk to the students. (Interviewee #6, Principal)*

It was evident from the interviews with the principals that they perceived external pressure to avoid promoting ICT in schools. They indicated that attempts to integrate ICT usage into learning and teaching were hindered by a lack of policy formulation and resources beyond the school's internal management. However, some of the principals remarked that they felt that they could overcome the local pressure of parents and the school committee, but that they would require better policy support. The most important *external barriers* stopping the principals from implementing or using ICT were: lack of policy support; lack of funds; lack of technology-integration plan; lack of support from parents and lack of ICT awareness among teachers, parents, committee and even students.

Based on these observations, it can be argued that *external barriers* have more influence on the actions and capacity of the principals to introduce and encourage ICT use than their own *behavioural intention* to use ICT.

5.2.6 Behavioural intention of the principals

The qualitative analysis revealed that eight among the 10 principals had a positive attitude towards the integration of ICT into teaching in their schools, saying that the use of ICT in primary education would be an efficient and effective step to improve teaching and learning. In this regard, Interviewee #2 said, *It is worthwhile and very desirable to integrate ICT in primary school, and I have a generally favorable attitude toward integrating ICT. (Interviewee #2, Principal)*

Most of the principals (eight out of 10) were intending to integrate ICT into primary education in their schools, but could not for reasons associated with *external barriers* and a lack of resources. Two of the most important reasons stated by the principals were the lack of *facilitating conditions* and the negative intention and attitude of the teachers. One of the principals remarked,

I like to encourage teachers to use the computers but we do not have enough devices in our school and a lot of teachers do not want to use them. (Interviewee #6Principal)

Interviewees #2, #3 and #8 expressed similar ideas in their own words. The summary of their concern includes the lack of resources, their financial constraints and the reluctance of the teachers to use ICT in class. They would like to use smart devices that would help teachers communicate with students, and Interviewee #2 envisaged students downloading lessons and doing their homework through an online program, with teachers giving them the feedback and grades online as well.

Interview analyses of the principals' responses highlighted some key points in this research. Most importantly, the analysis identified the positive *behavioural intention* of most of the principals and their favourable attitude about the potential of ICT in education in terms of increased teaching efficiency and ease of use. Thus, if ICT protocols were introduced, a majority of the principals would take it as positive. However, they were keenly aware of existing problems causing little or no use of ICT at Saudi primary schools.

The principals explained their constraints regarding lack of budget, supply of ICT facilities, lack of training, social pressure and some *external barriers*. Many of the responses detailed in this section confirm statements detailed by other researchers discovered through the literature review. The interviews with this target population provided valuable guidance in identifying the problems for the principals trying to introduce ICT.

5.3 Factors affecting the use of ICT in primary schools by teachers

Understanding the factors that influence the ICT usage of the teachers requires insight into the teachers' perceptions of current ICT conditions and their effectiveness. In order to capture a snapshot of the teachers' thoughts about ICT usage and the reasons for using or not using technology in the classroom, 10 primary teachers were interviewed. As with the principals, the teachers were selected randomly from the three major cities. The teachers included four science teachers, two Arabic language teachers, two English teachers and two maths teachers.

Nine out of ten interviewees took classes of children aged 10-11 years in levels four and five. The teachers interviewed had to take more than three classes per day, and they also had additional academic activities apart from teaching. All of the interviewees had basic ideas about ICT (such as, what it is, and what are common ICT facilities), and how it might relate to education, as most (8 out of 10) of them had higher degrees. The interviews were designed to explore the major areas of teacher concern and responses have been grouped under broad topics identified from the literature, as discussed below.

5.3.1 Performance expectation

Improvement of teaching and regular activities using ICT defined the performance expectations of the primary school teachers. Their performance had a direct effect on both their daily activities and student learning. Interviewing the ten teachers provided insight regarding their understanding of ICT and its implications for their performance. Among 10 teachers, seven directly mentioned that they felt the use of ICT contributed positively to improving their work efficiency, with several different benefits perceived. One of the teachers commented,

> *I have used ICT facilities in my everyday life, including communication, searching for new information, reading news and so on. And I found using ICT for teaching, such as searching and using new examples for students helps me to better explain the issues in the class room. (Interviewee #5, Teacher)*

Another teacher explained that the use of ICT was not only beneficial for teachers, but also for the students; he stated,

> *Use of ICT in classrooms improves teachers' teaching performance and increases learning productivity of primary school students. (Interviewee #3, Teacher)*

With regard to student improvement, the teachers argued that, if the students could do their homework with the help of ICT devices, they might beneficially combine ICT with class resources. Additionally, they also believed that with ICT based classes, the students might better understand some of the complex concepts and practise better in class, with different educational software and videos. In addition to these, the interview data also revealed that the teachers knew about the potential use of ICT in education (when properly used). Eight of the teachers indicated that they had used ICT for their own higher education and it had made their study much easier. Each of the teachers had had their own experience. However, one of them mentioned,

> *Use of ICT, especially internet and computer, was part of my learning in higher education, and I have found it much more productive; if the teachers can use the same technology with proper facilitation, it would be an overnight change for primary education in Saudi Arabia. I am looking forward to it. (Interviewee #8, Teacher)*

Another teacher explained some points regarding how they could use ICT to improve their performance, in his words,

> *Use of ICT in the classroom makes it easy to make the students understand about difficult topics, through use of photos and videos. This would save some time for the teachers, and provide more efficient learning for the students. And this encourages me to try for ICT usage in my teaching activities. (Interviewee #7, Teacher)*

However, not all teachers found ICT beneficial. Some of the teachers suggested it would not make much difference if they used ICT or not, in particular if the ICT facilities remained the same as present. One of them detailed this issue,

> *Use of ICT does not help me at present. Rather, I found it difficult to use ICT, as there are not enough facilities, and thus it takes more time for me to prepare for classes when I want to use computers or the internet. Usually I do not have much time to use them, so the existing ICT facilities are not improving my performance. (Interviewee #1, Teacher)*

Responses from the interviews suggested that a majority of the teachers had positive views regarding the use of ICT in terms of their increased productivity. The main keywords explored in their interviews for *performance expectancy* were *search information*, *productive*, and *easy explanation*. This indicates that the teachers viewed the use of ICT as a tool to improve their performance, although the lack of facilitation concerned some of them. Considering the positive views generally regarding the usefulness of ICT in teaching and learning, it appeared that the teachers are interested in using ICT in their activities to improve their performance. Therefore, they had a positive *behavioural intention* to use ICT to increase their efficiency.

5.3.2 Effort expectancy

Analysis of the interviews revealed that the *effort expectancy* of the teachers regarding the ease of use of ICT depended on their perceived level of their own proficiency. The easier the technology was to use, the more users were encouraged to use the technology. Most of the teachers interviewed (eight out of 10) were moderately or even highly proficient with ICT technology, based on their self-judgment and daily usage of ICT devices, such as cell phones and the internet. The teachers indicated that they used computers mainly for preparing lessons; however, they also mentioned the level of use was not high. One of them (Interviewee #3) said,

> *Using the computer for preparing lessons does not require a lot effort, but to use ICT in classrooms at advanced level requires some effort for which training is required. (Interviewee #3, Teacher)*

Furthermore, as noted previously, the teachers in general explained that they had experience of using ICT for their own education. In addition, ICT is becoming easier to use, and therefore most of the interviewees (nine out of 10) thought that using ICT for teaching would not be a complex practice to learn or implement. According to Interviewee#2,

> *The effort I need to explain complicated issues to students without any visual media is much more intensive. Often I cannot keep the attention of the students, while if the teachers get adequate support, I feel it would be easier for me to use ICT to prepare and deliver my lessons to the students, with more visual support. And I like to use it very often. (Interviewee #2, Teacher)*

In contrast to the optimistic comments about the use of ICT in teaching, one of the teachers stressed the potential difficulties in using ICT for teaching, pointing out that [Interviewee nine (#9)],

> *I accept that maybe the use of ICT facilities would not be complicated, but I only know how to use the Microsoft Office package, and have no idea how to use the internet extensively to search information and integrate it into a lecture. Additionally, without training, I think it would take lots of time and effort to use ICT in the classes, and other activities at school. Not all of the teachers are highly efficient in using ICT. But provided with proper training, it should not be difficult to use. (Interviewee #9, Teacher)*

The summary of interviews of this section found the key words were: *effective*, *easy to use*, *easy delivery*, and *search easily.* Interview data indicated that the teachers were generally proficient in using ICT, with most demonstrating basic *computer literacy*. However, levels of proficiency varied and some argued for further training and encouragement to enhance their skills.

In conclusion, it can be argued that primary school teachers' *effort expectancy* of ICT use influences their *behavioural intention* to use ICT in primary education. The most important factors affecting the perception of the teachers were: *easy to use*, *training to increase capacity*, and *support to use ICT efficiently.*

5.3.3 Social influences

With positive support and leadership from the principals, or enthusiasm from fellow teachers, it is highly likely that many of the teachers would use ICT more often. However, the present conditions in their schools deterred ICT usage. According to one of the teachers (Interviewee #1, Teacher),

> *Though I know that ICT in primary education saves time and effort, I do not feel encouraged to use it as my colleagues do not prefer to use it. (Interviewee #1, Teacher)*

In this regard, most of the teachers agreed that they did not have adequate positive *social influence*. Neither the principals, nor fellow teachers frequently used ICT for learning and teaching in their classes. Thus, the overall environment was not favourable for the use of ICT in primary school classes. Another teacher added that,

> *My principal once arranged a meeting to discuss about how we can use ICT in classes, but most of the teachers argued that, with the facilities we have it is not easy to use ICT now, as well as they are not comfortable using it. After that meeting, I also decided not to use them much, as others are not doing so. But still I use ICT a little to know about new ideas and explanations. (Interviewee #5, Teacher)*

In addition, many teachers pointed to the issue of general social views regarding the use of ICT in education, one of them explaining that,

> *It is the general view of the society that ICT is more useful for secondary or mostly for higher education; the children do not need ICT to learn. My friends and wife think ICT is not needed for children's education, as the lessons are quite easy. (Interviewee #6, Teacher)*

It was quite clear from the interviews that the teachers did not have ICT-positive social surroundings, despite the fact that they believed it might have a positive effect on their performance and effort. However, some of them mentioned that their principals often try to encourage them, but did not continually support them, as they were also not positively supported by the higher authorities. The lack of enthusiasm among their colleagues and acquaintances often reduced the teachers' own motivation, and it could therefore be assumed that social surroundings negatively influenced the primary school teachers' *behavioural intention* to use ICT.

5.3.4 ICT facilities for the teachers

Facilities or ICT infrastructure were central to all conversations with the interviewees. Teachers, like the principals, agreed that the availability of quality ICT resources, including hardware (i.e., computers, internet access, projectors) and software (i.e., educational software, customised tools to use in Arabic) was the most important factor affecting the use of ICT in primary schools. Most of the teachers (nine out of 10) highlighted the lack of infrastructure and *system quality* when explaining why they did not use ICT.

> *I know that using ICT improves the teaching quality, but I do not feel encouraged to use ICT in my classroom as there is not enough ICT hardware or software in the classrooms. (Interviewee #1, Teacher)*

Among 10 schools, five had computers in specialised classrooms (i.e., lab classes), while the other five only had one computer per teaching class, some of which were not modern. Due to out-of-date systems, the teachers faced problems reliably using ICT in the teaching process, which in turn reduced their effective teaching time. Interviewee #2 said,

> *I prefer not to use the computer available in the class rather than using it because within the limited class time this loses some time due to the outdated system. Moreover we are not provided with a projector in every classroom. For a class of a moderate to large number of students, a single computer is not enough. So it complicates the process rather than making it easy and simple. (Interviewee #2, Teacher)*

Furthermore, although the lab classes had computers, not all of them were internet-enabled. Compounding these problems, there was generally no dedicated IT support person or team located at the school. One teacher mentioned that,

> *I wanted to use ICT at classes, and also show the students how to use the internet to search information, but the labs have no access to the internet. I want to add that, once using the lab computer, the operating system hanged and later on crashed, but I do not know how to fix that. That computer is still not in use and the problem is not fixed. (Interviewee #3, Teacher)*

It was clear from the interview analysis that the ICT facilities were poor or non-existent at the time of the interviews. The lack of infrastructure and ICT resources had a negative impact on the *behavioural intention* to use ICT. The most important barriers were the lack of computers in the classroom, the lack of internet connectivity, lack of fully supported computer labs, *system quality* and lack of technical support or training to use ICT in classrooms.

5.3.5 Cultural factors

Because of Islamic culture and Saudi administration, the social structure of the Saudi people is different to other nations throughout the world. Data from the interviews indicated that the cultural environment exerts influence over the teachers' usage of technology in general, and particularly the use of the internet and computers at primary schools. Interviewee #4, for example, commented that,

> *I think ICT is not suitable for our culture as it contains some bad things. So I do not prefer using ICT. (Interviewee #4, Teacher)*

Some remarked that ICT in primary schools is unnecessary, while others referred to the varying levels of uncertainty in using ICT in class, as they could not always monitor what the students were doing. One of the teachers said,

> *I am not comfortable to give the computers and internet to the students yet. We have not enough control and knowledge about how they work, and what the students are allowed to do. There would be uncertainty regarding the use of materials for the students, and I am not sure what they would do – like play games, if the teacher is not in the class, or during the class break. (Interviewee #8, Teacher)*

However, there are some opposite views also regarding the cultural influence on ICT. Some teachers believe that Islam and ICT are not incompatible, and that it is possible to adopt ICT within the Islamic cultural system with proper use guidelines. As one of the teachers mentioned,

> *I think we can use ICT facilities with proper control and guidance, as Islamic scholars have previously contributed in science, and ICT is moving the world forward. Islam allows people to learn new things, but also keeping the Islamic values and norms together. (Interviewee # 6, teacher)*

After analysing all the interviews with the teachers, it was clear that Islamic rules and regulations influenced the ways the teachers thought of and perceived the use of ICT, and that they were not sure about what would be an optimum level of use for the students, as well as being concerned about the uncertainty and lack of positive social support. However, their Islamic views are also mixed, and it might have influenced their possible use of ICT facilities. The data analysis demonstrates that cultural environment influences primary school teachers' *behavioural intention* to use ICT.

5.3.6 External barriers for teachers

To make the use of ICT easy in the classroom, policy interventions are required. Teacher responses to the interview questions indicated that they believed there needed to be a review of policy. Teachers spoke of issues including:

- special budgets for ICT
- an integrated plan to provide ICT at the school
- devices adequate and appropriate for the large number of students per class
- enough time to use ICT in the classroom

- rewards for teachers who use ICT
- discussions with teaching staff about using ICT in the classroom
- technical support and training courses on ICT use.

One of the teachers indicated,

> *There is no plan for ICT use in my school, neither any budget. I was trying to use computers in some classes, but no one encouraged, and it took longer time to prepare the lecture, where I was not given extra time as I had to take more classes. (Interviewee #7, Teacher)*

In addition, all of the teachers indicated that their schools did not provide any technical support for ICT use to the teachers. Those interviewed also implied that they were not aware of any strategies in their schools to integrate ICT into primary education. Due to the perceived lack of resources and technical support from schools, most of the teachers found it difficult to use ICT in classrooms. Thus, they demonstrated a negative intention to use ICT. Interviewee #4 said,

> *I have taken the initiative to use ICT in my classrooms for teaching from my personal interest. I use lecture notes using a computer to make them more interesting to the students. But for this I have not received any special training from the school. So I only use the basic software like Microsoft Office Word. In addition, I do not get any help from the school for any troubleshooting. So day by day I am feeling discouraged to use ICT in my teaching. (Interviewee #4, Teacher)*

Responses from the interview indicated that the interviewees were facing diverse *external barriers* to the use ICT in classes. These *external barriers* influenced their *behavioural intention* to use ICT and include: lack of policy support; lack of funds; lack of technology-integration plan.

5.3.7 Computer literacy of the teachers

The teachers were asked to comment on their perceptions of their own *computer literacy*. Their responses to the interview questions demonstrated how their own skills affected their *behavioural intention* to use ICT in their classrooms. The responses indicated that only two of the respondents considered themselves to have high levels of ICT ability; six felt that they had moderate levels of skill; while the remaining teachers classified themselves as only possessing low levels of proficiency.

Eight of the teachers said that they had not attended any training courses that discussed the importance of using ICT in schools, and improving their skills in ICT. One of the interviewees (Interviewee #5) said in relation to his proficiency,

> *I did not get any training for the computer programs that I am able to use for teaching. I just can use Microsoft Word Office. (Interviewee #5, Teacher)*

The most common computer program the teachers said they used was Microsoft Office *Word*. Some of them said they can use Microsoft Office *PowerPoint* and Microsoft Office *Excel*. Due to lack of training, they use some preliminary software for preparing lessons, but they do not have the confidence to use computers for teaching in their classrooms. Interviewee #2 said,

> *As I have not received any training regarding ICT I feel discouraged to use ICT in classrooms. I fear that if I fail to perform the task in classroom, it will affect my reputation in front of the students. (Interviewee #2, Teacher)*

In contrast, some of the teachers showed greater self confidence in using ICT. One of them mentioned,

> *We use ICT facilities at our daily activities, and I have some experience in using ICT for my own examination papers for higher studies. It is not hard to use the basic operations, and I am sure if we have customised software for teaching, it would be easier to learn. (Interviewee#7, Teacher)*

As expected, those teachers who were more computer literate and confident in their skills, had typically positive views regarding the use of ICT. In contrast, those who reported less confidence, presented more negative views regarding ICT use in teaching. Primary school teachers' *computer literacy* has influenced their *behavioural intention* to use ICT in primary education. The most important factors affecting and representing the level of ICT proficiency of the teachers were: computer programs they commonly use, appearance in training programs, and their confidence in using ICT in the classroom.

5.3.8 Behavioural intention of the teachers to use ICT

Analysis of the interviews made it clear that the teachers were faced with multiple and quite serious barriers that inhibited the adoption and use of ICT among them, ranging from a lack of facilities to opposition arising from cultural norms. When the teachers were explicitly asked about their interest in using ICT, it was found that seven of the teachers (70%) interviewed had an overall positive attitude towards the integration of ICT into primary school teaching in their school. Therefore, the *behavioural intention* of the majority was positive, and, given the right circumstances, most of the interviewees would have been willing to learn more about ICT as a teaching and learning tool.

Interviewee #2 commented that,

> *We want to teach in class using computers, but the students do not show enough response in the class, as is to be expected, due to continuous interruption by the outdated computers. Moreover, it is difficult to manage the overcrowded class in such a situation. (Interviewee #2, Teacher)*

And Interviewee #1 noted that,

> *Parents of many students fear and do not want their children to use the technology. (Interviewee #1, Teacher)*

Interviewee #8 summarised the issue by saying,

> *It is worthwhile and very desirable to integrate ICT in primary school. But for this we will require further training programs to increase our proficiency and to increase our confidence in using ICT in classrooms. For this, school authorities should take necessary initiatives. (Interviewee #8, Teacher)*

External barriers posed by their community and culture, a lack of infrastructure and support were, therefore, major issues for the Saudi primary school teachers. Nevertheless, most were interested in trying ICT in their classrooms.

5.4 Factors affecting the use of ICT in primary schools by students

Identifying the factors responsible for influencing the ICT usage of the students was quite challenging, as the students are at the receiving end of the system. They do not have much (if any) decision making capacity, and they must depend on the school system as a whole. Interviews were conducted with 10 students to understand their perceptions of the issues associated with the use of ICT in learning.

The students were also selected from the three major cities. All of them were studying at level five (children were aged between 10 and 11 years); and they had at least one computer lab class during their week at school. Their interview responses are discussed in relation to the major variables identified in the literature review chapter.

5.4.1 Performance expectancy

The *performance expectancy* of the students was directly linked with their perceptions regarding the usability of the ICT facilities in their learning process and their familiarity with the available

ICT facilities. Seven students identified a range of devices that could provide ICT infrastructure, including computers, phones, tablet PC, netbook and notebook, and the internet. However, the students explained that while they were familiar with the names of various devices they did not know many details about them. Additionally, some students were not sure how these technologies could be used in their learning. One student indicated,

> *I know computer from my computer lab, but I have never used it for my other subjects, thus have no idea how it can help me. (Interviewee #3, Student)*

However, even though they have less access to or knowledge of ICT facilities and their use, most of them (nine out of 10) indicated that they felt ICT technology was important for teaching as it made the learning process fun and easy. Some of them explained it as follows,

> *Use of ICT in classrooms might increase our learning productivity. (Interviewee #6, Student)*

> *Use of ICT in the classroom would make some difficult topics easy to understand through the use of examples and video clips. We will also get more interested to learn things in this way. (Interviewee #1, Student)*

Analysis of the interview data indicated that the students were not fully aware of how ICT is used to enhance teaching and learning, but they hoped and believed that the use of ICT, in particular, the use of visual media in class, and the use of computers for assessment tasks might improve their learning process. One of the students mentioned,

> *Some of the homework can be done more easily, if we can use computers in place of hand writing. This would allow adding new information to my assignments from different sources. (Interviewee #2, Student)*

The data revealed that primary school students had positive performance expectations related to the use of ICT. Although they weren't experienced with ICT in education, they already liked technology and were familiar with many of its uses, at least conceptually. The analysis of the data clearly showed the students would use ICT in their learning if given the chance. Their concept of ICT usage was grounded in the idea that it could make their work easier and more effective, and the teaching more interesting.

5.4.2 Effort expectancy

The qualitative interview responses revealed that the students' perception of *effort expectancy* of ICT depended on their perceived level of proficiency and their actual ICT use. The majority of the students (seven out of 10) indicated that they did not feel prepared for using ICT in their learning, and did not have the experience to even imagine ICT as a teaching and learning tool. Although three of the students reported using their home computers with their parents' permission, all but one of the students (nine out of 10) did not consider themselves proficient (based on self-judgment and responses to the researcher's questions). Interviewee #7 said,

> *I have never used a computer by myself. I do not know how to operate it. And I think it is difficult to use, as I have no guide to use it independently. (Interviewee #7, Student)*

However, one of the more confident students responded,

> *It is obvious that I do not know how to use ICT facilities to make learning easy, or to get work done with more proficiency, but I am sure it would not be so hard to learn if the teachers just guide us how to use it. (Interviewee #10, Student)*

Clearly, the students' views of the effort required to use ICT in a learning environment were mixed because of their personal experiences with computers. Therefore, while a few students indicated that using ICT would probably pose little difficulty for them, others were not clear whether they could cope or not. Overall, primary school students' *effort expectancy* of ICT use was not clear among the students, but the general feeling seemed to be that ICT might be fairly easy to use and perhaps fun, if students were given appropriate guidance. Overall, the data indicated that their *behavioural intention* to use ICT could be influenced by positive *effort expectancy*.

5.4.3 Social influences on the students

Students are the target of ICT use in the primary schools, and therefore the surroundings influence them the most. The *social influence* on students in this study included the use of ICT by their friends, and their family members. The students were mostly guided by the teachers at school, and they also have to follow the rules at home. The interview data indicated that the social surroundings were the major determinant of their intention to use ICT facilities. During the interviews, students reported that they felt that Saudi parents often played a negative role in relation to computer use by their children. One of the students commented,

> *My parents do not allow me to use a computer. Two of my friends play games on a computer. But others are not allowed to use a computer at home, like me. (Interviewee #7, Student)*

Apart from restrictions at home, some of the students mentioned their elder brothers or sisters used computers for various purposes and most of them were completing higher level studies. The students also mentioned that the use of computers by their siblings had made them familiar with computers and they were hopeful that they would have the same resources to use with freedom. According to Interviewee#10, Student,

> *My brother uses computers for his study, and he has the computer in his room, so he can use it as he wants. I think, when in higher studies I would also have the same. Besides, some of the teachers tell us that if we were able to use computers it would be easier for us to learn more. So, if I can use it now, maybe that would make me more familiar with computers and its use in general. (Interviewee #10, Student)*

During the interviews, students indicated that they did not have much control over how or when they could use computers. At home, their families often restricted computer use, and some students were influenced by the computer use of their elder siblings, or friends. This indicates that the people interacting with the student daily in their environment played a part in influencing the students' *behavioural intention* to use ICT in primary education. However, the intention is greatly dependent on the availability of technology and the proficiency of their teachers, as well as the attitudes and experiences of their friends and family. Therefore, the major issue is the presence of positive and encouraging people around the students.

5.4.4 Computer facilities for the students

Appropriate ICT infrastructure has a great influence on the use of ICT by students, as without access to ICT facilities they cannot experience or understand its potential. In the previous sections, it was noted that among the 10 surveyed schools, five had computers in some classes (a very few). But in those schools, the teachers did not use computers for teaching. Even if a teacher chose to use the computer, it created more complications rather than making it easier to teach. Some of the students explained that,

> *We have computers in some of our classes but the teachers do not use those. (Interviewee #2, Student)*

> *When the teachers teach using computer, I cannot see anything if I sit at the back. (Interviewee #3, Student)*

> *It takes so much time to prepare computers before starting the lessons in the class. Sometimes the computers hang or whatever. When these happen I lose my concentration from the class. (Interviewee #5, Student)*

Based on the students' responses, there was limited access or effective use of ICT facilities in classes, and the lack of facilities meant that student education was limited. All the students surveyed stated that none of their schools was able to provide a computer for each student. Moreover, none of the schools had provision for ICT-focused lessons for the students. They stated that,

> *We do not use computers in our schools. (Interviewees #8, Students)*

Among 10 students, eight students (80%) indicated that they had a computer at home, but only three (30%) could use the computer with permission from their parents. Among the students surveyed, seven students did not use the computer in their home, either they do not know how or they simply were not permitted to use computers. According to one of the students,

> *There is computer at my home, but it is used by my father. So, I know it is possible to play games in that computer. However, I am not allowed to use it whenever I want. (Interviewee #5, Student)*

Students who had access to a computer and used it at home mostly used it only for gaming and not for any academic activity. Furthermore, their access was limited, and they had little opportunity to get acquainted with ICT for academic purposes either at school or at home. They did not know whether their schools had any plan to integrate ICT into primary education or not.

Summarising the data from all the interviews, it can be argued that of all the barriers to the use of ICT in primary schools by the students, it was the lack of computers and computer facilities that had the greatest influence on the students' perceived ease of use of ICT and their intention to use ICT. Furthermore, not only was there a lack of ICT infrastructure in the schools, there were restrictions on the use of computers in their homes, and their teachers didn't generally use computers effectively for teaching.

5.4.5 Computer literacy

Most of the students interviewed (nine out of 10) had very poor levels of computer literacy, based on their own self-judgment and researcher observations. Only three students had access to a computer in their home, and of these, two used them only for gaming. Some of them made comments, such as,

> *I have never used a computer by myself. I do not know how to operate it. And I think it is difficult to use. (Interviewee #7, Student)*

> *I use the computer for playing games and watch videos on internet. (Interviewee #3, Student)*

None of the schools had ICT training courses to teach students how to use ICT for educational purposes. However, there were some lab classes where they were given lectures about basic computer operations, such as how to operate the computer, how to see what programs were installed, the basic input and output unit of computers and so on. But these classes were very limited, and did not allow the private use of computers by the students. According to one student,

> *I am very interested to learn through computers. But I do not know how to use it for academic purpose other than from gaming or watching videos. (Interviewee #6, Student)*

The interviews indicated that the primary school students did not consider themselves to be very skilled. They had a very basic knowledge about the use of computers, and computing in general. This influenced their perceived ease of use and their perception of the usefulness of ICT in primary education, as they were not sure how to operate ICT for educational purposes. This suggests that to make them efficient users, better access and classes with computers are required, which is currently not available in most of the classes.

5.4.6 Perceived enjoyment

Enjoying the class has the potential to improve learning and this was highlighted by seven of the students interviewed who felt that ICT use in education could make education more fun. However, they did not learn about it from their schools. Rather, they came to know about it from foreign television programs, movies and other sources.

> *From movies I know that in foreign countries they use projectors in their class. They use photos, videos, and other visual aids for learning in their class. Even they watch movies in the class. (Interviewee #1, Student)*

Another student added,

> *Maybe using computers might increase our interest, but I have no practical experience of that, as the lab classes do not seem to explore the fun use of computers, rather more fixed and same things shown for longer time, I have not enjoyed it yet. (Interviewee#4, Student)*

Five students among 10 pointed out that there were computers in one or two classes (i.e., the lab class), but that the teachers did not use them to improve the learning process through fun. This was cross linked with the comments of the teachers, who admitted that they did not use computers to make lectures interesting as the facilities were not particularly useful. Therefore, it can be argued that the enjoyment of using ICT in primary education remains unexplored for the students.

The interview responses suggested that primary school students' perceived ICT use in education might be enjoyable, which influenced their attitude and *behavioural intention* to use ICT in primary education if given the chance. However, they reported that they were not experiencing any joy in the current situation, making this variable difficult to investigate with confidence.

5.4.7 Behavioural intention of the students

Six of the students interviewed demonstrated a positive intention towards using ICT for their learning purposes. Interviewee #6 said,

> *Learning through ICT would be fun. We want our teacher to take steps to use computers and projectors in our classrooms. (Interviewee #8, Student)*

The students mentioned that they were guided by their parents and teachers, and did not have much freedom to use computers. Additionally, they did not know how to use them for educational purposes, although they wanted to have the benefits of modern technology. Some of the students said that,

> *We want our teachers to use ICT in classrooms with more interesting ways. (Interviewee #1, Student)*

> *Out teachers and parents should allow us to use ICT for our education. (Interviewee #2, Student)*

Data from the interviews showed that the students would like to be involved in a system where ICT was used for educational purposes. The *behavioural intention* to use ICT was influenced by their surroundings, access to facilities and social norms. It was promising to see that students wanted to use new technologies, and that their intention to use them is integrated within their *behavioural intention*.

5.5 Summary

This chapter discussed the findings of the analysis of interviews conducted with principals, teachers and students in primary schools in Saudi Arabia. The purpose of this analysis was to understand the factors affecting the use of ICT in primary schools in Saudi Arabia.

The data from all interviewees showed that the use of ICT in primary schools in Saudi Arabia for teaching and learning is very limited. *Performance expectancy*, *effort expectancy*, *facilitating conditions*, *cultural factors* and *external barriers* greatly influence the *behavioural intention* of principals to use ICT in primary schools. Primary school teachers are influenced by the factors of *performance expectancy*, *effort expectancy*, *social influence*s, *facilitating conditions*, *cultural factors*, *external barriers*, and *computer literacy*. Finally, use of ICT in primary schools by students is influenced by *performance expectancy*, *effort expectancy*, *social influence*s, *facilitating conditions*, and *computer literacy*. This chapter reinforced the ideas extracted from the literature review, and described the existing ICT situation in Saudi primary schools. The content aided the formation of the questionnaire and helped to interpret the results of the quantitative analysis and model outputs.

Chapter 6

Quantitative analysis

This chapter presents the analysis of the data gathered from extensive surveys using different quantitative tools and techniques. The chapter is presented in three sections, each focusing on the major stakeholders: principals, teachers and students. Each section begins with an overview of the demographic nature of the respondents, followed by an account of the structural equation modelling (SEM), and concluding with judgements regarding the stakeholder hypotheses presented in Chapter 3. Finally, the chapter presents the conclusion of the quantitative analysis results.

6.1 Analysis of principals' data

This section details the quantitative data analysis from the principals' survey. Both descriptive statistics and SEM modeling are discussed in the following sections. Descriptive statistics describe the data, characteristics of principals, their ICT facilities usage pattern, and the ICT infrastructure in their schools. The modeling section tests the conceptual model developed and verifies the hypotheses in Chapter 3 . In addition, the modeling section also discusses the validity, reliability and predictive relevance of the principals' model.

6.1.1 Descriptive statistics

The survey was completed by 40 principals selected from a random sample across three cities in Saudi Arabia: Jeddah, Riyadh and Dammam. As Jeddah and Riyadh are the two most populous cities of the KSA, larger recruitment occurred here, with 16 principals (40.0%) surveyed from Jeddah schools and 17 surveyed (42.5%) from Riyadh. The remaining seven principals were from Dammam. The cities represent the major population centres in Saudi Arabia.

Gender and age. The majority of participating principals were male (36 male participants compared with four female participants). The heavy weighting toward male participants was due primarily to the cultural climate of the KSA. Female focused schools are not as readily accessible by male researchers as male schools and most school principals within the country are male.

The participant principals' ages ranged from 29 to 51 years. The mean age of the sample was 40.70 with a standard deviation of 5.5015. The mean age shows that the principals were generally young.

Anecdotal observations suggested that younger principals were more amenable to change than their older peers (Table 6.1).

Table 6.1 Mean and standard deviation of age of principals

	N	Minimum	Maximum	Mean	Std. Deviation
Age	40	29.00	51.00	40.70	5.50151

Educational attainment. The majority of the principals surveyed (37; 92.5%) possessed a Bachelor's level qualification as their highest level of education, while only three of the principals held a higher qualification at the Master's level (Table 6.2). None of the principals held doctorates. However, to be a principal in a primary school in Saudi Arabia, a Bachelor's degree is required, and this experience may have positively influenced their views of ICT in education, as they often use ICT facilities in their learning activities.

Table 6.2 Level of education of the principals

	Number of respondents	Percent	Cumulative percent
Lecturer - Bachelor's degree	37	92.5%	92.5%
Instructor - Office Management Diploma	0	0%	92.5%
Instructor - Master's degree	3	7.5%	100.0%
Professor - Doctoral degree	0	0%	100.0%

6.1.2 Use of a computer at home

All principals had used computers at home for more than two years and the majority of respondents (33; 82.5%) had been using a personal computer at home for more than five years (Table 6.3). Number of years using computers provides a guide to the experience of the principals in using ICT facilities, although it doesn't measure their actual level of competence. Several previous studies have claimed that years of experience and ICT familiarity lead to confidence in using ICT facilities at work, however, particularly for school teachers in general (Mumtaz, 2000). Therefore, the more the principals experience ICT privately, the greater likelihood that they will have positive views about its use professionally and in the classroom.

When asked about the applications on their computers with which they were comfortable, the principals all replied that they used their home computer to browse the internet and 37 (92.5%) made use of word processing applications. Email and chatting (through social media applications) were the other two uses identified by principals, with 33 (82.5%) respondents reporting they used their home computer for email correspondence, while only eight (20%) used personal chat services. Table 6.3 shows a breakdown of the responses provided by the principals relating to their home computer usage, and it is clear that using internet and word processing software are the most common use of computers for the principals.

The usage pattern of ICT tools indirectly indicates the ICT literacy of the principals, and their capabilities in handling ICT facilities in their activities. The evidence indicated that the more diverse and greater the personal use of ICT by the principals, the more likely they were to adopt ICT and support its use in the classroom (Hermans et al., 2008; Mumtaz, 2000).

Table 6.3 Purpose of using a computer at home by the principals

Purpose of using ICT facilities	Number of positive responses	Percentage of positive responses per the sample population
Internet browsing	40	100.00%
Chatting	8	20.00%
E-mail	33	82.50%
Games	0	0.00%
Design	0	0.00%
Word processing	37	92.50%
Programming	0	0.00%
Others	0	0.00%

Data in Table 6.4 indicate that 100% of principals spent some time everyday using a personal computer for one of four tasks, with 67.5% reporting that, on average, they used their home computer for 4-6 hours per week.

Table 6.4 Computer usage by the principals at home per week

	Frequency	Percent	Cumulative percent
0 hour / No use	0	0.00	0.00
1-4 hours	2	5.00	5.00
4-6 hours	27	67.50	72.50
more than 6 hours	11	27.50	100.00
Total	40	100.00	

All the principals surveyed reported they had been using a computer for at least six years, and 31 (77.5%) had been using a computer for up to 15 years (Table 6.5). This suggests, as discussed above, that the principals in the survey were all familiar and often comfortable with the use of computers.

Table 6.5 Principals' experience with computers

	Frequency	Percent	Cumulative percent
1-5 years of experience	0	0%	0%
6-10 years of experience	9	22.50%	22.50%
11-15 years of experience	31	77.50%	100.00%
16 or more years of experience	0	0%	100.00%

6.1.3 Computers and technology within the school

The principals' use of computers at school was quite important in the context of this research, since any introduction of ICTs into a school depends on school leadership. Almost three out of four principals used a computer at school for almost one hour a day. This suggests acceptance and leadership by doing.

The principals were asked to indicate how many ICT devices were available for classroom use in their schools. Table 6.6 indicates the minimum and maximum number of devices identified by the surveyed principals. These data reveal very limited availability of computers or peripheral equipment for educational purposes in the classrooms. Of particular concern was a lack of internet connectivity in the classrooms, as well as a lack of support for the presentation of content to the classroom by means of such a commonplace device as a projector. This is a common scenario in Saudi Arabian schools in general.

Table 6.6 Devices available for use in classrooms for educational purposes (minimum and maximum found from the survey)

Types of device use	Minimum numbers	Maximum numbers
Desktop	9	31
Desktop with internet	3	9
Laptop	0	3
Laptop with internet	0	1
Reader	0	1
Mobile phone	0	1
Whiteboard	0	3
Digital camera	0	1
Projector	1	5

The principals used their computers for various purposes (Figure 6.1) at the school. They communicated with other educational institutions and educational authorities, as well as conducting management tasks. Other important tasks for which they used their computers were searching for information and preparing presentations. This diversity of use indicates that most of the principals were using ICT facilities for their administrative activities, and were comfortable with their use.

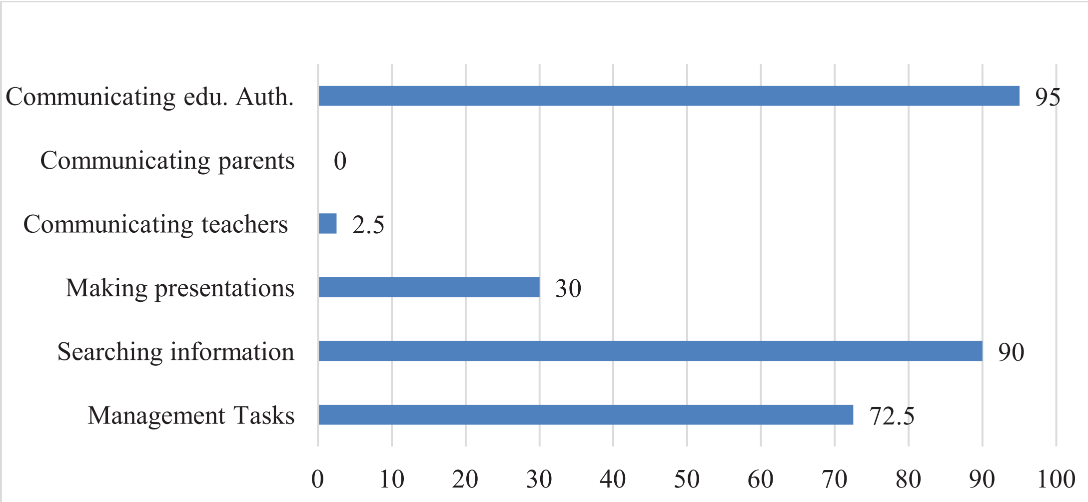


Figure 6.1 Principals' use of computer at school for different purposes

Compounding the problems of limited items of equipment was the issue of the usability or operational functionality of the equipment. Principals were asked to identify the proportion of their various technological devices, including computers, that were operational at the time of the survey, and 37 (92.5%) of the principals reported that less than 50% of their equipment was in a functional state. Two principals indicated that they felt they had 50-75% of their equipment operational while only one principal felt that 76-90% of their equipment was usable.

Even if the principals supported ICT usage, they did not have the capacity to take full advantage of ICT devices since the equipment for the majority of them was only intermittently available. This inconsistency in the operation of the ICT devices implies a lack of maintenance and effective ICT support, although all surveyed principals indicated that there was a member of staff employed to maintain the technology in the school. All schools were responsible for the maintenance of their own devices.

6.1.4 Modelling the use of ICTs by participating principals

The conceptual model for school principals' ICT adoption was formulated based on the research objectives and literature review. The model combined several endogenous and exogenous constructs, including the factors responsible for the adoption of ICT in primary schools by the principals, and tried to capture their preferences, as well as the *actual use* of ICT at present.

The conceptual model was developed using the UTAUT as a guide. However, new constructs and relationships were considered in the conceptual model to fit the specific situation in the primary schools of Saudi Arabia, as well as the factors relevant to the principals.

In addition to these, to explore the *actual use*, and the reasons behind the low use of ICT, an interactive model derived from the conceptual model was examined. Therefore, the conceptual model was modified in order to explore the possible factors that could predict ICT adoption by principals in Saudi primary schools.

The possible factors related to the principals' adoption of ICT in primary schools were explored using confirmatory factor analysis (CFA) to determine how well the measured variables represented the constructs. And the relationships between and within the factors, as well as the constructs, were examined using component based structural equation modelling. For principals, the use of ICT was not directly linked to the classroom. Their computer usage was more related to the management and operation of school activities, and how likely they were to support ICT introduction.

Descriptive statistics for principals' survey. The proposed model for ICT use intention and *actual use* in school activities had several endogenous constructs, such as:

- *performance expectancy*
- *effort expectancy*
- *facilitating condition*
- *social influence*
- *cultural influence*
- *computer literacy*
- *system quality*

while there were exogenous constructs, such as:

- *behavioural intention*
- *actual use.*

Fifty (50) principals were approached to participate in the study, and after receiving all responses, data cleaning and processing were conducted. After data cleaning, 40 valid responses were further taken to make analyses of different kinds. Table 6.7 illustrates the mean values *of effort expectancy, performance expectancy, computer literacy* and *behavioural intention* recorded high Likert scores (near to 5), indicating positive values for the responses, while mean values for *social influence, facilitating conditions, system quality,* and *actual use* were generally low, indicating considerable difference between the variables (Table 6.7).

It should be noted that the constructs that recorded high Likert scores all relate to how the principals perceived their computer competence and what the use of ICT more generally could help them achieve in their position, or help the school achieve in teaching and learning outcomes. The constructs they rated lowly all represent reasons ICT is not in use.

Table 6.7 Descriptive statistics for factors related to use of ICT in primary schools by principals

Constructs	Survey question (Item Description in Table 4.3., Chapter 4)	Likert scale Minimum	Likert scale Maximum	Mean
Effort expectancy (EE)	EE1	3	5	4.18
	EE2	2	5	4.28
	EE3	2	5	3.98
	EE4	2	5	3.95
	EE5	2	5	3.83
Performance expectancy (PE)	PE1	2	5	4.28
	PE2	1	5	4.08
	PE3	1	5	4.35
	PE4	1	5	3.73
	PE5	2	5	4.20
Social influence (SI)	SI1	1	3	2.18
	SI2	1	3	2.25
	SI3	1	3	2.25
	SI4	2	3	2.33
	SI5	1	4	2.20
Facilitating conditions (FC)	FC1	1	4	2.33
	FC2	1	5	2.25
	FC3	1	3	2.05
	FC4	1	4	2.30
	FC5	1	4	2.28
	FC6	1	4	2.18
System quality (SQ)	SQ1	1	3	1.75
	SQ2	1	3	1.70

Constructs	Survey question (Item Description in	Likert scale Minimum	Likert scale Maximum	Mean
	SQ3	1	3	2.08
	SQ4	1	4	2.03
	SQ5	1	3	1.50
Computer self-efficacy and literacy (CS)	CS1	1	4	3.23
	CS2	2	4	2.90
	CS3	2	5	3.70
	CS4	1	4	3.38
Obstacles (Lack)/ *External barriers*	Lack resource	2	4	3.50
	Lack_time	1	5	3.10
	Lack_interent	2	5	4.23
	Lack_develop	1	5	3.70
	Lack_support	1	5	3.65
	Lack_leader	1	5	2.98
	Lack_exam	1	5	4.13
	Lack_tec_support	1	5	3.68
Cultural influence (Cul)	Cul_1	1	5	2.65
	Cul_2	1	3	2.43
	Cul_3	2	4	2.75
	Cul_4	1	3	2.55
	Cul_5	1	5	2.53
	Cul_6	2	5	4.23
	Cul_7	2	5	4.35
	Cul_8	3	5	4.20
	Cul_9	2	5	4.20
	Cul_10	2	5	3.68
	Cul_11	2	5	4.28
	Cul_12	3	5	4.35
	Cul_13	2	5	4.23
	Cul_14	3	5	4.25
	Cul_15	4	5	4.33
Behavioural intention (BI)	BII1	1	5	3.48
	BII2	2	5	3.15
	BII3	2	5	4.05
	BII4	2	5	3.93
Actual use (AU)	AU1	1	3	1.73
	AU2	1	4	1.90

Measurement model for principals' use of ICT. The researcher aimed to find the factors which were more eligible for analysis in the model, that is, which items/factors most strongly reflected the constructs. In this case, a confirmatory factor analysis (the measurement model) was conducted for the principals' data, and based on the factor analysis, an indication of the necessary items was determined to best explain the model and the prediction for ICT usage in Saudi primary schools by the principals. All the factors or items were considered. However, not all the factors predicted the constructs with an acceptable factor loading (greater than 0.5).

The measurement model, which described how the measured variables fitted together to represent the theory, tested both the exogenous and endogenous constructs that were considered to determine the acceptability of ICT in Saudi schools by the principals.

The model ensured the validity and reliability of the items to be incorporated into the structural equation model. For the measurement model, all the constructs were reflective, and the loadings show how well these items determined the factors. The item loadings are shown in Figure 6.2 and Table 6.8.

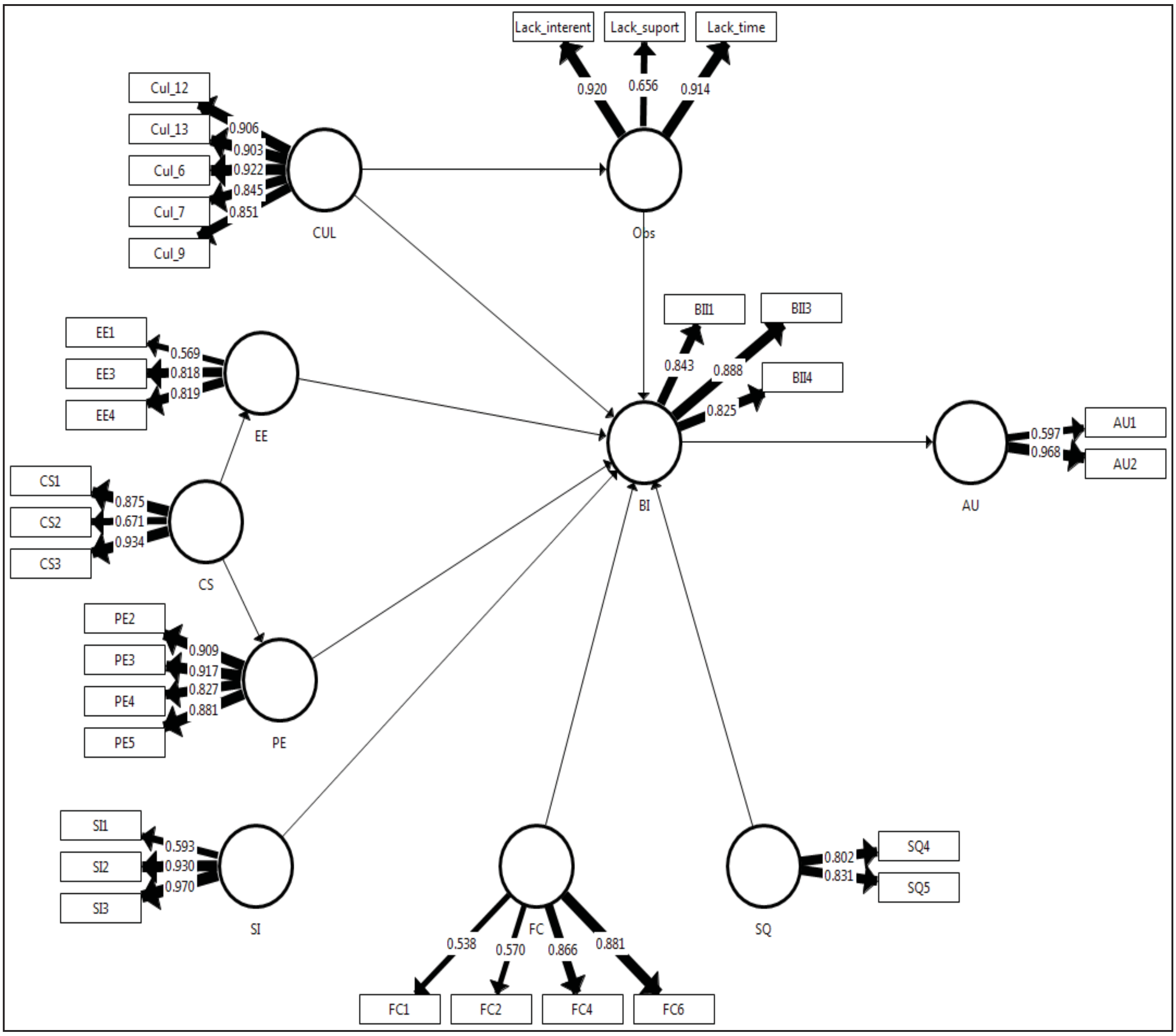


Figure 6.2 **Measurement model for the principals' ICT use in Saudi primary schools. This is a visualisation of the confirmatory factor analysis (CFA), i.e., the measurement model. The factor loading is the output of the factor analysis, a statistical valuation of different factors. The figure shows only loadings above 0.5.**

Table 6.8 Outer loadings of measurement model for principals

Constructs	Items	AU	BI	CS	CUL	EE	FC	Obs	PE	SI	SQ
Actual use	AU1	0.597									
	AU2	0.968									
Behavioural intention	BII1		0.843								
	BII3		0.888								
	BII4		0.825								
Computer Self-efficacy and literacy	CS1			0.875							
	CS2			0.671							
	CS3			0.934							
Cultural influence	Cul_12				0.906						
	Cul_13				0.903						
	Cul_6				0.922						
	Cul_7				0.845						
	Cul_9				0.851						
Effort expectancy	EE1					0.569					
	EE3					0.818					
	EE4					0.819					
Facilitating conditions	FC1						0.538				
	FC2						0.57				
	FC4						0.866				
	FC6						0.881				
Obstacles/ External barriers	Lack_ internet							0.92			
	Lack_ support							0.656			
	Lack_ time							0.914			
Performance expectancy	PE2								0.909		
	PE3								0.917		
	PE4								0.827		
	PE5								0.881		
Social influence	SI1									0.60	
	SI2									0.93	
	SI3									0.97	
System quality	SQ4										0.84
	SQ5										0.78

Table 6.8 shows that all of the item loadings of the measurement model were good and for each factor the average loadings of the corresponding items were above 0.7, a result widely accepted for a measurement model; thus the constructs were reflecting the reality corresponding to them. Therefore, it was confirmed that these reflective constructs with these items could proceed to structural equation modelling. Nonetheless, factor loadings were not sufficient to determine if the model would work for SEM. Acceptable reliability and validity was required for the factors. Thus, reliability and validity analyses for the factors of the measurement model were conducted to find whether the model would provide statistical validity and reliability.

Reliability and validity analysis for principals' model. In order to judge the **reliability** of the constructs, both Cronbach's alpha and composite reliability statistics were measured for the principals' responses. Cronbach's alpha values greater than 0.7 are considered to demonstrate good reliability, while a value greater or equal to 0.6 indicates moderate reliability, and a value less than 0.5 demonstrates a lack of validity. An analysis of the principals' data indicated that most of the constructs exhibited very high reliability, with a Cronbach's alpha value of at least 0.7.

However, for *actual use*, *service quality* and *effort expectancy*, the alpha values were close to 0.5. To understand why these constructs were low, an analysis of the responses to questions relating to these constructs was conducted. It was discovered that for these constructs the item answers were inconsistent because all the principals had different tasks according to the nature of their school, and therefore they had varying *actual use*s, and their expectancy and perception of quality varied.

However, Cronbach's alpha only indicated whether the respondents would give the same answers if the questions were asked differently. Moreover, Cronbach's alpha might over- or underestimate reliability (Raykov, 1997, 1998a). Thus, in addition to Cronbach's alpha, composite reliability was also measured, and it was found that all the factors showed a high composite reliability value (greater than 0.7). Based on these evaluations, it can be suggested that the model items and factors had an acceptable reliability (Table 6.9), which would support the reliability of the output of the SEM model.

Table 6.9 Reliability for the factors of the principals' model

Constructs	Cronbach's alpha	Composite reliability
AU	0.547	0.776
BI	0.821	0.889
CS	0.798	0.871
CUL	0.933	0.948
EE	0.627	0.785
FC	0.741	0.814
Obs	0.785	0.875
PE	0.909	0.935
SI	0.913	0.881
SQ	0.550	0.800

For **validity** analysis, average variance extracted (AVE) and the Fornell-Larcker discriminant validity test were conducted to calculate convergent and discriminant validity for the constructs of the measurement model for the principals. Convergent legitimacy was sought to indicate how well the latent constructs were explained by the observed variables, where an AVE value needed to be > 0.50 (Hair Jr. et al., 2010). As presented in Table 6.10, all the constructs had an AVE greater than 0.5; thus all have convergent validity.

Table 6.10 AVE for constructs of the principals' model

	Average Variance Extracted (AVE)
AU	0.647
BI	0.727
CS	0.696
CUL	0.785
EE	0.555
FC	0.535
Obs	0.704
PE	0.782
SI	0.72
SQ	0.667

For the principals' structural equation model, the discriminant validity was judged based on the comment of Ghadi, Alwi, Bakar, and Talib (2012),

> *Discriminant validity is a test to ensure there is no significant variance among different variables that could have the same reason. Discriminant validity indicates to differentiate between one construct and another in the same model.(p.140)*

Discriminant validity tests the similarity among model constructs, and finds if there are multiple constructs that provide similar outcomes. This ensures that each construct illustrates different elements in the model. When testing discriminant validity with the Fornell-Larcker test (Table 6.11), if the diagonal values of the matrix are greater than preceding co-relationship values, then discriminant validity between two reflective constructs has been established (Urbach, & Ahlemann, 2010; Fornell, & Larcker, 1981).

Table 6.11 Fornell-Larcker test for discriminant validity for the principals' measurement model

	AU	BI	CS	CUL	EE	FC	Obs	PE	SI	SQ
AU	0.804									
BI	-0.073	0.853								
CS	-0.061	0.53	0.834							
CUL	0.25	-0.196	0.313	0.886						
EE	0.091	0.412	0.523	0.095	0.745					
FC	-0.316	0.34	0.26	-0.198	0.15	0.732				
Obs	0.198	-0.349	0.033	0.498	0.016	-0.219	0.839			
PE	0.194	0.209	0.493	0.142	0.476	0.394	0.12	0.884		
SI	0.061	-0.184	-0.221	-0.167	-0.231	-0.266	-0.1	-0.149	0.848	
SQ	-0.286	-0.31	-0.449	-0.182	-0.162	-0.129	0.13	-0.428	-0.03	0.816

According to the analysis of the Fornell-Larcker test for discriminant validity, data in Table 6.11 demonstrate that each hypothesis was unique, and that the structural paths between the exogenous and endogenous constructs had been established.

Structural equation model for principals' use of ICT. For principals' use of ICT in primary schools, the structural model, test estimated path coefficients, t-values (critical ratio) and standard deviation are presented. In this case, the path coefficient and the critical ratio reflect the strength of the relationships between the exogenous and the endogenous constructs (Figure 6.3).

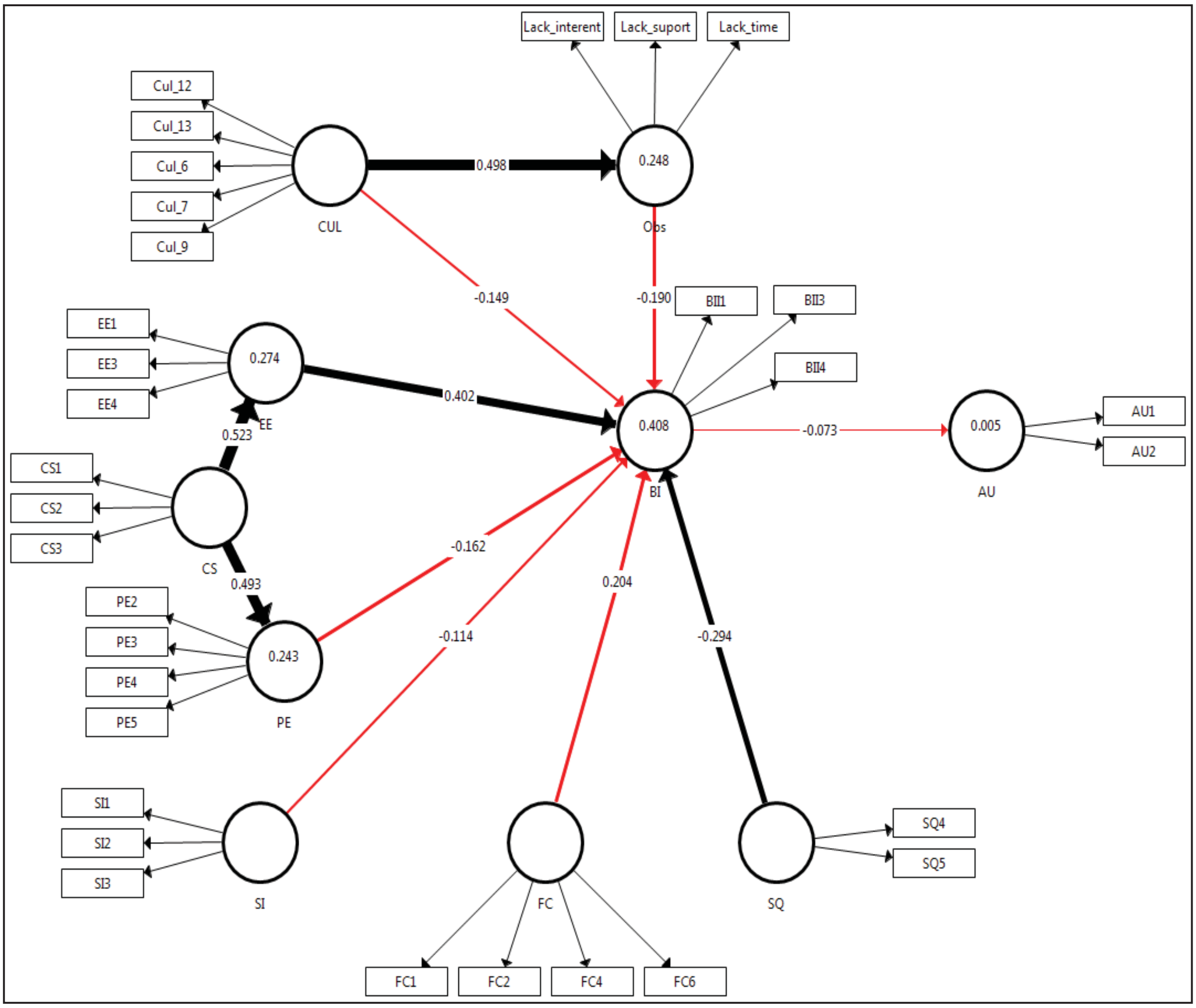


Figure 6.3 Structural equation path analysis for principals' use of ICT in primary schools

Table 6.12 shows that *computer literacy* had a very strong positive relationship with *effort expectancy* (t= 6.284, p<0.05) and *performance expectancy*, indicating that *computer literacy* had a significant influence on both effort and *performance expectancy* (t= 3.641, p<0.05). For these constructs, the corresponding relations are supported.

Effort expectancy demonstrated a strong positive relationship with the *behavioural intention* of the principals to use ICT in primary schools (t = 2.553, p<0.05). In contrast, *performance expectancy* showed only a weak negative relationship with *behavioural intention*, which was not statistically significant (t= 1.043, p>0.05). These results indicate that only *effort expectancy* positively increased the *behavioural intention* of the principals to use ICT in primary schools, and that they were not concerned about their performance.

Table 6.12 Research model output based on SEM analysis for principals' data

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Relationship between constructs
BI -> AU	-0.073	-0.218	0.117	0.627	0.530	Not supported
CS -> EE	0.523	0.573	0.083	6.284	0.000	Supported
CS -> PE	0.493	0.538	0.135	3.641	0.000	Supported
CUL -> BI	-0.149	-0.204	0.148	1.004	0.315	Not supported
CUL -> Obs	0.498	0.519	0.142	3.51	0.000	Supported
EE -> BI	0.402	0.373	0.157	2.553	0.011	Supported
FC -> BI	0.204	0.222	0.144	1.418	0.156	Not supported
Obs -> BI	-0.19	-0.259	0.176	1.079	0.281	Not supported
PE -> BI	-0.162	-0.204	0.156	1.043	0.297	Not supported
SI -> BI	-0.114	-0.162	0.114	1.002	0.316	Not supported
SQ -> BI	-0.294	-0.293	0.141	2.089	0.037	Supported

As illustrated in Table 6.12, *facilitating condition* showed a weakly positive and insignificant relationship ($t = 1.418$, $p > 0.05$) with *behavioural intention*, indicating that the facilities in the schools did not influence the intention to use ICT in school activities as far as the principals were concerned. Nor did *social influence* show any significant relationship to *behavioural intention* to use ICT in schools by the principals ($t = 1.002$, $p > 0.05$). These results indicate that at the time of the study, there was no positive *social influence* affecting the *behavioural intention* of the principals to use ICT in their schools.

System quality had a moderate negative relationship with *behavioural intention*, indicating that poor *system quality* would reduce the principal's intention to use ICT.

External factors, such as *culture* and various *obstacles* were also considered in the model. The analysis found that there was a strong relationship between *culture* and *obstacles* ($t = 3.51$, $p < 0.05$). This is a reflection of the fact that ICTs in schools are not yet widely accepted in Saudi Arabia, and the cultural context consistently presents *obstacles* to the adoption of ICT systems in schools.

However, neither *culture* nor external *obstacles* showed a significant relationship with the principals' *behavioural intention* ($p > 0.05$) to use ICT. That is, despite the cultural context being unfavourable to ICT usage, the principals' intention to use ICT in school activities was not dampened. If reliable and comprehensive ICT systems had been available, the principals would have used them regardless of cultural *obstacles*.

Finally, the model showed a very weak negative, insignificant, relationship between *behavioural intention* and *actual use* of ICTs by the principals (t= 0.627, p>0.05). The R-square value for the *actual use* of ICTs was only 0.005, indicating that the *behavioural intention* to use ICTs in class only explains 0.5% of the *actual use* of ICTs. This is very low and fails to explain even 1% of the reason the primary school principals used ICTs. The implied *behavioural intention*, therefore, does not actually explain the current use of ICTs by the principals, none of whom had introduced working ICT systems into their schools. Although *behavioural intention* was high, *actual use* was very low.

Therefore, it can be assumed that *actual use* of ICTs for education may be determined by factors other than just *behavioural intention*. Nevertheless, the model was able to predict the *behavioural intention* of the principals with reasonable accuracy since the intention to use computer systems can be considered quite separately from actually using them.

The R-square value for *behavioural intention* was 0.408, indicating that factors different from those modelled could nonetheless explain 40.8% of the *behavioural intention* to use ICTs in primary schools. The R-square value is a better representation of the model. Thus, it can be postulated that *effort expectancy* positively increases the intention to use ICT in schools, while poor ICT *system quality* decreases the intention to use ICT.

The structural model was further tested to examine if it was really reflecting the data, and for this, a blinded analysis was conducted (Table 6.13). In the structural model, a Q^2 value larger than zero for a certain reflective endogenous latent variable indicates the predictive relevance of the model path for this particular construct (Hair Jr. et al., 2014).

Table 6.13 Test of the structural model's predictive relevance from the blinded analysis

	Sum of squares of observations (SSO)	Sum of squared prediction errors (SSE)	Q^2 (=1-SSE/SSO)
AU	80	82.81	-0.035
BI	120	95.586	0.203
CS	120	120.00	
CUL	200	200.00	
EE	120	107.124	0.107
FC	160	160.00	
Obs	120	104.632	0.128
PE	160	133.08	0.168
SI	120	120.00	
SQ	80	80.00	

Table 6.13 presents the predictive relevance of the model for the constructs with formative relationships, in this case, *behavioural intention, effort expectancy*, *obstacles* and *performance expectation*. All have Q^2 values larger than zero, indicating the model has statistically accepted predictive relevance. In contrast, the *actual use* has no acceptable predictive relevance. Thus, some new relationships were needed to explain the *actual use* of ICT in primary schools by the principals.

6.1.5 Interactive SEM model to explore the *actual use* of ICT in class

The initial SEM lacked the predictive capacity to explain the *actual use* of ICT in primary schools by the principals. A further investigation was completed looking at different relationships between several independent constructs and *actual use* to find the constructs that really explained the current *actual use* of ICT in the primary schools by the principals. The *actual use* data showed that, in reality, the principals never or rarely used ICT in school activities.

A second SEM assessing the principals' use of ICT in primary school, the structural model, test estimated path coefficients, t-values (critical ratio) and standard deviation are discussed in the following sections. In this case, the path coefficient and the critical ratio reflect the strength of the relationship between the exogenous and the endogenous construct (Figure 6.4).

In this second model, the relationships of *behavioural intention* with other independent variables remained the same as in the first SEM. *Facilitating conditions, social influence, performance expectancy* and *system quality* had no significant relationship with *behavioural intention*. For all these constructs, the null hypotheses were retained, and the p-value was greater than 0.05 (alpha).

Computer literacy had a significant relationship with both *effort* and *performance expectancy* ($p<0.05$). However, compared with the initial SEM, *culture* had no significant relationship with *behavioural intention* ($t=0.972$, $p>0.05$), yet had a strong positive relationship with *obstacles* ($t= 3.432$, $p<0.05$). As in the first SEM, *behavioural intention* was found to have no significant relationship with *actual use* ($t= 0.433$, $p>0.05$). The second, modified model shows an R-square value of 0.229 for *actual use*, indicating that the model can explain 22.9% of the variance of *actual ICT use* in Saudi primary schools by the principals.

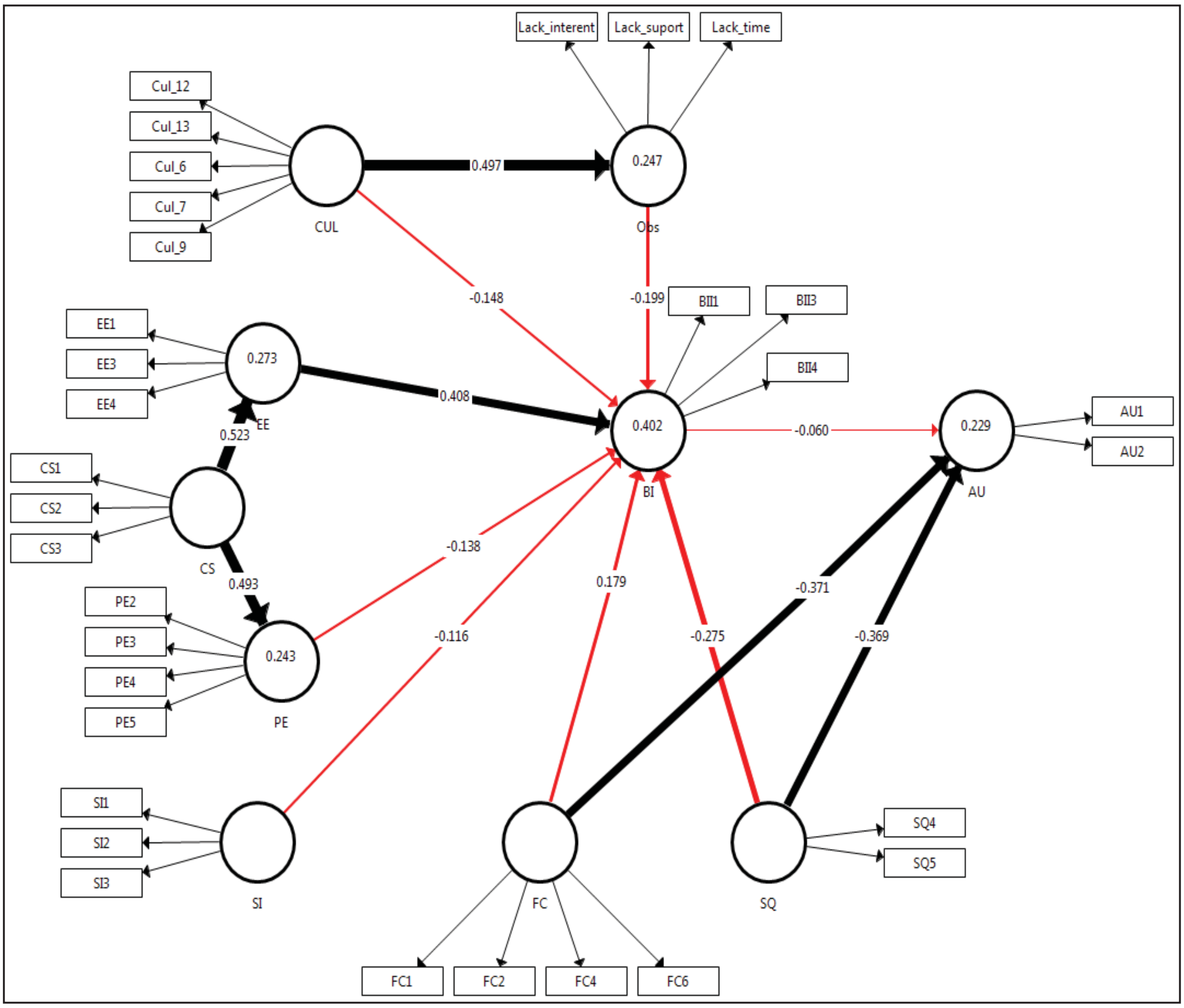


Figure 6.4 Modified structural equation path analysis for principals' use of ICT in primary schools

System quality and *facilitating conditions* have a significant relationship ($p<0.05$) with *actual use* of ICT. There are negative relationships between *system quality* and *actual use*, as well as *facilitating conditions* and *actual use*. This indicates that if *system quality* is poor and the *facilitating conditions* are not well developed, there will be lower *actual use* of ICT in primary schools by the principals. This is currently the situation for ICT use at Saudi primary schools, which suggests that the modified SEM successfully predicted the *actual use* of ICT by the principals (Table 6.14).

Table 6.14 Interactive research model output based on SEM analysis for principals' data

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Relationship between constructs
BI -> AU	-0.06	-0.173	0.138	0.433	0.665	Not supported
CS -> EE	0.523	0.575	0.083	6.277	0.000	Supported
CS -> PE	0.493	0.536	0.138	3.574	0.000	Supported
CUL -> BI	-0.148	-0.209	0.152	0.972	0.331	Not supported
CUL -> Obs	0.497	0.515	0.145	3.432	0.001	Supported
EE -> BI	0.408	0.389	0.163	2.51	0.012	Supported
FC -> AU	-0.371	-0.373	0.158	2.352	0.019	Supported
FC -> BI	0.179	0.192	0.142	1.256	0.209	Not supported
Obs -> BI	-0.199	-0.269	0.18	1.108	0.268	Not supported
PE -> BI	-0.138	-0.199	0.154	0.897	0.370	Not supported
SI -> BI	-0.116	-0.168	0.117	0.988	0.323	Not supported
SQ -> AU	-0.369	-0.369	0.163	2.268	0.023	Supported
SQ -> BI	-0.275	-0.283	0.147	1.873	0.061	Not supported

The modified model was further tested to examine if it was really reflecting the data, and for this a blinded analysis was conducted. In the structural model, a Q^2 value larger than zero for a certain reflective endogenous latent variable indicates the path model's predictive relevance for this particular construct (Hair Jr. et al., 2014).

Table 6.15 presents the figures for the predictive relevance of the model for the constructs with formative relationships. In this case, for *actual use*, *behavioural intention*, *effort expectancy*, *obstacles*, *performance expectancy*, *social influence* and *system quality* all have a Q^2 value larger than zero, indicating the model has statistically accepted predictive relevance.

Table 6.15 Test results for the model's predictive relevance for interactive SEM

	Sum of squares of observations (SSO)	Sum of squared prediction errors (SSE)	Q^2 (=1-SSE/SSO)
AU	80	74.103	0.074
BI	120	101.743	0.152
CS	120	120.00	
CUL	200	200.00	
EE	120	107.507	0.104
FC	160	160.00	
Obs	120	105.335	0.122
PE	160	134.703	0.158
SI	120	120.00	
SQ	80	80.00	

The model result shows the reality from the data set, and, most importantly, the relationship between *actual use* and *behavioural intention* demonstrates a higher level of predictive capacity.

6.2 Teachers' data analysis and model results

Using the survey, a wide range of questions was put to the teacher group recruited for the study. Their opinion and responses were analyzed to illustrate the existing conditions of ICT use by teachers in Saudi primary schools, and teacher's ideas regarding the possible use of ICT in primary education. In this regard, both descriptive statistics and statistical modeling were utilised. The following sections elaborate the results of the teachers' survey responses and provide details of the outcome of the SEM model for teachers' ICT use intention and *actual use*.

6.2.1 Descriptive statistics of teachers

This section presents the demographic information and the existing ICT usage patterns of the teachers at home and at school. Possible connections between demographic attributes and the *behavioural intention* to use ICT are discussed. Two hundred (200) teachers were surveyed, and after data cleaning and checking for completeness, 170 responses were identified as complete and clean. These 170 responses were then included in the data analysis process.

Location. In the sample, teachers from three major cities were selected randomly: Jeddah, Riyadh and Dammam. Among these cities, Jeddah and Riyadh are the two most important and populous cities of the KSA. Dammam is an important city in eastern Saudi Arabia, and accounts for a large proportion of the population in the east of the kingdom. Dammam provided 24.6% of the survey participants. Jeddah is the largest sea port on the Red Sea, and the second-largest city in Saudi Arabia after Riyadh, with a population of 4.2 million. The city is an important commercial hub, and 47.4% of the survey participants were living and working in Jeddah. The rest of the teachers were selected from schools in the capital city, Riyadh, the most populous city in the kingdom, with over six million inhabitants.

Selections of teachers from these cities ensured that the sample represented most of the populated areas in Saudi Arabia, which ensured a wide range of participants.

Gender. Access to the teachers from female schools was limited, and communication was difficult with the female teachers for cultural reasons. Nevertheless, Table 6.16 shows one fifth of survey participants were female teachers (18.24%), while 81.73% were male. Despite the dominance of male teachers in the sample, the researcher tried to keep responses from the female teachers in order to ensure there were no direct, gender related limitations in the teachers' section (Table 6.16).

Table 6.16 Distribution of gender of the teachers

	Frequency	Percent
Male	139	81.76
Female	31	18.24

Age. The maximum and minimum ages of the teachers were 23 and 49 respectively. The mean age of the sample teacher group was 30.68, with a standard deviation of 4.44 (Table 6.17).

Table 6.17 Age distribution of the teachers

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age	170	23.00	49.00	30.68	4.44

Teacher participants were selected randomly to ensure the absence of any bias, with selection based on the teaching interest of the teacher. Teachers who taught almost all subjects were of particular interest.

Subjects taught. As illustrated in table 6.18, around 22% of the teachers taught mathematics (the largest proportion); another 17.9% taught language, and 16.2% taught almost every subject. Thus, the teachers were reasonably diverse in their teaching strengths, and it was expected that they would consider both science and non-science related subjects when answering questions relating to ICT usage intention.

Table 6.18 Distribution of subjects taught by the teachers in classes

Subjects Taught	Frequency	Percent
All subjects or almost	28	16.2
Language	31	17.9
Mathematics	38	22.0
Sciences	27	15.6
Computing	10	5.8
Geography	14	8.1
Religions studies	22	12.7

Levels of educational achievement. The majority of the teachers held a Bachelor's degree (82.35%) (Table 6.19). The primary schools of Saudi Arabia require a minimum of either a Diploma or a Bachelor's degree before they are able to teach. There is also an office management diploma and a Master's degree, which leads to positions of greater responsibility. The level of education was considered to be an indication of the level of familiarity the teachers would have with the current world and their views of ICT usage, as higher studies in university require the use of ICT facilities, such as computers, the internet and other tools to complete assignments to the required level (Table 6.19). Therefore, higher education, with greater exposure to ICT might result in greater familiarity with ICT use in education among the teachers.

Table 6.19 Level of education of the teachers

Level of Study	Frequency	Percent
Lecturer - Bachelors' degree	140	82.35
Instructor - Office Management Diploma	17	10.00
Instructor - Master's degree	13	7.65
Total	170	100.00

6.2.2 Use of ICT by the teachers

ICT usage by the teachers generally reflected the capabilities of the teachers in handling ICT in their daily lives, their *actual use* of ICT facilities in their existing condition and the potential for using ICT facilities in the future.

Using a computer at home. More than 76% of the teachers had had a personal computer at home for more than five years (Table 6.20). The number using computers and the number of years of experience with ICT at home clearly indicates that the majority of the primary school teachers were familiar with ICT facilities in their day-to-day lives and were used to working with ICT facilities. ICT familiarity might help in developing a positive attitude to ICT adoption in the school.

Table 6.20 Number of years using personal computer at home

Years of experience	Frequency	Percent
1-2 years	4	2.35
2-5 years	36	21.18
5+ years	130	76.47
Total	170	100.00

Purpose of using computer and internet at home. A person using a personal computer at home rarely uses it for a single purpose, particularly an adult using a personal computer for several years. It is likely that teachers in the KSA used personal computers at home for multiple purposes.

Analysis of the data indicated that all of the teachers browsed the internet at home using their personal computer or other devices. Word processing was also a major reason to use the computer. Table 6.21 shows that around 82% (140) of the teachers used their personal computers at home for word processing. This showed that they were probably working at home, which is quite common for teachers as often they prepare documents for the students or do personal study (Table 6.21).

Table 6.21 School teachers' use of computer at home (multiple choice allowed)

Use	Number of teachers use	Percentage
Internet browsing	170	100.00%
Chatting	73	42.94%
E-mail	96	56.47%
Games	35	20.59%
Design	17	10.00%
Word processing	140	82.35%
Programming	3	1.76%

More than 56% (96) of primary school teachers in the KSA regularly used their personal computers for email. Chatting, gaming and designing were also important uses of computers at home. A very few of them used their computers for programming. The different types of use clearly show that the majority of the teachers were familiar with basic ICT facilities and that they possessed the minimum capacity to use ICT facilities that are essential for daily life. They were familiar with Microsoft *Office* applications, with browsing and with making social connections and communicating using the internet on their computers, as well as related devices, such as cell phones or tablet PCs.

Hours of computer and internet use at home by teachers. The time spent using the computer and the internet at home confirmed the teachers' usage in more detail. Table 6.22 shows that around 75.7% of the teachers spent more than six hours per week using computers at home, and there was every indication that this regular use improved their skills and confidence and made them more likely to use ICTs in the classroom (Gajek, 2015; Vrasidas, 2015; Lindberg et al., 2017).

Table 6.22 Hours spent in computer at home weekly by the teachers

Hours of use per week at home	Frequency	Percent
6 hours	39	22.5
more than 6 hours	131	75.7

Years of experience of using computers and internet. Analysis of the data revealed that most teachers had been using computers for 6 to 10 years (Table 6.23). In general, for these teachers, the beginning of the 21st century had coincided with a change in the attitudes of the teachers and their views of education. Teachers have been getting more used to computers and upgraded technologies and have been using them increasingly in their lives, and in their profession daily (Ertmer, & Ottenbreit-Leftwich, 2010; Schibeci et al., 2008). Almost all the teachers understood the importance of technology in their lives, and have been getting more experience with computers over the last decade.

Table 6.23 School teachers experience with computer

	Frequency	Percent
1-5 years of experience	60	35.2
6-10 years of experience	105	61.76
11-15 years of experience	5	2.94

Use of ICT at school by teachers. This section explores the existing ICT usage of the primary schools teachers at their schools.

Computers in schools

The descriptive analysis showed the teachers agreed that access to computers in the classroom is limited. More than 90% (Figure 6.5) of the teachers did not have access to a computer in their classroom.

Lack of access to computer facilities means that the majority of the teachers were unable to use ICT for teaching in primary schools, despite the fact that they were able to use computers and used them at home.

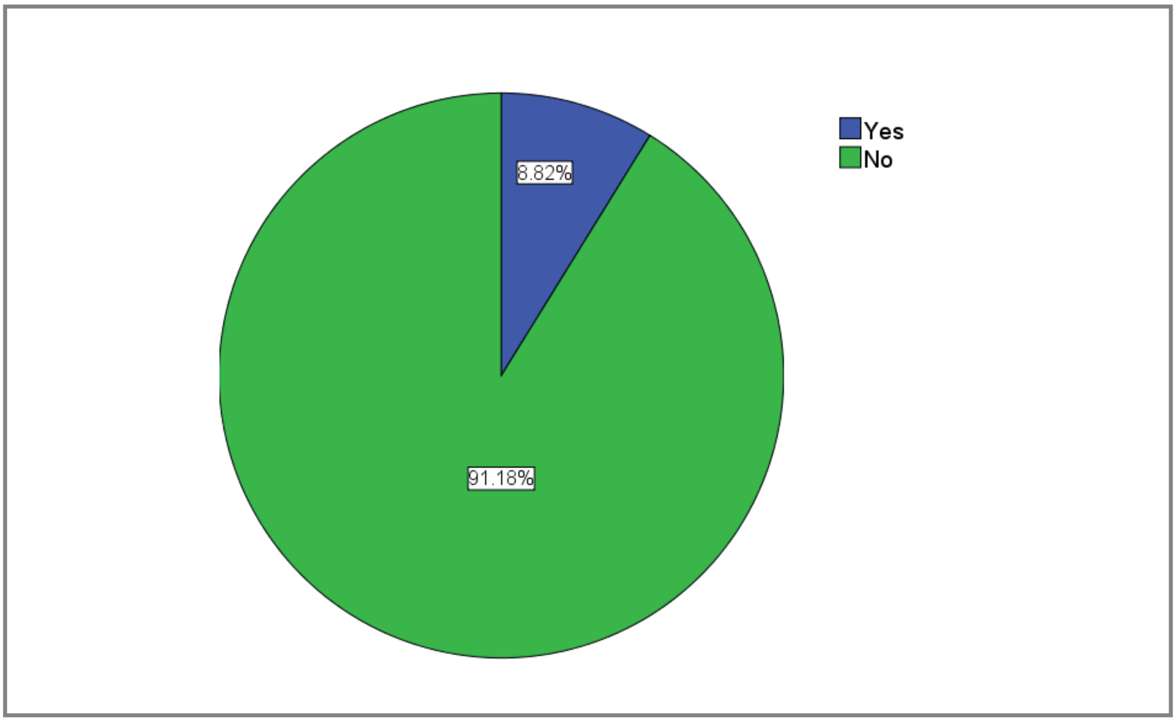


Figure 6.5 Access to computers

Hours of computer and internet use at school by teachers

Table 6.24 illustrates the majority of the teachers usually did not have access to computers or the internet at school, and approximately 71% of the teachers never used computers or the internet at school. 23% used them approximately four hours per week; and another 3.5% used computers or the internet around six hours per week, which is very low compared to the total sample of teachers.

Table 6.24 Hours of computer and internet use at school per week by the teachers

Hours of use of computer and internet at school per week	Frequency	Percent
0 hour	123	72.35
4 hours	41	24.12
6 hours	6	3.53

The overall use of computers and the internet is very low for the teachers at school compared to their home usage. Actual ICT use by teachers in schools is quite low or non-existent in Saudi primary schools, which clearly illustrates that there is room for introducing ICT facilities to ensure wider accessibility and functionality.

General condition of ICT facilities at school

Analysis of the data indicated that even students of advanced ability and students with their own computers or other technological devices were not provided ICT facilities by the schools. Nor did the classrooms accommodate ICT, but were equipped with whiteboards. 67.05% of the schools did, however, have a computer screen projector (Figure 6.6) in some fixed classes (e.g., common room, lab classes). In some cases, teachers had access to a computer, but mainly for instruction purposes.

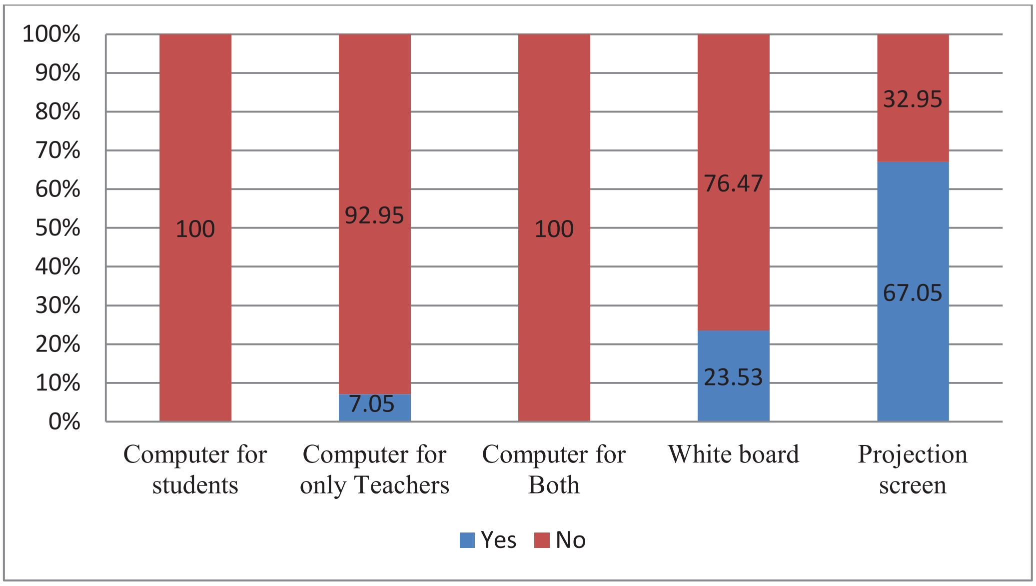


Figure 6.6 Condition of ICT facilities at the class of the primary schools

In summary, data indicated that teachers were using ICT facilities in their homes, and they were aware of the potential use of ICT for various purposes, including teaching. However, the facilities provided at the schools did not encourage the use of ICT for education or education administration on the part of teachers. There is, therefore, scope for improvement and the implementation of ICT in Saudi primary education.

6.2.3 Teacher data modelling for ICT use

Based on the research objectives and questions, a conceptual model for teachers' use of ICT in primary schools in Saudi Arabia was developed. The model consisted of several endogenous and exogenous constructs, including the factors responsible for adoption of ICT in primary schools by the teachers, and thus captures their preferences, as well as the *actual use* of ICT at present. The conceptual model was based on the UTAUT model. However, new constructs and relationships were also considered in the conceptual model to fit the situation in the primary schools of Saudi Arabia, as elaborated in Chapter 3.

To explore the actual usage and determine the reasons for the low usage of ICT, an interactive model derived from the conceptual model was examined, exploring the possible constructs that can predict ICT adoption in Saudi primary schools by class teachers. In this section, the possible factors related to the teachers' adoption of ICT in primary schools have been explored using a measurement model (confirmatory factor analysis), and, finally, the relationships between and within the factors, as well as the constructs, have been examined using component based structural equation modelling.

Descriptive statistics for items in the model. The proposed model for ICT use intention and *actual use* in class had several endogenous constructs such as:

- *performance expectancy*
- *effort expectancy*
- *facilitating condition*
- *social influence*
- *cultural influence*
- *computer literacy*
- *system quality*

while there are exogenous constructs such as:

- *behavioural intention*
- *actual use.*

All these constructs had several items that have been discussed in the methodology sections. A random selection of 200 teachers from schools in the three major cities in Saudi Arabia were recruited, after receiving all responses, data cleaning and processing have been conducted. After data cleaning, a total of 170 valid responses have been further taken to develop and investigate the model.

As for the descriptive analysis of the factors, the mean values of effort expectancy, performance expectancy, computer literacy and behavioural intention are very high (near to 5), while mean values for social influence, facilitating conditions, and actual use are near one, indicating the differences among the constructs vary and these might be positive or negative relationship indicators in the model (Table 6.25).

Table 6.25 Descriptive statistics for items related to use of ICT in primary schools by teachers

Constructs	Item Description in Table 4.4, Chapter 4	Minimum	Maximum	Mean
Effort expectancy (EE)	EE1	2	5	4.41
	EE3	3	5	4.38
	EE4	2	5	4.20
	EE5	2	5	4.29
Performance expectancy (PE)	PE2	2	5	4.58
	PE3	2	5	4.62
	PE4	1	5	4.58
Social influence (SI)	SI3	1	4	1.85
	SI4	1	3	1.52
	SI5	1	4	1.91
Facilitating conditions (FC)	FC1	1	3	1.59
	FC4	1	3	1.50
	FC5	1	3	1.53
	FC6	1	3	1.44
System quality (SQ)	SQ2	1	3	1.66
	SQ3	1	3	1.62
	SQ4	1	3	1.75
	SQ5	1	3	1.49
Computer literacy (CS)	CS1	1	4	1.91
	CS2	1	4	1.91
	CS3	1	4	1.89
Behavioural intention (BI)	BI2	2	5	4.56
	BI3	3	5	4.41
	BI4	1	5	4.73
Cultural influence (Cul)	Cul_7	2	5	4.48
	Cul_9	2	5	4.29
	Cul_12	3	5	4.41
	Cul_13	2	5	4.22
Obstacles (Obs)/External barriers	LA2_i	1	3	1.34
	LA3_s	1	3	1.49
	LA4_t_s	1	3	1.47
Actual use (AU)	AU1	1	3	1.34
	AU2	1	3	1.45
	AU3	1	5	2.02

As these factors have categorical responses as answers, they are not normally distributed and not fully fit for covariance based SEM models. Thus, the researcher selected a component based structural equation model (PLS-SEM) (Hair Jr. et al., 2014). Furthermore, the main issue of this research was to find the factors that might influence the use of ICT in primary school; however, the ICT technology is currently not widely available in the schools, making it impossible to test established theory. However, the model could predict the use of ICT based on *behavioural intention* and the observed relationships in the existing patterns. This would confirm the way teachers would accept the technology in class, as well as how they are using it at present (if available). As per the theory, component based structural equation modelling (PLS- SEM) was best (Hair Jr. et al., 2013) for a predictive model.

Measurement model for teachers' use of ICT. The items which actually define the constructs or are related to the constructs need to be investigated before running the final model to identify the factors most eligible for analysis. In this case, confirmatory factor analysis was conducted on the teachers' data. Based on the factor analysis, the researcher was able to ascertain which factors would best explain the constructs in the model and predict ICT usage by teachers in Saudi primary schools. Not all the factors predicted the constructs with acceptable factor loadings (greater than 0.5).

The selected factors were tested using a measurement model in order to identify both exogenous and endogenous constructs capable of determining the acceptance by teachers of ICT in Saudi primary schools. For the measurement model, all the constructs proved reflective, and the loadings showed how well these items determined the constructs. The item loadings are shown in Figure 6.7 and Table 6.26.

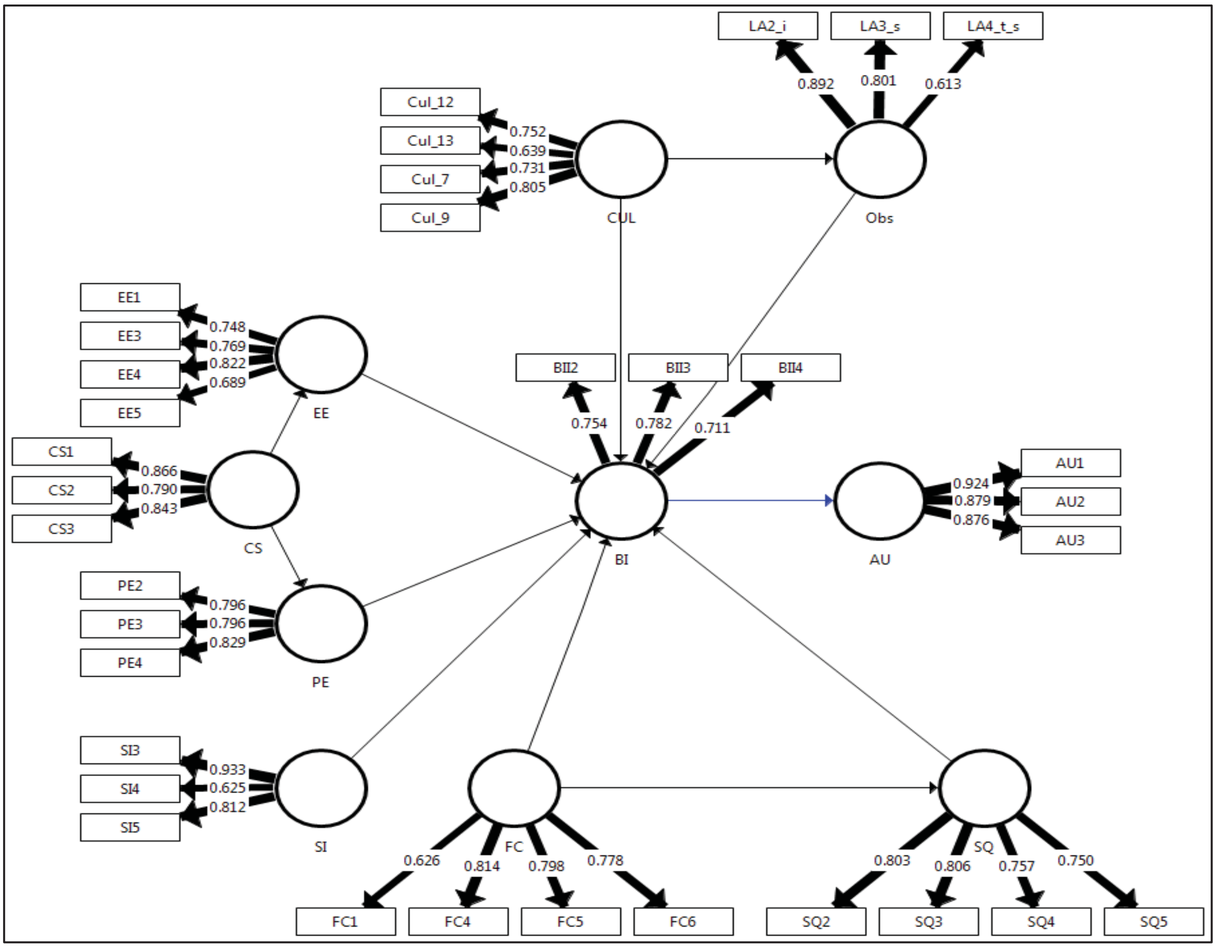


Figure 6.7 Measurement model for the teachers ICT use in Saudi primary schools

Table 6.26 shows that all the item loadings of the measurement model were good, and that for each construct the average loadings of the corresponding items were above 0.7, which is widely accepted for a measurement model (Hair Jr. et al., 2014). Thus, it could be confirmed that the constructs with these items could proceed to a PLS based structural equation model, once reliability and validity analysis for the factors of the measurement model had been established.

Table 6.26 Outer loadings of measurement model for teachers

Constructs	Items	AU	BI	CS	CUL	EE	FC	Obs	PE	SI	SQ
Actual use	AU1	0.92									
	AU2	0.87									
	AU3	0.87									
Behavioural intention	BII2		0.75								
	BII3		0.78								
	BII4		0.71								
Computer self-efficacy literacy (CS)	CS1			0.86							
	CS2			0.79							
	CS3			0.84							
Cultural	Cul_12				0.75						

Constructs	Items	AU	BI	CS	CUL	EE	FC	Obs	PE	SI	SQ
influence	Cul_13				0.63						
	Cul_7				0.73						
	Cul_9				0.80						
Effort expectancy	EE1					0.74					
	EE3					0.76					
	EE4					0.82					
	EE5					0.68					
Facilitating conditions	FC1						0.62				
	FC4						0.81				
	FC5						0.79				
	FC6						0.77				
Obstacles	LA2_i							0.89			
	LA3_s							0.80			
	LA4_t_s							0.61			
Performance expectancy	PE2								0.79		
	PE3								0.79		
	PE4								0.82		
Social influence	SI3									0.93	
	SI4									0.62	
	SI5									0.81	
System quality	SQ2										0.80
	SQ3										0.80
	SQ4										0.75
	SQ5										0.75

Reliability and validity analysis for teachers' model. In order to determine the reliability of the constructs, both Cronbach's alpha, and composite reliability statistics were measured for the teachers' responses (Table 6.27). A value for Cronbach's alpha greater than 0.7 shows high reliability, while a value greater than or equal to 0.6 shows moderate reliability. If the value is less than 0.5, reliability is lacking. Analysis of the teachers' results indicated that all constructs had a Cronbach's alpha of 0.7 or greater, showing high reliability, indicating that the test items were highly correlated .

It must be recognised, however, that Cronbach's alpha is sensitive to the actual number of items in a test and may over- or underestimate reliability (Raykov, 1997, 1998a). Thus, in addition to Cronbach's alpha, composite reliability was also measured, and it was found that all the factors showed a high composite reliability value (greater than 0.7). It was confirmed, therefore, that the model items and constructs had acceptable reliability (Table 6.27).

Table 6.27 Reliability for the factors of teachers' model

Constructs	Cronbach's alpha	Composite reliability
AU	0.874	0.922
BI	0.611	0.794
CS	0.78	0.872
CUL	0.714	0.823
EE	0.753	0.844
FC	0.753	0.842
Obs	0.713	0.818
PE	0.734	0.849
SI	0.727	0.839
SQ	0.784	0.861

Using the average variance extracted (AVE) and the Fornell-Larcker criterion, the convergent and discriminant validity for the constructs of the measurement model for the teachers were determined.

Convergent validity shows how well the latent constructs are explained by the observed variables, and for that the AVE needs to be > 0.50 (Hair Jr. et al., 2010). As presented in Table 6.28, all the constructs had an AVE greater than 0.5. Thus all had convergent validity; that is, the responses to the survey questions/statements were sufficiently correlated with the respective latent variables.

Table 6.28 AVE for constructs of the teacher model

	Average Variance Extracted (AVE)
AU	0.798
BI	0.562
CS	0.695
CUL	0.539
EE	0.575
FC	0.574
Obs	0.604
PE	0.651
SI	0.64
SQ	0.608

Discriminant validity confirms that measures of a latent construct that are not supposed to be related are not related.

> *A measurement model containing latent variables is generally considered to have acceptable discriminant validity if the square root of the average variance extracted for each latent variable is higher than any of the bivariate correlations involving the latent variables in question. (Fornell, & Larcker, 1981, cited in Kock, n.d., slide 9)*

Using the data from an AVE, according to the Fornell-Larcker criterion (above), if the diagonal values of the matrix are greater than other correlation values, discriminant validity has been established between two reflective constructs (Urbach, & Ahlemann, 2010; Fornell, & Larcker, 1981). This would ensure the model constructs have discriminant validity and would be useful for structural equation modelling (Table 6.29).

Table 6.29 Results of the Fornell-Larcker test for discriminant validity (the Fornell-Larcker criterion)

	AU	BI	CS	CUL	EE	FC	Obs	PE	SI	SQ
AU	0.894									
BI	0.319	0.75								
CS	0.439	0.296	0.834							
CUL	0.416	0.698	0.406	0.734						
EE	0.44	0.625	0.415	0.726	0.759					
FC	0.588	0.216	0.268	0.283	0.283	0.758				
Obs	0.514	0.129	0.162	0.177	0.307	0.701	0.777			
PE	0.147	0.535	0.028	0.556	0.482	0.043	-0.009	0.807		
SI	0.538	0.199	0.655	0.334	0.315	0.439	0.273	0.07	0.8	
SQ	0.612	0.231	0.408	0.226	0.297	0.739	0.622	-0.054	0.519	0.78

Structural equation model for teachers' use of ICT. Structural equation modelling for the teachers' use of ICT in primary school tested estimated path coefficients, t-values (critical ratio) and standard deviation. The path coefficient and the critical ratio reflect the strength of the relationships between the predicator (exogenous) and the dependent (endogenous) construct (Figure 6.8).

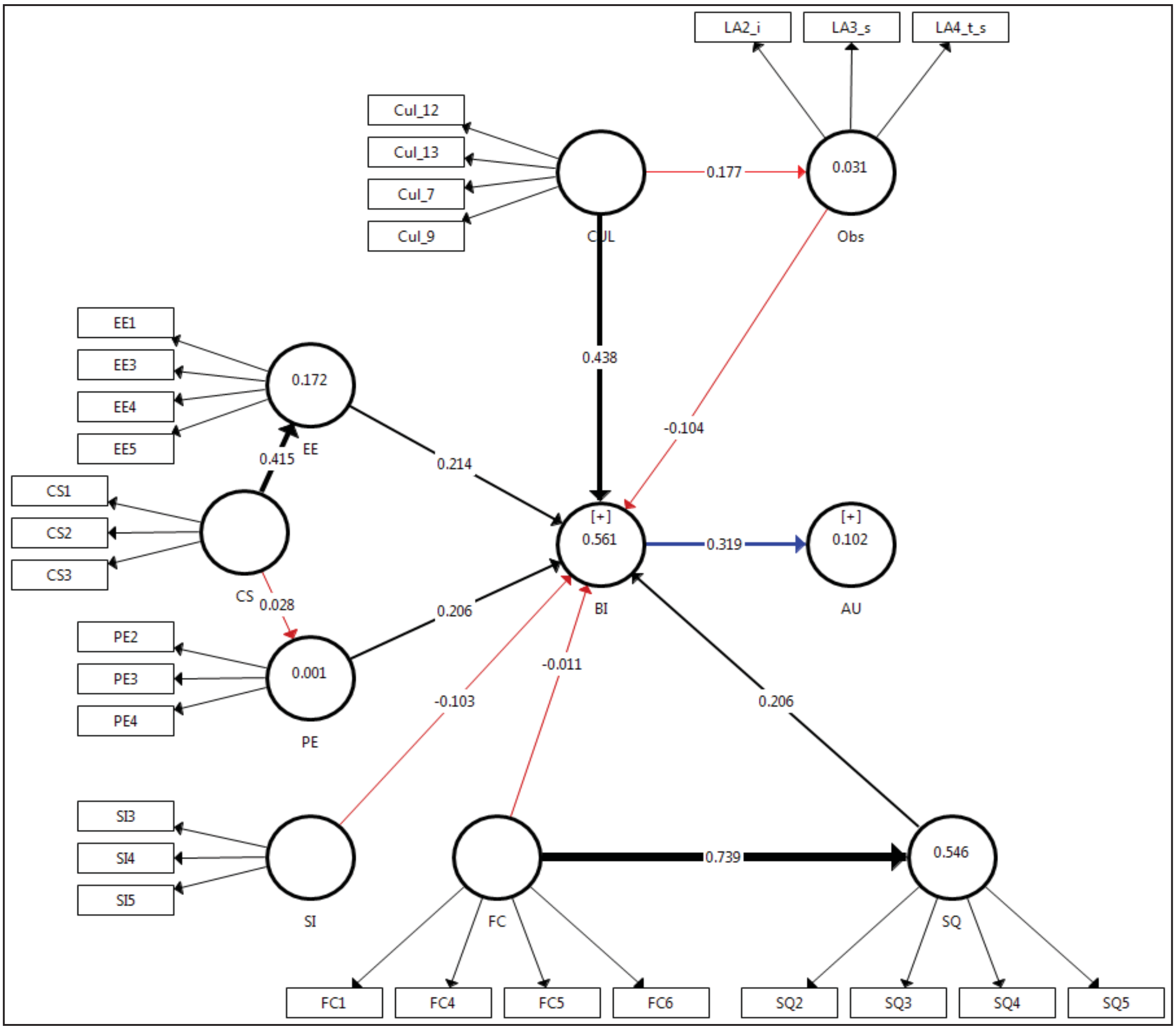


Figure 6.8 Structural equation path analysis for teachers' use of ICT in primary schools

As shown in Table 6.30, *computer literacy* (CS) has a very strong positive relationship with *effort expectancy* (t=4.988, p<0.05). However, CS has a weak and insignificant (t=0.292, p>0.05) positive relationship with *performance expectancy*, indicating CS has no significant influence on *performance expectancy*.

Table 6.30 Research model output based on SEM analysis for teachers' data

	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Relationship between constructs
BI -> AU	0.319	0.085	3.733	0.000	Supported
CS -> EE	0.415	0.083	4.988	0.000	Supported
CS -> PE	0.028	0.097	0.292	0.770	Not Supported
CUL -> BI	0.438	0.089	4.937	0.000	Supported
CUL -> Obs	0.177	0.152	1.16	0.247	Not Supported
EE -> BI	0.214	0.09	2.379	0.018	Supported
FC -> BI	-0.011	0.103	0.109	0.913	Not Supported
FC -> SQ	0.739	0.031	23.709	0.000	Supported
Obs -> BI	-0.104	0.098	1.06	0.290	Not Supported
PE -> BI	0.206	0.101	2.036	0.042	Supported
SI -> BI	-0.103	0.061	1.687	0.092	Not Supported
SQ -> BI	0.206	0.096	2.141	0.033	Supported

Effort expectancy has a moderately strong positive relationship with the *behavioural intention* of the teachers to use ICT in primary schools ($t=2.379$, $p<0.05$). In addition, *performance expectancy* also has a moderately strong positive relationship with *behavioural intention* ($t=2.036$, $p<0.05$). Therefore, there is a significant relationship between *performance expectancy* and *behavioural intention* to use ICT in class.

The results indicate that both *effort* and *performance expectancy* increases the *behavioural intention* of the teachers to use ICT for teaching in primary schools. However, *facilitating condition* has weak negative, yet insignificant ($t=0.109$, $p>0.05$) relationship with *behavioural intention*; implying facilities in the schools do not influence the intention to use ICT in classes, and there is no relationship with *behavioural intention.*

Facilitating conditions has a very strong positive relationship with *system quality* and flexibility ($t= 23.709$, $p<0.05$). This indicates that the better the *facilitating conditions*, the more likely it is that *system quality* and flexibility will increase, along with better use of ICT. Furthermore, *social influence* shows no significant ($t=1.687$, $p>0.05$) relationship with *behavioural intention* to use ICT in schools by the teachers. The analysis indicates that there is no positive *social influence* or that there is social hindrance in Saudi schools in terms of intention to use ICT in class by the teachers. In addition to this, *system quality* demonstrates a moderately significant ($t=2.141$, $p<0.05$) positive relationship with *behavioural intention*, which indicates that if *system quality* were better, the teachers would be more willing to use ICT in class.

The model found there is a strong significant ($t = 4.937$, $p < 0.05$) positive relationship between *culture* and *behavioural intention* to use ICT in class. This indicates that based on teacher responses Saudi *cultural factors* can positively influence the use of ICT in class for Saudi primary schools. However, culture has no significant relationship with *obstacles* to use ICT, and *obstacles* to use ICT have a negative yet insignificant relationship with *behavioural intention* *($t=1.06$, $p>0.05$)*. This indicates that *obstacles* can affect the use intention, but in the case of Saudi schools, this is not significant.

Finally, the model shows a moderately positive relationship with *behavioural intention* and *actual use* ($t=3.733$, $p<0.05$) of ICT by the teachers in class. Importantly, the R-square value for the *actual use* is only 0.102, indicating *behavioural intention* to use ICT in class only explains 10.2% of *actual use* of ICT in class. This is very low, indicating *behavioural intention* does not explain the existing *actual use*. This is because *actual use* is not high at present (as explored in the descriptive section) by the teachers; therefore, *behavioural intention* cannot predict *actual use*. Additionally, *actual use* may be determined by factors other than *behavioural intention*.

Analysis of the data to estimate the relationship among the variables overall revealed that the R-square value for *behavioural intention* was 0.561, meaning that about 56% of the variance in the dependent variable *behavioural intention* was predictable by the independent variables.

To further test the model, a blindfolded analysis of the model was conducted to measure the Q^2 values. In the structural model, a Q^2 value larger than zero for a reflective endogenous latent variable indicates the path model's predictive relevance for a particular construct (Hair Jr. et al., 2014) (Table 6.31).

Table 6.31 Test of the model's predictive relevance

	Sum of Squares of observations (SSO)	Sum of Squared prediction Errors (SSE)	Q^2 (=1-SSE/SSO)
AU	510	473.345	0.072
BI	510	368.77	0.277
CS	510	510	
CUL	680	680	
EE	680	615.327	0.095
FC	680	680	
Obs	510	507.166	0.006
PE	510	511.179	-0.002
SI	510	510	
SQ	680	460.2	0.323

In Table 6.31, the predictive relevance of the model for the constructs with formative relationships has been presented. In this case, AU, BI, EE, Obs, PE, SI, and SQ all have Q^2 values greater than zero, indicating the model has statistically accepted predictive relevance. Thus, the model result reflected the reality of the data set in predicting the relationship among the constructs.

Interactive SEM model to explore the *actual use* of ICT in class. The final model lacked the predictive capacity to explain the *actual use* of ICT in primary schools by the teachers, as the R-square value was only 0.102. In this instance, the relationships between several independent constructs and *actual use* were investigated to identify the constructs that really explained the current *actual use* of ICT in the primary schools by the teachers. In this case, the *actual use* data showed that, in reality, the teachers never or rarely use ICT in class (Table 6.32). However, a new SEM for teachers' use of ICT in primary school, the structural model (Figure 6.9) test-estimated path coefficients, t-values (critical ratio) and standard deviation are presented in the following sections. In this case, the path coefficient and the critical ratio reflect the strength of the relationship between the predicator (exogenous) and the dependent (endogenous) construct.

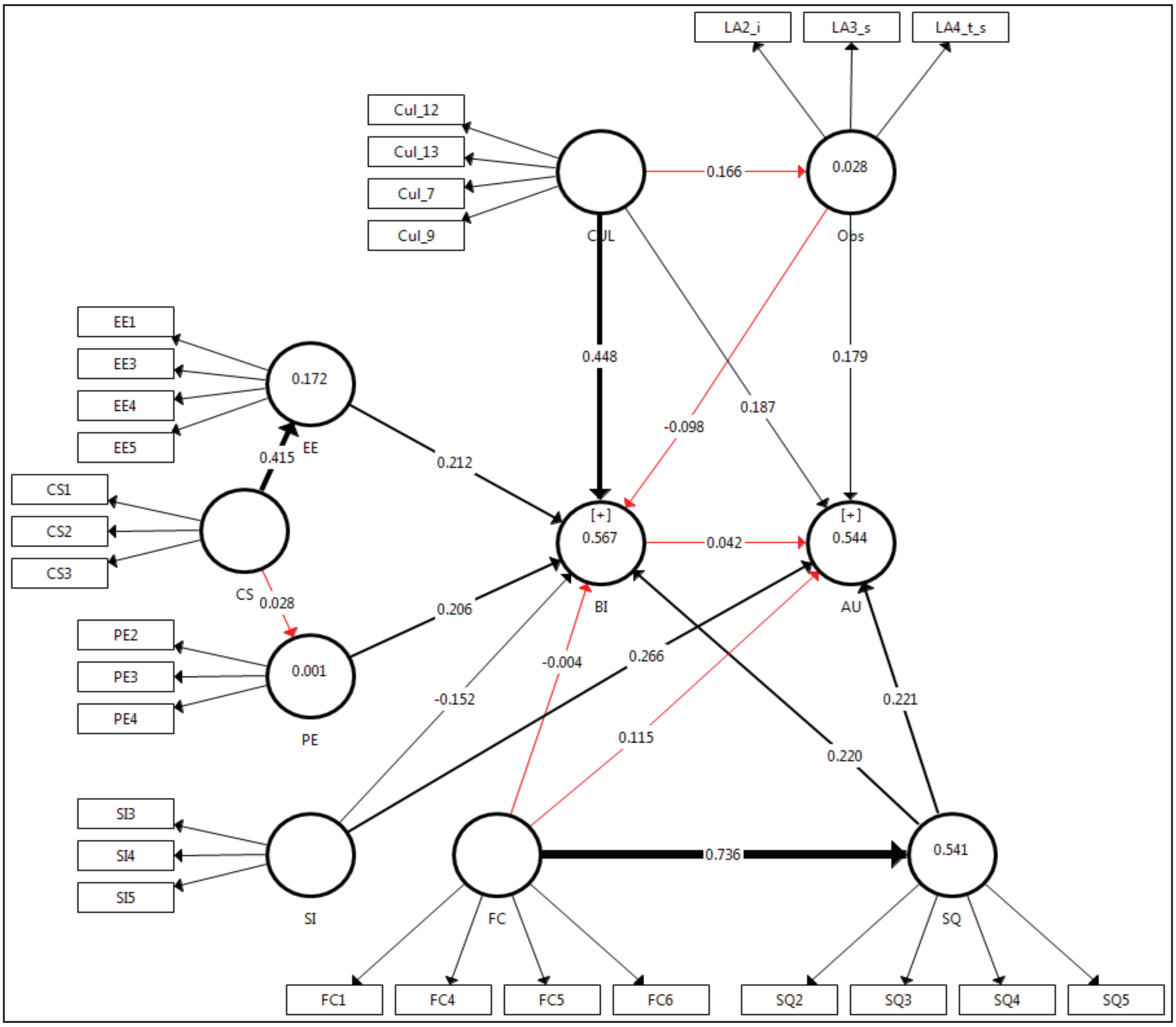


Figure 6.9 Modified structural equation path analysis for teachers' use of ICT in primary schools

Table 6.32 Interactive research model output based on SEM analysis for teachers' data

	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Relationship between constructs
BI -> AU	0.042	0.084	0.495	0.621	Not Supported
CS -> EE	0.415	0.078	5.317	0.000	Supported
CS -> PE	0.028	0.093	0.304	0.762	Not Supported
CUL -> AU	0.187	0.074	2.515	0.012	Supported
CUL -> BI	0.448	0.088	5.078	0.000	Supported
CUL -> Obs	0.166	0.111	1.502	0.134	Not Supported
EE -> BI	0.212	0.089	2.389	0.017	Supported
FC -> AU	0.115	0.1	1.153	0.250	Not Supported
FC -> BI	-0.004	0.096	0.038	0.970	Not Supported
FC -> SQ	0.736	0.031	24.109	0.000	Supported
Obs -> AU	0.179	0.077	2.336	0.020	Supported
Obs -> BI	-0.098	0.095	1.023	0.307	Not Supported
PE -> BI	0.206	0.098	2.115	0.035	Supported
SI -> AU	0.266	0.066	4.045	0.000	Supported
SI -> BI	-0.152	0.051	2.97	0.003	Supported
SQ -> AU	0.221	0.088	2.499	0.013	Supported
SQ -> BI	0.22	0.086	2.569	0.010	Supported

In this new model, the relationships with *behavioural intention* and other independent variables remained the same as in the previous model. *Facilitating conditions* and *system quality* had no significant relationship with *behavioural intention* to use ICT in class by the teachers, and the null hypothesis is retained with a p-value greater than 0.05. In addition, *computer literacy* had no significant relationship ($t=0.304$, $p>0.05$) with *performance expectancy*, and culture had no significant relationship ($t=1.502$, $p>0.05$) with *obstacles*, as was the case in the previous model.

Behavioural intention had no significant relationship with *actual use* in this model, while in the previous model, *behavioural intention* shared a significant positive relationship with *actual use*. However, the new model did have a R-square value of 0.541 for *actual use*, indicating the model could explain 54.10% of the variance of the actual ICT use in Saudi primary schools by the teachers.

The model showed that *system quality, social influence, culture* and *obstacles* have significant relationships ($p<0.05$) with *actual use* of ICT at the time of the study in Saudi Arabian primary schools. *System quality,* for example is not high in Saudi primary schools; and the *actual use* of ICT is very low, thus the two variables have a positive relationship, indicating that poor *system quality* is responsible for the lack of use of ICT in class. The ICT facilities are simply not in place to support the use of the technology for teaching and learning in primary school.

In addition, *social influence* also has a positive relationship with *actual use* of ICT in classes, in that SI discouraged AU. Neither the principals, teachers nor parents advocated for the use of ICT in class. O*bstacles* or barriers other than *social influence* also exhibited a positive relationship with *actual use* and ICT was not in use in the classroom because too many features of the school system and the society obviated against it. Conversely and importantly, *obstacles* had a negative relationship with *behavioural intention*. The teachers, on the whole, were interested in trying ICT in the classroom.

Finally, *cultural factors* were also found to have a significant negative relationship with *actual use* of ICTs in Saudi primary schools. The very conservative Saudi Society presented cultural, organisational and demographic issues that opposed, both consciously and unconsciously, the use of ICT in primary school classes. Cultural norms do not encourage primary school teachers to take up ICT as a teaching tool, and therefore the teachers do not. As a whole, this model showed that Saudi *culture*, *social conditions, system quality*, and *obstacles* are responsible for the neglect of ICT as a teaching and learning tool in Saudi primary schools.

To further test the model, a blindfolded analysis of the model was conducted to measure the Q^2 values. In the structural model, a Q^2 value larger than zero for a reflective endogenous variable indicates the path model's predictive relevance for a particular construct (Hair Jr. et al., 2014) (Table 6.33).

Table 6.33 Test the model predictive relevance for the interactive SEM.

	Sum of Squares of observations (SSO)	Sum of Squared prediction errors (SSE)	Q^2 (=1-SSE/SSO)
AU	510	299.169	0.413
BI	510	368.194	0.278
CS	510	510	
CUL	680	680	
EE	680	615.329	0.095
FC	680	680	
Obs	510	504.763	0.01
PE	510	511.179	-0.002
SI	510	510	
SQ	680	461.322	0.322

Table 6.33 illustrates the predictive relevance of the model for the constructs with formative relationships. AU, BI, EE, Obs, PE, SI, and SQ all had Q^2 values greater than zero, indicating the model had a statistically accepted predictive relevance and showed the reality from the data set. Most importantly, *actual use* and *behavioural intention* recorded fairly strong predictive capacity compared to other constructs, except for *system quality*, which was also strongly predictive of an unwillingness to adopt ICT when there were no suitable facilities.

6.3 Students' profile and ICT usage details

In order to study the student perspective of computer and internet services in primary schools in Saudi Arabia, a student sample was selected from three major cities in the KSA, as described earlier in the sections on principals and teachers.

6.3.1 Demographic characteristics

Out of 500 students, 47.4% were located in Jeddah; another 28% were in Riyadh; and the rest were located in Dammam (24.6%) (Figure 6.10).

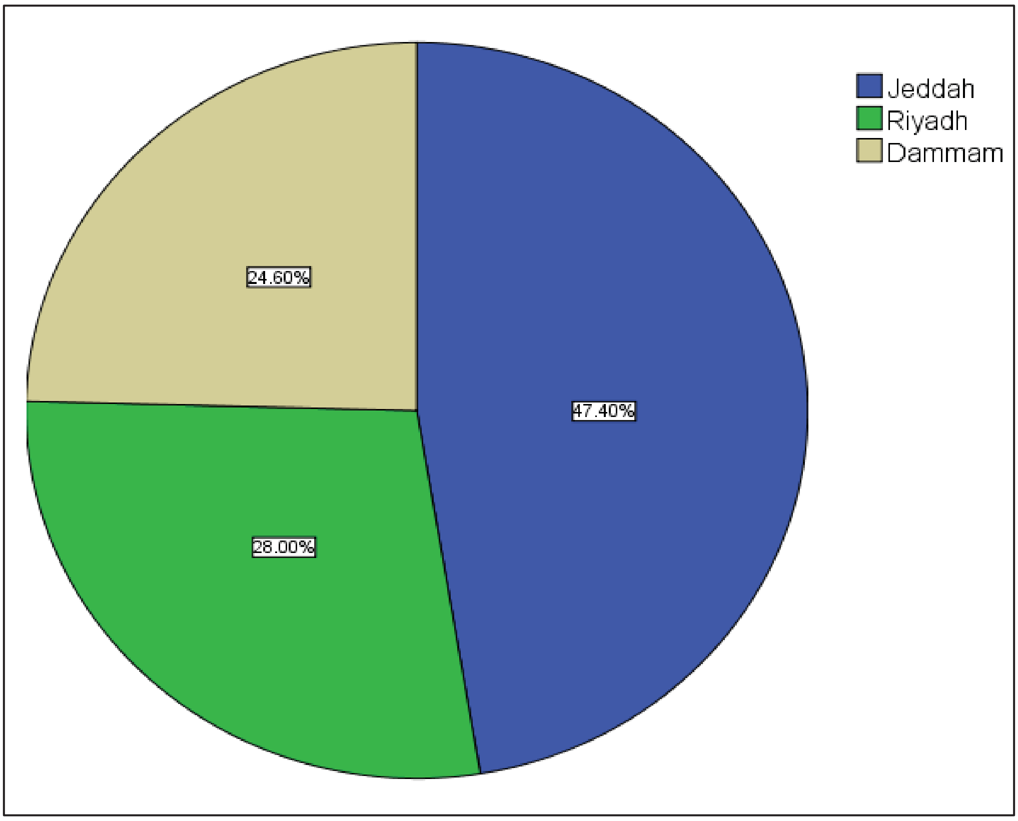


Figure 6.10 Number of student respondents from different cities

Gender and age. For cultural reasons, it was not possible to contact female students, which is acknowledged as a major limitation of the study. The survey was therefore conducted with male students only. The mean age of the students was 10.02, with a standard deviation of 0.133 (Table 6.34).

Table 6.34 **Mean and standard deviation of age of the respondents**

	N	Minimum	Maximum	Mean	Std. Deviation
Age	500	10	11	10.02	.133

Levels and years of study. Table 6.35 shows that the students in the selected sample were in the fifth or sixth year of their studies (depending on their enrolment). Saudi students enrol in primary education when they turn six and are expected complete six years of study. The group of 10-11 year olds was selected because at that age they had well-developed impressions of primary school and the wider community (Table 6.35).

Table 6.35 **Mean and standard deviation of year of schooling of the students**

	N	Minimum	Maximum	Mean	Std. Deviation
Year of schooling	500	5	6	5.03	.159

6.3.2 ICT and computer usage of the students at home

Ownership and usage. A large number of the students did not have access to a computer or such devices at home. Among the students who had access to a computer at home, most of them used a desktop computer (42.60%). Around 16% used laptops. However, smartphones and tablet computers have also emerged at present and considerable numbers of students in the sample are now using smartphones (8%), and tablets (3.2%) in their homes. With the growth of smartphones and tablets in the computer market, these devices are now becoming popular with children and not just adults; children are using them for various purposes as well as their gaming devices (Ibanez Martinez, 2014; Vincent, 2015) (Figure 6.11).

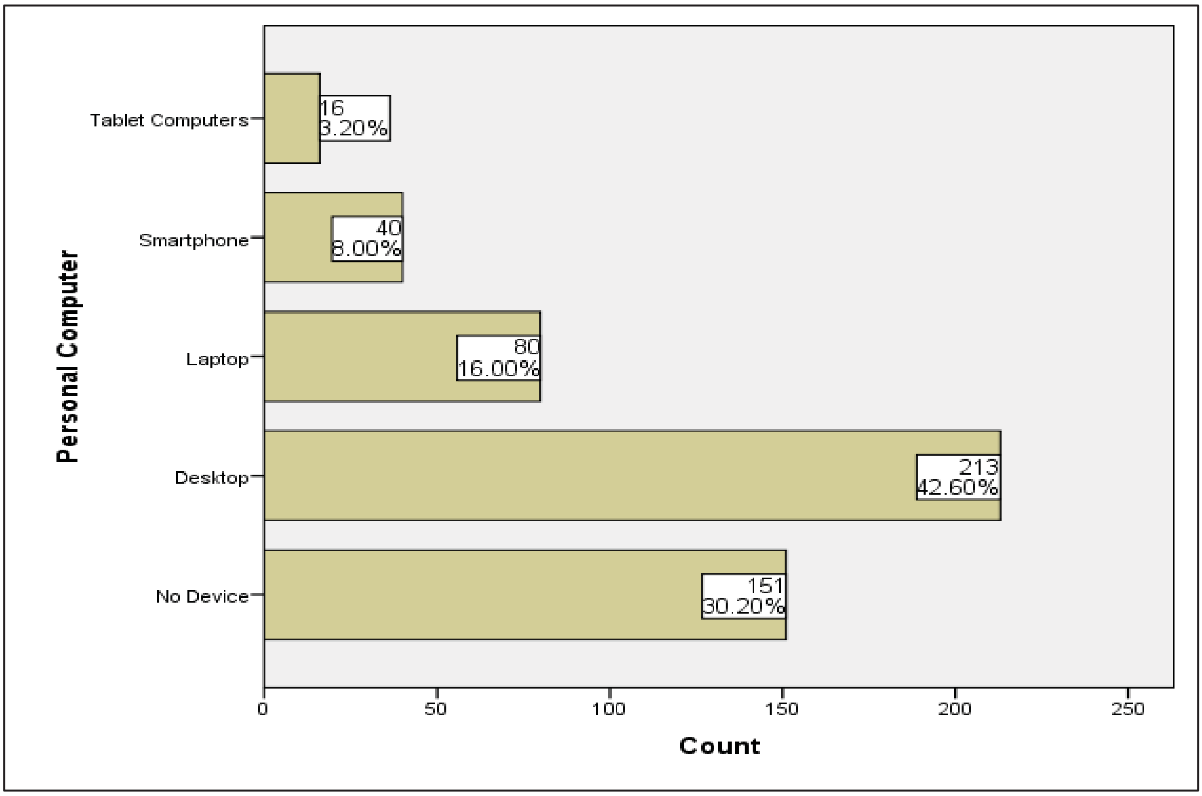


Figure 6.11 Distribution of personal computer users at home by the students

The majority of the respondents used computers at home for multiple purposes. The children generally passed their time on technological devices for entertainment. Among the student sample, for example, game playing was the most common use of computers and devices (76% of students). After gaming, students used the computer for browsing (35%) different websites on the internet and chatting with friends (25.2%).

Some students also used computers for word processing (17.8%) and e-mailing (13%). Word processing could indicate computer usage for some sort of educational purpose at home, but the students may not have been using computers in the schools. Very few students, however, were using higher computer functions, such as programming or design (Figure 6.12).

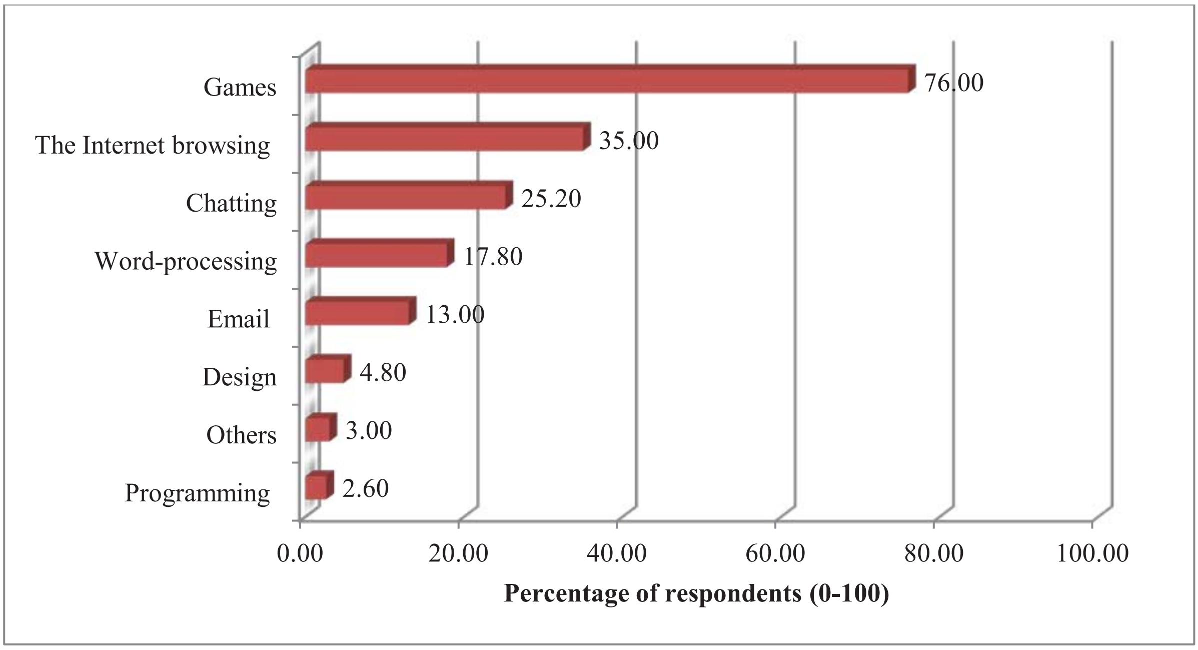


Figure 6.12 Purpose of using computers and related gadgets at home by the students (Multiple uses were considered.)

Time. The survey results showed that almost 43% of the students (Figure 6.13) used their computers at home for more than six hours in a week, whether gaming, browsing, communicating or word processing. However, it must be noted that almost 15% of the students never used a computer at home for any purpose.

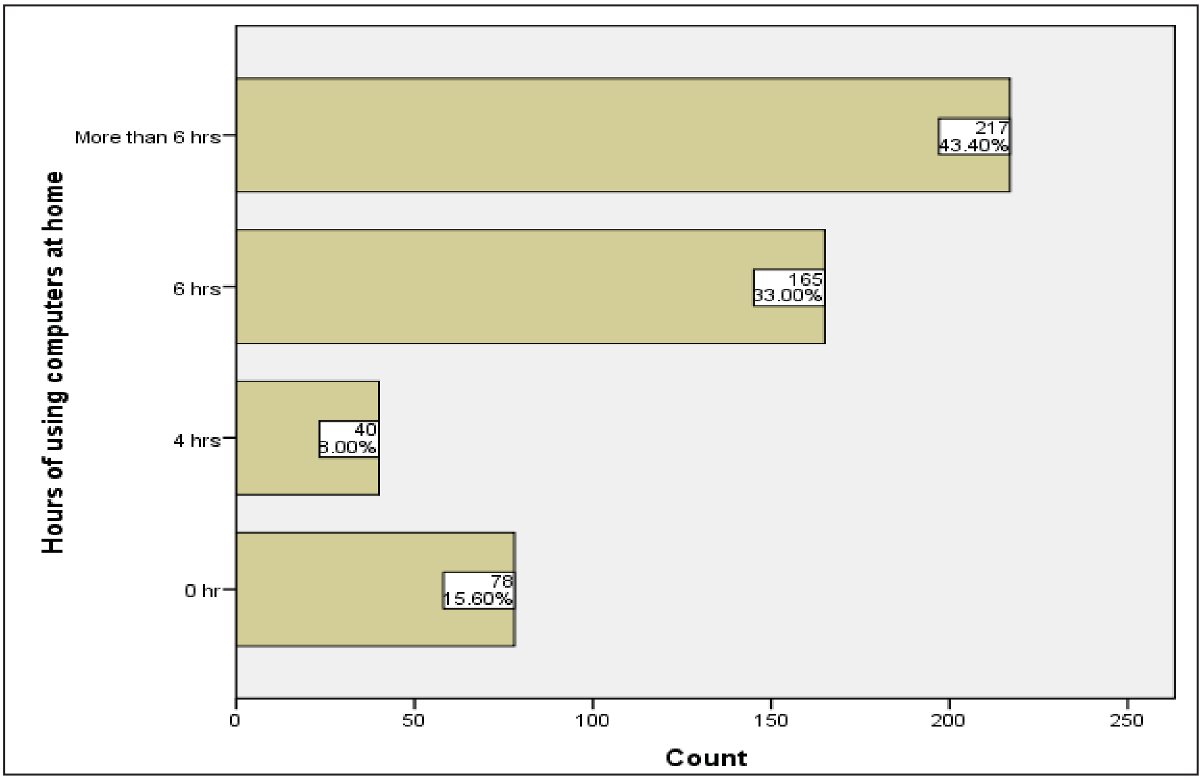


Figure 6.13 Hours of computer and related device at home by students

6.3.3 The use of information and computer technologies in schools

Except for some renowned schools in large Saudi cities, computers are unavailable in classes in primary school. Approximately 60% of the students surveyed had no computer access in their school (Figure 6.14); another 40% had limited access. Computers were not part of the educational program.

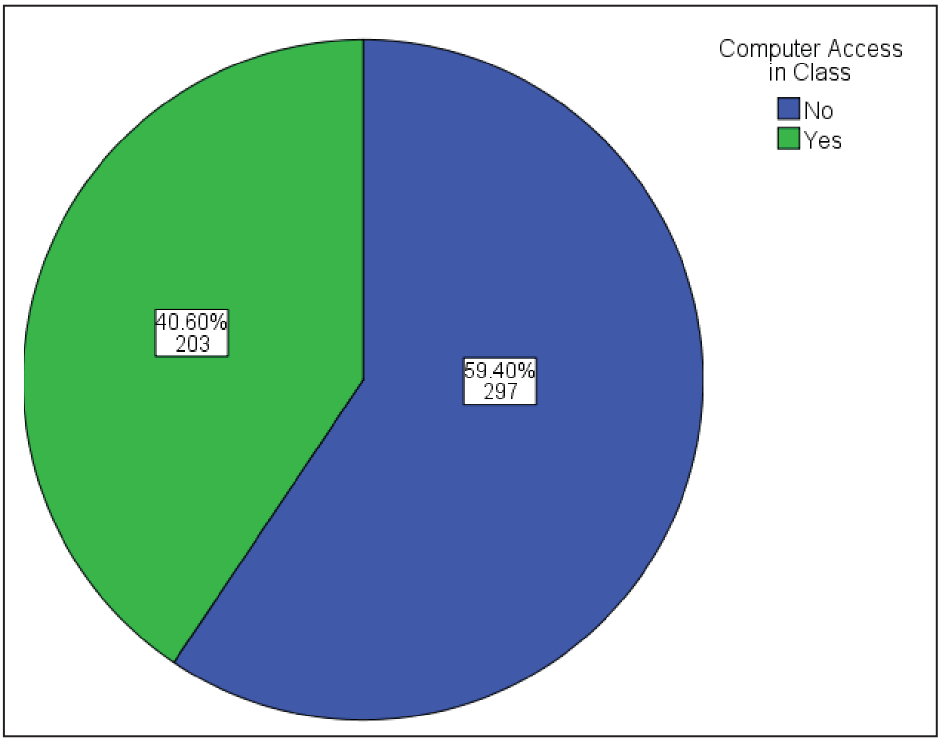


Figure 6.14 Access of computers at primary schools of Saudi Arabia

Among the respondents who had access to computers at school (n=203), around 39% did not use them. Therefore, computers were present, but not in use by students. On the other hand, around 38% of the survey respondents used computers at school at least four hours per week. Another 17% used them around six hours per week, and the remainder used them more than six hours per week. This indicates, some schools actually allow the students to use computers in class, yet they are very minimal Figure 6.15.

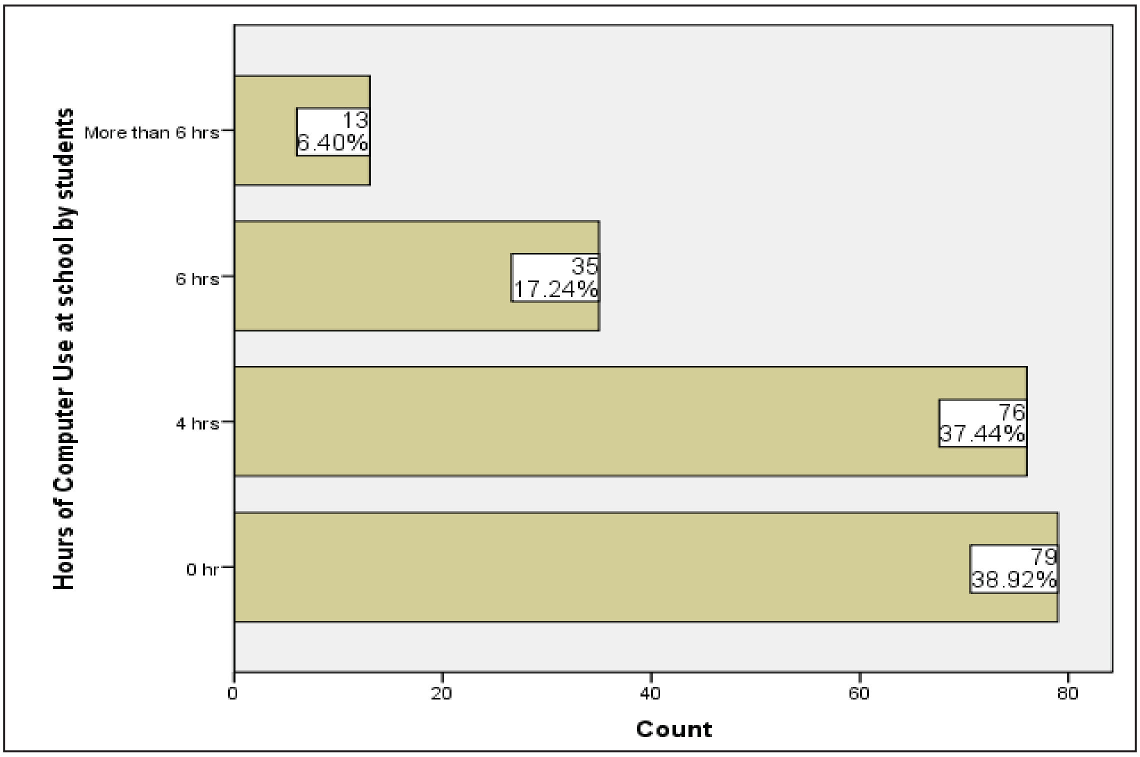


Figure 6.15 Hours of computer usage in classes at schools by the students

Internet use in primary schools by students. Limited access to ICT hardware and software in the classroom means limited access in school to the internet. The study found that only 5.8% (Figure 6.16) of primary school students had access to the internet in the classroom.

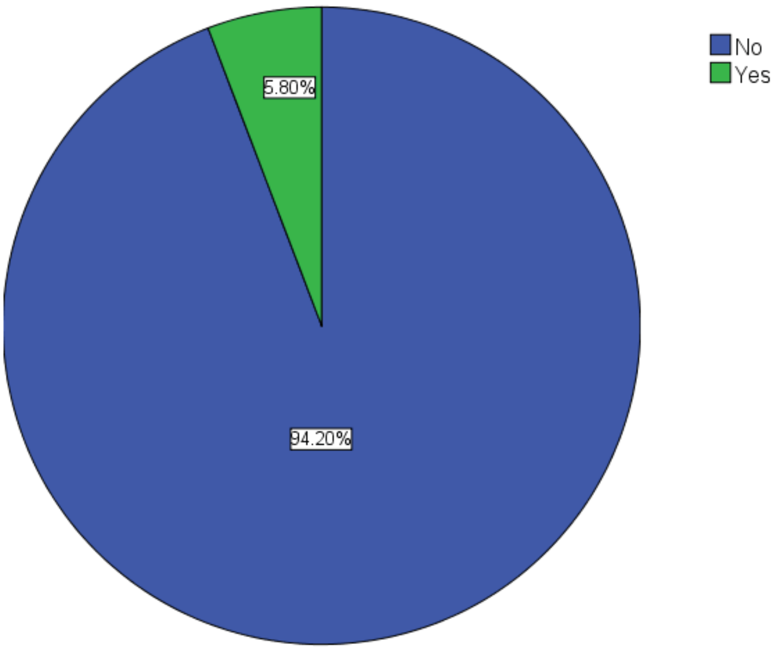


Figure 6.16 Internet access at Saudi primary schools for the students

The overall ICT usage pattern shows that the students had a moderate level of access to computers at home and low levels of access to computers at schools. Access to the internet was so low that the influence of internet usage at school on educational experiences was negligible. In addition, the main use of computer technology is for gaming and entertainment at home. This indicates that computers and related technologies are not typically available or used for education purposes at school or at home by students.

6.3.4 Data modelling for ICT use

Students were evaluated on the basis of the conceptual model described for students in Chapter 3. As a conceptual model, it consisted of several endogenous and exogenous constructs, including the factors responsible for the adoption of ICT in primary schools by Saudi students, just like the models previously used to explore the ICT use for principals and teachers. In this section, the possible factors related to the students' adoption of ICT in primary schools and their identification are explained, along with the use of factor analysis, a measurement model, and the relationships between and within the factors, along with the constructs, which have been examined using component based structural equation modelling.

Descriptive statistics for model items. The proposed model contained endogenous constructs, such as *performance expectancy*, *effort expectancy*, *facilitating condition, social influence* and *computer literacy*. The endogenous constructs were *behavioural intention* and *actual use.* 600 students were contacted. After receiving all responses, data cleaning and processing were conducted. After data cleaning, a total of 500 valid responses were used for analysis.

The descriptive data show that the mean values for *effort expectancy*, *performance expectancy*, *computer literacy* and *behavioural intention* are very high (near to 5), while mean values for *social influence*, *facilitating conditions*, and *actual use* are near 1, indicating a very high difference among the variables (Table 6.36).

Table 6.36 Descriptive statistics for factors related to use of ICT in primary schools by students

Constructs	Item Code (Description in table 4.5, Chapter 4)	Minimum	Maximum	Mean	Std. Deviation
Effort expectancy	EE1	1	5	4.25	.844
	EE2	1	5	4.21	.834
	EE3	1	5	4.17	.813
	EE4	1	5	4.18	.868
	EE5	1	5	4.21	.846
Performance expectancy	PE1	3	5	4.66	.548
	PE2	2	5	4.60	.595
	PE3	1	5	4.40	.706
	PE4	1	5	4.48	.641
	PE5	3	5	4.65	.538
	PE6	3	5	4.55	.590
Social influence	SI1	1	5	1.98	.925
	SI2	1	5	2.09	.935
	SI3	1	4	1.88	.927
	SI4	1	5	1.87	.856
	SI5	1	4	1.72	.938
Facilitating conditions	FC1	1	4	1.51	.650
	FC2	1	4	1.53	.750
	FC3	1	5	1.75	.867
	FC4	1	4	1.78	.822
	FC5	1	5	1.74	.852
	FC6	1	4	1.63	.714
Computer literacy	CS1	1	5	4.11	.880
	CS2	1	5	4.19	.791
	CS3	1	5	4.03	.923
	CS4	1	5	3.95	.972
Behavioural intention	BII1	1	5	4.33	.735
	BII2	1	5	4.22	.729
	BII3	2	5	4.36	.661
	BII4	3	5	4.50	.612
Actual use	AU1	1	5	1.62	.828
	AU2	1	5	1.64	.825
	AU3	1	11	1.95	1.296

The goal of this research was to identify the factors that influence the use of ICT in primary schools in Saudi Arabia. To that end, principals, teachers and students participated in surveys specifically designed for each cohort. While the principals and the teachers used ICT in their schools for a variety of reasons, but not extensively, ICT technology was not available to all students.

Nevertheless, it would be possible to quantify *behavioural intention* since the students might want to use computers in class if given the chance; and, therefore, structural equation modelling (PLS-SEM) could be used to analyse the data (Hair Jr. et al., 2014).

Measurement model for students' use of ICT. Before going to the structural model, a measurement model was tested for both exogenous and endogenous constructs to determine the acceptability of ICT in Saudi primary schools (Figure 6.17). This measurement model and its validity, as well as reliability, would confirm the factor structure of each individual variable.

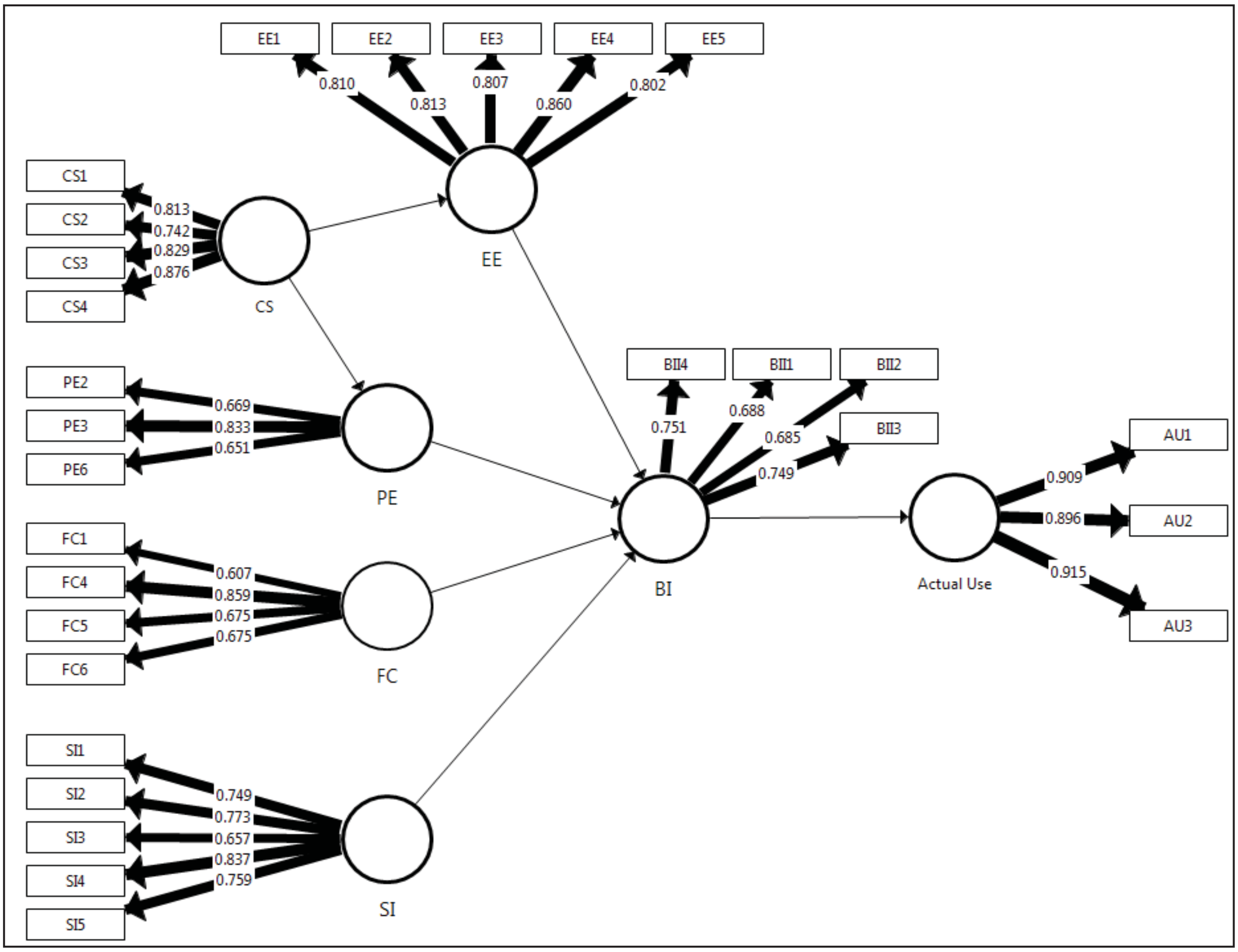


Figure 6.17 Measurement model for the students' ICT use in Saudi primary schools

In this case, for the measurement model, all the constructs were reflective, and the loadings showed how well these items determined the factors. The item loadings are shown in Table 6.37.

Table 6.37 Outer loadings of measurement model

Items	Actual Use	BI	CS	EE	FC	PE	SI
AU1	0.909						
AU2	0.896						
AU3	0.915						
BII1		0.688					
BII2		0.685					
BII3		0.749					
BII4		0.751					
CS1			0.813				
CS2			0.742				
CS3			0.829				
CS4			0.876				
EE1				0.810			
EE2				0.813			
EE3				0.807			
EE4				0.860			
EE5				0.802			
FC1					0.607		
FC4					0.859		
FC5					0.675		
FC6					0.675		
PE2						0.669	
PE3						0.833	
PE6						0.651	
SI1							0.749
SI2							0.773
SI3							0.657
SI4							0.837
SI5							0.759

Table 6.37 shows that all the item loadings of the measurement model are good and for each factor the average loadings of the corresponding items are above 0.7, which is a widely accepted value for the measurement model. This value confirms that these reflective constructs with these items can proceed to structural equation modelling. Apart from factor analysis items, one new item, for *social influence,* was added to examine whether the particular item could work in the measurement model and it proved to be accurate.

Reliability and validity analysis for the factors of the measurement model were needed before SEM, and the analysis was undertaken.

Reliability and validity analysis for students' model. For the reliability of the constructs, both Cronbach's alpha and composite reliability statistics were measured for the students' responses. For Cronbach's alpha, if the value is greater than 0.7, reliability is good. Reliability is moderate if the value is greater or equal to 0.6. A value less than 0.5 indicates a lack of validity.

Cronbach's alpha is, of course, sensitive to the actual number of items in a test and may over- or underestimate reliability (Raykov, 1997, 1998a). Thus, in addition to Cronbach's alpha, composite reliability was also measured, and it was found that all the factors showed a high composite reliability value (greater than 0.7). It was confirmed, therefore, that the model items and constructs had an acceptable reliability. Therefore, the output of the model would be reliable (Table 6.38).

Table 6.38 Reliability for the factors of students' model

Constructs	Cronbach's alpha	Composite reliability
AU	0.9	0.93
BI	0.7	0.81
CS	0.8	0.88
EE	0.9	0.91
FC	0.7	0.80
PE	0.6	0.76
SI	0.8	0.87

For validity analysis, convergent and discriminant validity had to be calculated. Using the data from an AVE (Table 6.39), all the constructs had a result greater than 0.5, indicating that all displayed convergent validity (Hair Jr. et al., 2010) and would be useful for structural equation modelling.

Table 6.39 AVE for constructs of the student model

	Average Variance Extracted (AVE)
AU	0.822
BI	0.517
CS	0.667
EE	0.670
FC	0.504
PE	0.521
SI	0.574

Discriminant validity was tested using the heterotrait-monotrait ratio of correlations (HTMT). If the HTMT value is below 0.90, discriminant validity has been established between two reflective constructs (Henseler et al., 2015, Hair Jr. et al., 2014) (Table 6.40).

Table 6.40 Heterotrait-monotrait ratio for discriminant validity

	Actual Use	BI	CS	EE	FC	PE	SI
AU	-						
BI	0.318						
CS	0.211	0.702					
EE	0.252	0.313	0.688				
FC	0.671	0.357	0.13	0.162			
PE	0.303	0.756	0.336	0.167	0.337		
SI	0.827	0.361	0.139	0.099	0.727	0.403	-

Table 6.40 shows that all the ratios are below 0.9. This was an indication of the discriminant legitimacy of all constructs in the study model. Each hypothesis was unique, and that the structural paths between the exogenous and endogenous constructs had been established.

Structural equation model for students' use of ICT. The SEM for students' use of ICT in primary school produced the structural model (Figure 6.18), estimated path coefficients, t-values (critical ratio) and standard deviation. In this case, the path coefficient and the critical ratio reflected the strength of the relationships between the predictor (exogenous) and the dependent (endogenous) constructs (Table 6.41).

Table 6.41 Research model output based on SEM analysis for Students' data

	Original sample (O)	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	P values	Relationship between constructs
CS -> EE	0.603	0.046	13.077	0.000	Supported
CS -> PE	0.234	0.046	5.044	0.000	Supported
EE -> BI	0.187	0.046	4.081	0.000	Supported
FC -> BI	0.183	0.037	4.93	0.000	Supported
PE -> BI	0.421	0.047	8.995	0.000	Supported
SI -> BI	0.076	0.047	1.619	0.106	Not Supported
BI -> AU	0.260	0.034	7.596	0.000	Supported

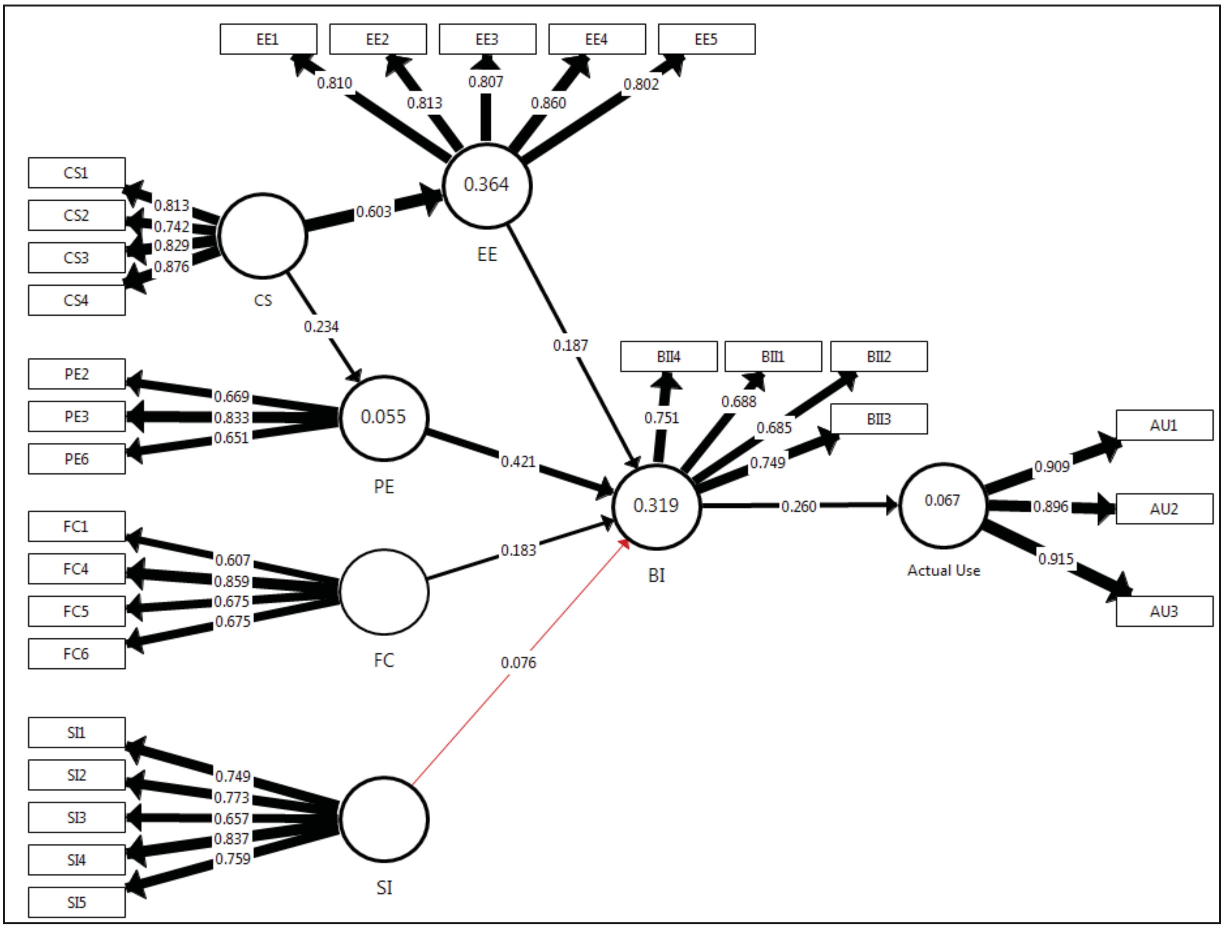


Figure 6.18 Structural model for the students ICT use in Saudi primary schools

As presented in Table 6.41, *computer literacy* has very strong positive relationship with *effort expectancy* (t=13.077, p<0.05), while it has a moderately strong positive relationship with *performance expectancy* (t=5.044, p<0.05). *Effort expectancy* has a weak positive relationship with the *behavioural intention* (t=4.081, p<0.05), of the students to use ICT in schools; in contrast, *performance expectancy* has moderately strong positive relationship with *behavioural intention* (t=8.995, p<0.05). This indicates that *performance expectancy* increases the *behavioural intention* of the students to use ICT in schools.

However, *facilitating condition* has only a weak positive relationship with *behavioural intention* (t=4.93, p<0.05), implying the lack of facilities in the schools de-motivates the students. Furthermore, *social influence* has no significant relationship with student *behavioural intention* (t=1.619, p>0.05) to use ICT in schools, which indicates that *social influence* plays no part in student intention to use ICT. These significant constructs (have a relationship with *behavioural intention*) predicted 31.9% of variance in the *behavioural intention* of the students to use ICT, which corresponds well with the intentions of the students to use ICT in their education. Finally, the model shows a moderate positive relationship with *behavioural intention* and *actual use* ($t=7.596$, $p<0.05$), of ICT in classes at present. Importantly, the R-square value for the *actual use* is only 0.067, indicating *behavioural intention* to use ICT in class only explains 6.7% of the *actual use* of ICT in classes. This is very low, indicating *behavioural intention* does not relate to *actual use*, which is a logical response to not having computers to use, but being willing to use them.

In Table 6.42, the model was further tested to determine whether it really reflected the data. A blinded analysis of the model was conducted to measure the Q^2 values. In the structural model, a Q^2 value larger than zero for a reflective endogenous variable indicates the path model's predictive relevance for a particular construct (Hair Jr. et al., 2014) (Table 6.42).

Table 6.42 Test the model predictive relevance

	Sum of Squares of observations (SSO)	Sum of Squared prediction Errors (SSE)	Q^2 (=1-SSE/SSO)
AU	1,497.00	1,416.19	0.054
BI	1,996.00	1,689.21	0.154
CS	1,996.00	1,996.00	
EE	2,495.00	1,894.06	0.241
FC	1,996.00	1,996.00	
PE	1,497.00	1,457.86	0.026
SI	2,495.00	2,495.00	

The values presented in Table 6.42 illustrates the predictive relevance of the model for the constructs with formative relationships. AU, BI, EE, Obs, PE, SI, and SQ all had Q^2 values greater than zero, indicating the model had a statistically accepted predictive relevance and showed the reality from the data set. No interactive model was developed and examined in this case, as it was for principals and teachers, since the reality was a lack of ICT in the classrooms.

6.4 Summary

This chapter presented the quantitative analysis from principals', teachers' and students' surveys. Descriptive statistics regarding their age, gender, and level of study are discussed. In addition, the ICT usage pattern of principals, teachers and students have been explored. Descriptive analyses showed a lack of ICT use in Saudi primary schools by all three groups.

Three different models were presented and discussed in this chapter. The models were analyzed based on the conceptual models developed in Chapter 3 for principals, teachers and students. Using survey data, and *SmartPLS* (v3) software, these structural models were analyzed and a measurement model of the factors, validity and reliability of the factors were explored in the process of developing the structural model.

The structural models identified the significant factors which are responsible for the intention to use ICT by principals, teachers and students. However, in all three models, *behavioural intention* is predicted with considerable strength. *Actual use* was not predicted with appropriate statistical strength for the principals' and teachers' model. Therefore, two interactive models were tried to explore what factors were responsible for the low level of *actual use* of ICT by the principals and teachers.

Chapter 7

Discussion

This chapter presents a discussion of the findings from the qualitative and quantitative analysis of the research data, and makes comparisons to prior research that either supports or contradicts the discoveries made. This is followed by a summary of final models with supported and unsupported constructs representing the factors influencing the uptake of ICT in Saudi primary education by principals, teachers and students. At the end of this chapter validations of modelled results are demonstrated based on focus group discussions held with each of the stakeholders.

7.1 Findings from quantitative and qualitative analysis

This study explored the characteristics of primary school principals, teachers and students in Saudi Arabia along with their *actual use* of ICT in education. The characteristics explored included personal information, and information regarding computer use at home and school. As well as using SEM models, several hypotheses related to the use and adoption of ICT in the Saudi primary education system were tested. A detailed discussion of these findings is presented below.

7.1.1 Characteristics and *actual use* of ICT in primary education in Saudi Arabia

Following is a summary of the findings discovered through the surveying of the participants involved in this research. This brief discussion is followed by a table (Table 7.1) summarising the key points discovered.

Analysis of the data revealed that most of the principals had had from 11 to 15 years experience with computers, while most teachers had worked with computers for six to 10 years. Computer use reflects the changes occurring technologically in Saudi Arabia with the opening of the country to the international community and 21st century commerce (Ertmer, & Ottenbreit-Leftwich, 2010; Schibeci et al., 2008). Most of the principals and teachers surveyed had been using a personal computer at home for more than five years. The majority of them used a computer for six or more hours per week.

Students at the primary level had far less experience with ICT than their teachers. Although internet-enabled smartphones are making inroads at all levels of Saudi society, including young people under 15 years, unlike computers and other communication technologies, such as projectors, smartphones are not considered to be educational tools.

Even among the principals and teachers, ICT was not employed for teaching and learning activities. Computers were for personal or administrative use, and a general range of technological facilities was not available in the primary schools.

In their homes, the majority of the principals and teachers used their computers for internet browsing, word processing, e-mail and chatting. These activities represent the use of ICT largely for entertainment, supporting the findings of Al Mulhim (2013), who found that teachers in Saudi primary schools suffer from a great gap in their knowledge of ICT, lacking both basic technical and pedagogical skills for making the best use of the technology. Furthermore, the general lack of access to technology, lack of training, lack of time and lack of facilities, discourage them from using technology in teaching. Although the teachers use computers and smartphones privately, using technology for effective teaching and learning requires a set of skills and behaviours that require specific training and considerable support before a critical mass of experienced educators is in place.

There appeared to be no opportunity at all for students to use ICT in class and few seemed to use computers or other technologies at home. Restrictive *social conditions* and norms in the KSA discourage parents from allowing their children to use technology (Cavendish, 2006) because it is interpreted as frivolous and distracting from their commitment to Islam. Among the few students who were permitted access to computers at home, most used desktop computers for gaming, internet browsing and chatting.

In summary, none of the participant groups surveyed thought of ICT as a tool for education at primary level, although most of the adults used technology at home or for personal activities. While the use of ICT in primary educational setting clearly appealed to the study participants, their lack of experience, along with substandard facilities, training and leadership in this area, meant that the use of technology in the classrooms of primary schools never occurred and was not often considered as a teaching strategy .This finding supports that of Alwani and Soomro (2010); Al Mulhim (2014); and Albugami and Ahmed (2015), who found in their studies that despite considerable funding, there exists a failure to adopt ICT in Saudi secondary schools and a persistent lack of access to technology, lack of hardware and lack of internet access overall in the Saudi education system. Although in many schools there are staff recruited by the school authority solely to maintain technological devices or other equipment, there are very few devices present in the primary schools and the majority of them are not fully operational or in too poor a condition to be used regularly. These findings are also consistent with the observations of Almalki and Williams (2012).

Table 7.1 Summary data for primary school principals, teachers and students in Saudi Arabia

Characteristics		Principals	Teachers	Students
Personal information	Location	40% Jeddah, 42.5% Riyadh., 17.5% Dammam.	47.4% Jeddah, 28% Riyadh and 24.6% Dammam.	40% Jeddah, 42.5% Riyadh and 17.5% Dammam.
	Gender	90% male, 10% female	81.76% male and 18.24% female	100% male
	Age	29 – 51 average 40	23 – 49 average 30	10 – 11 average 10
	Education level	Majority (92.5%) bachelor degree holder	Most of them (82.35%) bachelor degree holder.	All are at primary education.
Information regarding computer use at home	Duration of experience with computer	77.5%, 11-15 years	76.47% 6-10 years	-
	Device used	personal computer	personal computer	most do not have access to a computer
	Duration of using device at home	82.5% using for more than five years	60.7% using for more than five years	-
	Hours spent (weekly)	67.5% use 4-6 hours.	75.57% more than six hours	majority among those who have access to the computer at home use more than six hours
	Purpose of use	internet browsing, word processing, e-mail, chatting.	internet browsing word processing e-mail	gaming internet browsing chatting
Information regarding computer use at school	Access to device	mostly desktop computer	most with no computer facility or internet access at classroom Some with computer projection screen	most of them have no access to computer facility or internet
	Hours spent (daily)	majority 4 hours	71.1% do not use computer or internet at school at all, 23% use for 4 hours	majority do not use computer or internet at school at all
	Functionality	more than 50% devices are not properly functioning	-	-
	Purpose of use	communication searching information management task	-	-

7.1.2 Summary of factors affecting the adoption of ICT in Saudi Arabian primary education

In order to determine whether a factor positively or negatively affected the *behavioural intention* and *actual use* of ICT by the principals, teachers and students at primary schools of Saudi Arabia, 29 hypotheses were formulated. Eleven were formulated to understand the factors affecting the adoption of ICT in primary education by principals (H1 to H11). Eleven were formulated to understand the factors affecting the adoption of ICT in primary education by teachers (H12 to H22), and seven were formulated to understand the factors affecting the adoption of ICT in primary education by students (H23 to H29). A summary of the results of these hypotheses is presented in Tables 7.2, 7.3 and 7.4.

Table 7.2 Results of hypothesis testing regarding adoption of ICT in primary education by principals in Saudi Arabia compared to prior studies

No.	*Variable*	Hypothesis	Findings	Prior studies
H1	***performance expectancy*** **–>** ***behavioural intention***	Primary school principals' *performance expectancy* of ICT had a significant positive effect on *behavioural intention* to use ICT. (PE -> BI)	Not supported (*Performance expectancy* had a weak negative relationship with *behavioural intention* to use ICT in schools by the principals)	Some studies have findings supporting the hypothesis, and which, therefore, contradicts the findings of the present study. Oyaid (2009); Alwani, & Soomro, (2010); Almalki, & Williams (2012); and Albugami, & Ahmed (2015) found that school managements' personal *performance expectancy* of ICT had a significant positive effect on *behavioural intention* to use ICT.
H2	***effort expectancy*** **–>** ***behavioural intention***	Primary school principals' *effort expectancy* of ICT use had a significant positive effect on their *behavioural intention* to use ICT. (EE -> BI)	Supported	This finding is in line with some other studies (Oyaid 2009; Alwani, & Soomro, 2010; Almalki, & Williams 2012; Albugami, & Ahmed 2015) who found that principals' *effort expectancy* of ICT use has a significant positive effect on their *behavioural intention* to use ICT.
H3	***social influence*** **–>** ***behavioural intention***	Positive *social influence* on the primary school principals had a significant positive effect on their *behavioural intention* to use ICT. (SI -> BI)	Not supported (*Social influence* had no significant relationship with *behavioural intention* to use ICT in schools by the principals)	This result contrasts with previous studies (Almalki, & Williams 2012; Amoudi, & Sulaymani, 2014) which found that negative *social influence*s discourage the principals from using ICT in education.
H4	***facilitating conditions*** **–>** ***behavioural intention***	ICT *facilitating conditions* had a significant positive effect on primary school principals' *behavioural intention* to use ICT. (FC -> BI)	Not supported (*Facilitating condition* had a weak positive yet insignificant relationship with *behavioural intention* to use ICT in schools by the principals)	This finding is inconsistent with that of other researchers (Oyaid 2009; Alwani, & Soomro, 2010; Almalki, & Williams 2012; Alhawiti 2013; Al Mulhim, 2014; Amoudi, & Sulaymani, 2014; Albugami, & Ahmed 2015) who concluded that lack of *facilitating conditions* greatly hinders ICT use by principals in education.

No.	*Variable*	Hypothesis	Findings	Prior studies
H5	***culture*** **–>** ***behavioural intention***	There is a direct and positive relationship between *culture* and *behavioural intention* to use ICT in school for the principals. (CUL -> BI)	Not supported (*Culture* had no significant relationship with *behavioural intention* to use ICT by the principals)	Some studies have findings supporting this hypothesis which contradicts with the findings of this study. Almalki, & Williams (2012); and Amoudi, & Sulaymani, (2014) found that *culture* had great influence on principals *behavioural intention* to use ICT in education.
H6	***culture*** **–>** ***obstacles***	There is a significant relationship between *culture* and *external barriers* to use ICT in school for the principals. (CUL -> Obs)	Supported	This result is consistent with previous researches (Almalki, & Williams 2012; Amoudi, & Sulaymani, 2014) who found that there is a significant relationship between *culture* and *external barriers* to use ICT.
H7	***external barriers*** **–>** ***behavioural intention***	External barriers would have negative and direct effects on *behavioural intention* to use ICT in primary schools by the principals. (Obs -> BI)	Not supported (External barriers have no significant relationship with *behavioural intention* to use ICT by the principals)	This finding is inconsistent with that of other researchers (Almalki, & Williams 2012; Amoudi, & Sulaymani, 2014) who concluded that *external barriers* have negative and direct effect on *behavioural intention* to use ICT by the principals.
H8	***computer literacy*** **–>** ***performance expectancy***	Primary school principals' *computer literacy* had a significant positive effect on primary school principals' *performance expectancy* of ICT use. (CS -> PE)	Supported	In line with the findings from this study, other studies have found that principals' *computer literacy* had a significant positive effect on primary school principals' *performance expectancy* of ICT use (Alwani, & Soomro, 2010; Almalki, & Williams 2012)
H9	***computer literacy*** **–>** ***effort expectancy***	Primary school principals' *computer literacy* had a significant positive effect on their *effort expectancy* of ICT use. (CS -> EE)	Supported	This result is consistent with many studies which have found that principals' *computer literacy* had a significant positive effect on their *effort expectancy* of ICT (Alwani, & Soomro, 2010; Almalki, & Williams 2012)

No.	*Variable*	Hypothesis	Findings	Prior studies
H10	***system quality*** **–>** ***behavioural intention***	*System quality* and flexibility had a significant and direct influence on *behavioural intention* to use ICT in primary schools by the principals. (SQ -> BI)	Supported	This result is consistent with previous research of Alwani, & Soomro, (2010); Al Mulhim, (2014); Amoudi, & Sulaymani, (2014); and Albugami, & Ahmed (2015)
H11	***behavioural intention*** **–>** ***actual use***	Principals' *behavioural intention* to use ICT had a significant and direct relationship with their *actual use* of ICT in school administration and academic activities. (BI -> AU)	Not supported (There is a very weak negative as well as insignificant relationship with *behavioural intention* and *actual use* of ICT by the principals)	This result contrasts with previous studies (Oyaid 2009; Alwani, & Soomro, 2010; Almalki, & Williams 2012; Albugami, & Ahmed 2015) who found that principals' *behavioural intention* to use ICT had significant and direct relationship with their *actual use* of ICT in school administration and academic activities

Table 7.3 Hypotheses testing regarding adoption of ICT at primary education by teachers in Saudi Arabia with prior studies

	Variable	Hypothesis	Findings	Prior studies
H12	***performance expectancy*** **–>** ***behavioural intention***	Primary school teachers' *performance expectancy* of ICT had a significant positive effect on their *behavioural intention* to use ICT. (PE -> BI)	Supported	This result is consistent with previous researches of Alwani, & Soomro, (2010); Alkhalaf et al. (2012); Al Mulhim (2013); and Albugami, & Ahmed (2015), who found that teachers' *performance expectancy* of ICT had a significant positive effect on their *behavioural intention* to use ICT in teaching.
H13	***effort expectancy*** **–>** ***behavioural intention***	Primary school teachers' *effort expectancy* of using ICT had a significant positive effect on their *behavioural intention* to use ICT. (EE -> BI)	Supported	This result is consistent with many studies (Alwani, & Soomro, 2010; Bingimlas 2010; Al Mulhim 2013; Albugami, & Ahmed 2015) which have found that teachers' *effort expectancy* of using ICT had a significant positive effect on their *behavioural intention* to use ICT in teaching.

	Variable	**Hypothesis**	**Findings**	**Prior studies**
H14	***social influence*** **–>** ***behavioural intention***	Positive *social influence* on the primary school teachers had a significant positive effect on their *behavioural intention* to use ICT. (SI -> BI)	Not supported (*Social influence* had no significant relationship with *behavioural intention* to use ICT in schools by the teachers)	This finding is inconsistent with that of Alkanani (2012) and Almalki, & Williams (2012) who found that negative *social influence*s discouraged teachers from using ICT in teaching.
H15	***facilitating conditions*** **–>** ***behavioural intention***	*Facilitating conditions* of ICT had a significant positive effect on primary school teachers' perceived ease of use of ICT. (FC -> BI)	Not supported (*Facilitating condition* had weak positive yet insignificant relationship with *behavioural intention* to use ICT in schools by the teachers)	Some studies have findings supporting the hypothesis which contradicts with the findings of this study (Oyaid 2009; Alwani, & Soomro, 2010; Ageel 2011; Alkanani 2012; Alsahli 2012; Al Mulhim 2013; Albugami, & Ahmed 2015; Al-Zahrani, 2015).
H16	***culture*** **–>** ***behavioural intention***	There is a direct and positive relationship between *culture* and *behavioural intention* to use ICT in classes by the teachers. (CUL -> BI)	Supported	This finding is in line with the study of Almalki, & Williams (2012) and Alkanani (2012) who found that in Saudi Arabia, *culture* had significant influence on the intention to use ICT.
H17	***culture*** **–>** ***obstacles***	There is a significant relationship between *culture* and *external barriers* to use ICT in class by the teachers. (CUL -> Obs)	Not supported (*Culture* had no significant relationship with *obstacles* to use ICT in schools by the teachers)	This result contrasts with the study of Almalki, & Williams (2012) who found that in Saudi Arabia, cultural condition may give rise to other *obstacles*.
H18	***external barriers*** **–>** ***behavioural intention***	External barriers have negative and direct effect on *behavioural intention* to use ICT in primary schools by the teachers. (Obs -> BI)	Not supported (External barriers have negative yet insignificant relationship with *behavioural intention* to use ICT by the teachers)	Almalki, & Williams (2012) supporting the hypothesis which contradicts with the findings of this study.

	Variable	**Hypothesis**	**Findings**	**Prior studies**
H19	***computer literacy*** **–>** ***performance expectancy***	Primary school teachers' *computer literacy* has a significant positive effect on primary school teachers' *performance expectancy* of ICT use. (CS -> PE)	Not supported (*Computer literacy* had weak and insignificant positive relationship with *performance expectancy* of ICT use by teachers)	This finding is inconsistent with some other studies of Alwani, & Soomro, (2010); Alsahli (2012); Al Mulhim (2013); and Albugami, & Ahmed (2015) who found that teachers who are efficient in using compute are expected to have better performance to use ICT in teaching.
H20	***computer literacy*** **–>** ***effort expectancy***	Primary school teachers' *computer literacy* had a significant positive effect on their *effort expectancy* of ICT. (CS -> EE)	Supported	This result is consistent with previous researches of Alwani, & Soomro, (2010); Alsahli (2012); Al Mulhim (2013); and Albugami, & Ahmed (2015) who found that teachers who are efficient in using computers require less effort to use ICT in teaching.
H21	***system quality*** **–>** ***behavioural intention***	*System quality* and flexibility had a significant and direct influence on *behavioural intention* to use ICT in primary schools by the teachers. (SQ -> BI)	Supported	This result is consistent with studies of Alwani, & Soomro, (2010); and Albugami, & Ahmed (2015) who have found that *system quality* and flexibility had significant and direct influence on *behavioural intention* to use ICT by the teachers
H22	***actual use*** **–>** ***behavioural intention***	Teachers' *behavioural intention* to use ICT had significant and direct relationship with their *actual use* of ICT in their classes and teaching. (BI -> AU)	Supported	This finding is in line with some other studies of Bingimlas (2010); Alwani, & Soomro, (2010); Ageel (2011); Alkhalaf et al. (2012); and Almalki, & Williams (2012). Alwani, & Soomro, (2010); and Almalki, & Williams (2012) found that teachers' personal beliefs and negative attitudes greatly limit their use of technology in teaching. Ageel (2011) found that majority of teachers do not make use of ICT in their teaching because they think that that ICT would hinder the teaching process to an unwillingness to change long-standing teaching methods.

Table 7.4 Hypotheses testing regarding adoption of ICT at primary education by students in Saudi Arabia with prior studies

		Hypothesis	Findings	Prior studies
H23	***performance expectancy –> behavioural intention***	Primary school students' *performance expectancy* of ICT had a significant positive effect on their *behavioural intention* to use ICT. (PE -> BI)	Supported	This result is consistent with previous researches of Albugami, & Ahmed (2015), and Alenezi et al. (2010) who confirmed the importance of attitude in mediating the relationship between perceived usefulness, perceived ease of use and the students' *behavioural intention*.
H24	***effort expectancy –> behavioural intention***	Primary school students' *effort expectancy* of use of ICT had a significant positive effect on their *behavioural intention* to use ICT. (EE -> BI)	Supported	This result is consistent with Albugami, & Ahmed (2015), and Alenezi et al. (2010) who confirmed the importance of attitude in mediating the relationship between perceived usefulness, perceived ease of use and the students' *behavioural intention*.
H25	***social influence –> behavioural intention***	Positive *social influence* on the primary school students had a significant positive effect on their *behavioural intention* to use ICT. (SI -> BI)	Not supported (*Social influence* had no significant relationship with *behavioural intention* to use ICT in schools by the students)	Some studies have findings supporting the hypothesis which contradicts with the findings of this study. Al-Harbi (2011) found that students' attitudes toward *social influence* are critical determinants of students' *behavioural intention* to use ICT.
H26	***facilitating conditions –> behavioural intention***	*Facilitating conditions* of ICT have a significant positive effect on primary school students' *behavioural intention* to use ICT. (FC -> BI)	Supported	This finding is in line with some other studies of Albugami, & Ahmed (2015) and Al-Harbi (2011) who found that students' attitudes toward ICT *facilitating conditions* are critical determinants of students' *behavioural intention* to use ICT.
H27	***computer literacy –> performance expectancy***	*Computer literacy* had a significant positive effect on primary school students' *performance expectancy* of use of ICT. (CS -> PE)	Supported	This result is consistent with previous research of Alenezi et al. (2010) who indicated that computer anxiety and *computer literacy* significantly influence the students' *performance expectancy* to use ICT.

		Hypothesis	Findings	Prior studies
H28	***computer literacy*** **–>** ***effort expectancy***	*Computer literacy* had a significant positive effect on primary school students' *effort expectancy* of use of ICT. (CS -> EE)	Supported	This result is consistent with Alenezi et al. (2010) who found that *computer anxiety* and *computer literacy* significantly influence the students' *effort expectancy* to use ICT.
H29	***actual use*** **–>** ***behavioural intention***	Primary school students' *behavioural intention* to use ICT had a significant positive effect on their *actual use* of ICT in learning. (BI -> AU)	Supported	This finding is in line with some other studies. Alenezi et al. (2010) confirmed the importance of attitude in mediating the relationship between perceived usefulness, perceived ease of use and the students' *behavioural intention*, which in turn affect their *actual use*. Oyaid (2010); and Nassuora (2012) revealed that students with positive *behavioural intention* towards ICT show greater *actual use* of ICT in their education.

7.2 Discussions of final models

Three conceptual models were developed in this research to identify factors influencing adoption of ICT at primary education by principals, teachers and students in Saudi Arabia through unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003) – which has been developed and validated in Western nations. However, for this research, contextual modifications have been taken into consideration. In the following section, these modified conceptual model results are discussed.

7.2.1 Discussion of final model for primary school principals in Saudi Arabia

The model for primary school principals in Saudi Arabia consisted of ten constructs: *performance expectancy, effort expectancy, social influence, facilitating conditions, cultural factors, external barriers, computer literacy, system quality, behavioural intention* and *actual use* of ICT. In the following section, supported and unsupported constructs are described and explained which have been verified through hypothesis testing.

Supported relationships in the principals' model. As per hypothesis testing in the model, the supported construct for primary school principals in Saudi Arabia were *effort expectancy, computer literacy*, and *system quality* (Table 7.2). In this section the possible explanations supporting these constructs are discussed.

- ***Effort expectancy and behavioural intention to use ICT of the principals***

The model found a strong positive relationship between the principals' *effort expectancy* and their *behavioural intention* to use ICT in primary schools ($p<0.05$) in Saudi Arabia. It confirmed that *effort expectancy* positively increased the intention to use ICT in schools by the principals. Firstly, they were familiar with popular ICT tools, such as Microsoft *Word* or internet browsers, and seemed confident that they could learn what was required to use ICT in an educational context. Moreover, their familiarity with the technology encouraged them to believe that its adoption would assist them with their administrative tasks.

This result is in line with the concept of the UTAUT model indicating that ease of use (*effort expectancy*) exerts significant influence on users' *behavioural intention* and acceptance of ICT and its extended and sustained usage (Venkatesh et al., 2003; Fathema, Shannon, & Ross, 2015; Park, 2009). Also, as illustrated in Table 7.2, these findings are consistent with Oyaid (2009); Alwani, &

Soomro, (2010); and Almalki, & Williams (2012). These researchers found that for education at different levels in contexts similar to Saudi Arabia, the perception of the effort required to use ICT can motivate or demotivate the adoption of ICT by administrative personnel.

- ***Computer literacy, effort, and performance expectancy of the principals***

As discussed earlier in Chapter 3, the *computer literacy* construct depicts the judgment or the confidence of the principals' in their own ability to use computers for their daily activities, both administrative and academic. This research found that principals' *computer literacy* has a very strong positive relationship with their *effort expectancy* ($p<0.05$), and *performance expectancy* ($p<0.05$), indicating *computer literacy* has a significant influence on both *effort* and *performance expectancy*. The reason behind such a result is that, the principals of Saudi Arabian primary schools are concerned with the effort required to use ICT, and also want to improve their performance while using the ICT. Table 7.2 (H8 and H9) shows that Alwani and Soomro (2010) and Almalki and Williams (2012), researching in the domain of education, also found computer literacy to be a significant predictor of ICT usage in education.

Fathema et al. (2015), Park, Nam, & Cha, (2012); Ong, & Lai, (2006); Roca, Chiu, & Martinez, (2006); Pituch, & Lee, (2006); Ong, Lai, &Wang, (2004) have all indicated that *performance* and *effort expectancy* are influenced by the effect of the perceived *computer literacy* of the users. However, in the model, *performance expectancy* was not found to be a significant predictor of *behavioural intention* to use ICT. Despite this non-significant relationship with the intention to use ICT, *computer literacy* influences *performance expectancy* since personal efficacy would likely improve the performance while operating the system.

- ***System quality and behavioural intention to use ICT of the principals***

This study found that *system quality* has a moderate negative relationship with principals' *behavioural intention* ($p<0.05$) in Saudi primary schools. From the research, it can be suggested that poor ICT *system quality* decreases the intention to use ICT by the principals (Table 7.2, H10). As explored in the Chapter 2, sections 2.7.6 and 2.7.7, ICT systems are not properly developed in Saudi schools (both secondary and primary), and often the facilities remain broken and unusable by the principals or teachers. The lack of access to reliable facilities can be very off putting for anyone attempting to learn a new technology and the quality of the existing system would negatively influence intention.

As presented in Table 7.2, this result is consistent with studies (Alwani, & Soomro, 2010; Al Mulhim, 2014; and Albugami, & Ahmed 2015) that have explored the factors that hinder ICT adoption in Saudi Arabia, where studies indicate that poor *system quality* is a negative influence and results in a lower uptake of technology. However, this finding is inconsistent with Fathema et al. (2015), who found no significant relationship between *system quality* and *behavioural intention* to use ICT. The possible difference might be caused by contextual variations of *system quality*, as well as the level of education. As this research focussed on primary education, it might be more specific at this level.

- ***Cultural conditions and obstacles to using ICT***

The model found a strong positive relationship between *culture* and *obstacles* to the use of ICT in schools in the data for the principals ($p<0.05$). This indicates that Saudi *cultural factors* can positively increase the *obstacles* to the use of ICT for principals in primary schools. This is a common phenomenon in Saudi, as ICTs are not yet widely accepted, and therefore, the cultural context raises *obstacles* to the use of ICT systems in primary schools. Table 7.2 (H6) shows that this is a finding consistent with Almalki and Williams (2012) and Amoudi and Sulaymani, (2014), whose studies also indicate possible connections between Islamic *culture* and *obstacles* to the use of ICT in general. Lack of openness to ICT in the wider cultural context in this case results in barriers to the adoption of ICT in such an early level of study.

Clearly, Saudi society generally is not sure about ICT usage yet, and certainly not as used to it as more developed societies. The use of ICTs by the younger generations in the population is viewed negatively for a variety of reasons. Despite the fact that Islam does not prevent the acceptance of new ideas, nor does the use of ICT contradict Islamic values, there are issues with the inclusion of new ideas via the introduction of new technologies, with no societal or cultural agreement on their resolution established yet.

Unsupported relationships in the principals' model. The model also found unsupported constructs and corresponding relationships for primary school principals in Saudi Arabia, which were: *performance expectancy*, *social influence*, *facilitating conditions*, *cultural factors*, *obstacles (external barriers)*, *behavioural intention* and *actual use* of ICT. This study identified that there were insignificant or no valid relationships supporting these constructs. In this section the possible explanations for not supporting these constructs are discussed.

- ***Performance expectancy and behavioural intention to use ICT of the principals***

The study found that *performance expectancy* has a weak negative relationship with the *behavioural intention* of primary school principals in Saudi Arabia (Table 7.2, H1); however, the relationship is not statistically significant (p>0.05). Interestingly, this result contradicts the qualitative findings and the findings of other research, where it has been found that *performance expectancy* has positive impact on the intention to use ICT. As indicated in qualitative interviews,

> *Use of ICT in classrooms improves primary school teachers' teaching performance and increases the learning productivity of primary school students. (Interviewee #6, principal)*

Table 7.2 also showed the results are inconsistent with other research. The possible reasons for such a contradiction may be found in the views of the selected sample of principals, or due to the more generalised perception of the principals regarding their performance. The principals might, for example, have simply accepted that ICT use would eventually improve their performance, and their answers reflected their confidence. Therefore, in this model, *performance expectancy* was found to have no significant relationship with intention to use. However, it should be noted that, despite *performance expectancy* being insignificant in the model, during the interviews, the principals expressed a strong perceived relationship between *behavioural intention* and *performance expectancy,* and thus it should have some influence on the use of ICT by the principals.

- ***Social influence and behavioural intention to use ICT by the principals***

The results in this study show that *social influence* had no significant relationship with *behavioural intention* to use ICT in primary schools by the principals in Saudi Arabia (p>0.05). As presented in Table 7.2 (H3), this outcome is dissimilar to previous studies, as well as contradicting some interviews. The possible cause might be that there is no *social influence* that strongly affects the choices of the principals in their decisions about the adoption of ICT in their schools.

- ***Facilitating conditions and behavioural intention to use ICT by the principals***

The study found that *facilitating conditions* had a weak positive, yet insignificant, relationship with *behavioural intention* to use ICT in primary schools by the principals in the study (p>0.05). However, the model outcome contradicts previous studies, as indicated in Table 7.2 (H4). Additionally, the interviews also suggested that facilitating conditions might have influenced ICT use by principals. A possible reason for this outcome could have been that the principals were aware of the impact of poor ICT facilities, but did not allow poor conditions to dissuade them from adopting technologies.

- ***Cultural factors and behavioural intention to use ICT by the principals***

The model found that *cultural factors* had no significant relationship with the *behavioural intention* of principals to use ICT in primary schools in Saudi Arabia ($p>0.05$). Thus, even though the cultural contexts of Saudi Arabia are not particularly favourable to the uptake of ICT, the intention of primary school principals to use ICT in school activities was not influenced by *cultural factors*.

- ***External barriers/Obstacles and behavioural intention to use ICT by the principals***

This study found that *external barriers (obstacles)* had no significant relationship with the *behavioural intention* of principals to use ICT in primary schools in Saudi Arabia ($p>0.05$). Thus, although may be the principals faced *obstacles* to the adoption of ICT due to cultural context, these would probably not affect their intention to use ICT. *Obstacles* to the use of ICT in primary schools by the principals who participated in this study ($p<0.05$) were mostly cultural. The use of ICT is a new phenomenon for Saudi Arabians, and its acceptance varies across the society. While principals and students might embrace the use of technologies, acceptance of their use in schools might be opposed by the wider school community.

- ***Behavioural intention and actual use of ICT by the principals***

According to the UTAUT, users' *behavioural intention* to use a technology influences their *actual use* (Venkatesh et al., 2003). In the context of this study, the circumstances in which the principals worked produced an outcome that seemed to contradict the UTAUT. While the data from the principals' responses indicated that they would be interested in using use ICT more fully than they already did, this resulted in very little *actual use* in the schools ($p>0.05$).

Table 7.2 shows (H11) that this outcome is inconsistent with previous studies. The reasons for this contradiction can be found in other data generated by the surveys. Although familiar with ICT, and using it at home and minimally at school, it was clear that the existing facilities were inadequate and dysfunctional. Interview data demonstrated that the principals felt positive about the potential impact of ICT on learning and teaching, but were prevented from adopting the technology by circumstances at the current time.

Conversely, it is also possible that the principals actually do not have a positive intention to use ICT for school affairs, as found by Alwani, and Soomro, (2010), which in turn was responsible for the lower than expected level of *actual use* of ICT in schools.

Overall, the current model can predict the *behavioural intention* of the principals with greater accuracy (R-square value for the *behavioural intention* is only 0.408), which indicates that different factors affecting use of ICT by principals in class can explain 40.8% of their *behavioural intention* toward ICT in primary schools. But it failed to predict the reasons for lower *actual use* of ICT, only 0.05% of variance of *actual use*. Interactive model results are explained in the following section, indicating the reasons for lower *actual use* of ICT by the principals.

Interactive model to explore principals' *actual use* of ICT in class. The SEM model developed to explore the factors responsible for principals' *behavioural intention* and *actual use* of ICT, lacks the predictive capacity to explain the *actual use* of ICT in primary schools by the principals. Thus, an interactive SEM model was developed to further investigate different relationships between several independent constructs and *actual use* to find the constructs that really explained the current *actual use* of ICT in the primary schools by the principals.

In this new model, the relationships between *behavioural intention* and other independent variables remain the same as in the previous model. However, the interactive new model can explain 22.9% of the variance of actual ICT use in Saudi primary schools by the principals. In this case, *system quality* and *facilitating conditions* have a significant relationship ($p<0.05$) with the *actual use* of ICT by principals in Saudi Arabian primary schools. There are negative relationships between *system qualities* and *facilitating conditions* with *actual use*. This result indicates that ***as the system quality is poor and the facilitating conditions are not well developed, there is lower actual use of ICT in primary schools by the principals***. This is the present scenario of ICT use at Saudi primary schools. Thus, the model successfully predicts and demonstrates statistically accepted predictive relevance that can explain the *actual use* of ICT in primary schools by the principals in Saudi Arabia.

The interactive (experimental) model was therefore able to identify the reasons for the result of poor *actual use.* It is poor *system quality* in schools, with poor functionality, that dissuades the principals from using ICT in their schools. Hardware is not available and internet facilities, if they exist, are unreliable. However, it was also found that positive *behavioural intention* to use ICT increases as training and practice increase. With better facilities and greater proficiency, the principals would be much more likely to actually use ICT facilities for their school activities.

7.2.2 Summary of final model for primary school teachers in Saudi Arabia

The model for primary school teachers in Saudi Arabia consisted of ten constructs (Figure 6.8):

- *performance expectancy*
- *effort expectancy*
- *social influence*
- *facilitating conditions*
- *cultural factors*
- *external barriers*
- *computer literacy*
- *system quality*
- *behavioural intention*
- *actual use.*

In the following section, supported and unsupported relationships among these constructs are described and explained. They have been verified through hypothesis testing and qualitative interviews.

Supported path relationships in the teachers' SEM model. Table 7.3 shows the results of the SEM model's hypothesis testing supported the following constructs for primary school teachers in Saudi Arabia:

- *performance expectancy*
- *effort expectancy*
- *cultural factors*
- *computer literacy*
- *system quality*
- *behavioural intention*
- *actual use.*

In this section, the possible explanations supporting these constructs and relationships are discussed.

- ***Performance expectancy and behavioural intention***

In this study, it has been found that *performance expectancy* of the teachers has moderately strong positive relationship with *behavioural intention* of primary school teachers to use ICT ($p<0.05$). *Performance expectancy* had significant influence on *behavioural intention* to use ICT in class in Saudi Arabian primary schools (Table 7.3, H12). As discussed in qualitative interviews, some teachers also found ICT productive for various activities of their lives, as mentioned by one of the teachers,

> *Use of ICT, especially internet and computer was part of my learning at my higher education, and I have found it much more productive; if the teachers can use the same technology with proper facilitation, it would be overnight change for primary education in Saudi Arabia. I am looking forward to it. (Interviewee #8, Teacher)*

It can be argued that, if the teachers are provided with proper facilities, due to their positive views, they would use ICT in their school activities to experiment with new, perhaps approved ways of teaching. This finding is consistent with the basic idea of the UTAUT model, which suggested that *performance expectancy* would have a significant relationship with *behavioural intention*. Table 7.3 shows that this position is consistent with Al Mulhim (2013) and Albugami and Ahmed (2015), who suggested that perceived improvement in performance could motivate the teachers to use ICT facilities more frequently. Therefore, it can be concluded that, the stronger the *performance expectancy* of the teacher, the greater their intention to use ICT.

- ***Effort expectancy and behavioural intention of the teachers***

The teachers' SEM model found that *effort expectancy* had a moderately strong positive relationship with *behavioural intention* to use ICT in Saudi Arabian primary schools ($p<0.05$). The qualitative interviews were aligned with this result. The results indicated that if ICT proved easy to use, the teachers would be more likely to adopt the technology. However, Al Mulhim (2014) and Alhawiti (2013) argued that lack of access to technology, lack of training and lack of time made the use of ICT in teaching much more difficult, which concurs with the current study [Table 7.3 (H13)].

Some of the teachers had used ICT during their own higher education, and also for their personal use. Due to their experience of using ICT facilities (i.e., MS *Office* software on their PC), they expected to have little difficulty using ICTs within the classroom. Nevertheless, some of the teachers also pointed out that they would need training, particularly if new ICT facilities were introduced.

- ***Cultural factors and behavioural intention to use ICT by teachers***

Analysis of the data indicated that many of the teachers' behaviour in the school and their desire to use ICT in class tended to relate to the cultural context. The analysis found that there was a strong significant positive relationship between *culture* and *behavioural intention* to use ICT in classes among the primary school teachers who participated in the study ($p<0.05$). This indicated that Saudi *cultural factors* could positively influence the use of ICT by teachers in classes for Saudi primary schools. Table 7.3 (H16) shows this result is consistent with some previous studies, which also argued that cultural context can influence ICT use.

This finding proved quite interesting and somewhat surprising. Other studies based in the context of Saudi Arabia have indicated that Islamic culture and the Saudi Arabian social system do not welcome ICT usage. Nearly 2000 internet sites are blocked by the government, including pornographic and anti-Islamic content, demonstrating a desire to control aspects of the ICT sector and its users (Albugami, & Ahmed, 2015). However, in this study, neither culture nor religious factors were proved to be negative for the teachers.

Saudi Arabia is changing its social and economic structure in an effort to modernise, that is, to keep up with the developed world. Thus, Saudi Vision 2030 encourages greater engagement with ICT and education for young people as part of an effort to reduce dependency on an oil-based economy. Most of the teachers in the research sample were relatively young adults, and it is possible that they were considering ICT in their schools and classrooms from the point of view of the changing social and economic mood that is shaping Saudi Arabia currently. The interviews revealed a range of opinions among the teachers about the efficacy of ICT, but many were very positive about the introduction of ICT and the positive changes the technology could bring.

- ***Computer literacy with effort expectancy of the teachers***

The model suggested that there was a very strong positive relationship between *computer literacy*, *computer literacy* and *effort expectancy* of primary school teachers in Saudi Arabia ($p<0.05$). This finding was also supported by the interviews, where the teachers expressed the idea that with the help of ICT they might be able to express their ideas to their students more effectively and with less effort, but that they would need more time to achieve this outcome.

The teachers also mentioned that most of them had a basic understanding of how to operate computers, and often can run Microsoft *Office* products (such as *Word, Excel*), so their capabilities might enable them to learn how to use ICT for teaching purposes fairly quickly, despite the fact they might need specific training and updating. However, due to the lack of access to technology, the lack of training and the lack of time to practice, the teachers questioned their ability to use ICT for teaching, as that would require special skills and knowledge. Al Mulhim, (2014) has argued the similar points but mostly for secondary schools and universities in Saudi Arabia (Table 7.3). Bingimlas (2010) also explored 'lack of effective professional development' as a major problem for Saudi primary school science teachers in implementing ICT in their classes. Of course, the more teachers who reached a minimum standard of *computer literacy*, the more they would be inclined to use ICT in their school activities since the effort would become less and less, until a critical mass was reached and ICT in schools became genuinely mainstream, reflecting the government plan.

- ***System quality and behavioural intention of the teachers***

The teachers' SEM model found that *system quality* had a moderate significant ($p<0.05$) positive relationship with the *behavioural intention* of primary school teachers in Saudi Arabia to adopt ICT as a teaching tool. This indicates that if the *system quality* were better; the teachers would be more willing to use ICT in classes. As presented in Table 7.3 (H21), this finding is quite different from other studies, as, in general in Saudi Arabia, the quality of the current ICT system lags behind many other countries, despite the fact that the government is trying to improve the system as a whole.

Primary schools continue to lack proper staffing for ICT system support, and even if an ICT system exists in primary schools, it is often outdated (Al Mulhim, 2013; Alhawiti, 2013). Upon analysis, the data offered little evidence that the teachers understood what a quality system was, although it was clear that they understood that their systems were not appropriate. In most cases, the ICT facilities were non-existent, but the teachers expressed the belief that *system quality* would encourage them to use ICT. Thus, there existed a strong, positive relationship between *system quality* and *behavioural intention*.

It has been argued by several studies that **perceived** *system quality* as well as **actual** *system quality* can both influence the *behavioural intention* to use ICT (Fathema, & Sutton, 2013; Park, Nam, & Cha, 2012; Park, 2009; Delone, & Mclean, 2003). That is, if it is perceived that *system quality* is average or above, individuals are more willing to adopt ICT and learn to participate in its use as a teaching and learning tool. If, however, actual *system quality* is below average – poor internet connection, poor maintenance, poor training and support, substandard devices – uptake is discouraged and forward momentum halted.

In summary, it can be postulated that positive *system quality* significantly increases the *behavioural intention* to use ICT facilities by teachers. This is a crucial aspect that needs to be considered when introducing ICT into primary schools in Saudi Arabia. The model strongly suggests that *facilitating conditions* have a very strong positive relationship with *system quality* and flexibility ($p<0.05$), indicating that if the *facilitating conditions* were better, then *system quality* and flexibility would increase, with better use of ICT by primary school teachers in Saudi Arabia.

- ***Behavioural intention and actual use of ICT by the teachers***

Analysis of the data demonstrated that the participant teachers faced several limitations when it came to using ICT facilities in their classes. These barriers restricted the *actual use* of ICT in teaching. Al Mulhim, (2014) and Alhawiti (2013) have commented on these barriers for mostly secondary and higher education, and similar types of barriers exist at the primary level. This is not to say that the teachers wouldn't use ICT, only that they had valid reasons why they could not. There was a range of issues to be overcome, but it was clear that the teachers had the *behavioural intention* to use ICT if issues such as training and facilities were overcome.

The model in this study showed a moderate positive relationship between *behavioural intention* and *actual use* ($p<0.05$) of ICT by the primary school teachers. However, upon analysis of the data, it emerged that the R-square value for the *actual use* was only 0.102, which only explains 10.2% of *actual use* of ICT in classes. This is very low, indicating that they are not actually using ICT in class despite having an intention to. The model, therefore, is able to predict the *behavioural intention* of the teachers with greater accuracy (R-square value for the *behavioural intention* is 0.561) than it is able to predict *actual use,* indicating that different factors from those used in the model are needed to understand the gap between teachers' intention to use and the very low uptake of ICT in reality.

Unsupported path relationships in the teachers' model. As per the teachers' SEM model path analysis, the unsupported construct and relationships for primary school teachers in Saudi Arabia were:

- *social influence* and *behavioural intention*
- *facilitating conditions* and *behavioural intention*
- *culture* and *behavioural intention*

In this section, the possible explanations for not supporting these relationships are discussed.

- ***Social influence and behavioural intention to use ICT by teachers***

S*ocial influence* showed no significant ($p>0.05$) relationship with *behavioural intention* to use ICT in schools by primary school teachers. As presented in Table 7.3 (H14), this was an unexpected finding since social surroundings often play a vital role in the adoption of new technologies, such as ICT. It is possible that the existing social circumstances in Saudi primary schools have no influence on the intention to use ICT, but are already influencing the *actual use* of ICT by the teachers. In this regard, one of the teachers mentioned during the interviews that,

> *It is general view of the society that ICT is more useful for secondary or mostly for higher education; the children do not need ICT to learn. My friends and wife think ICT is not needed for children's education, as the lessons are quite easy. (Interviewee #6, Teacher)*

Comments such as this show that teachers are aware of the educational possibilities of ICT, but have no particular desire to use technology in certain situations (i.e., when facilities are inadequate and social acceptance low). In such circumstances, *social influence* definitely influences *actual use*, and intention is not an issue.

Pynoo et al. (2011) conducted a cross-sectional study and found that the relationship between *social influence* and *behavioural intention* to use ICT by teachers does not remain the same consistently. It varies according to the context in which the teachers find themselves. Saudi primary school teachers usually do not use ICT for teaching and *social influence* does not predict their intention to use ICT very clearly, but it may influence their *actual use* (an idea explored in the interactive model for the teachers).

- ***Facilitating conditions and behavioural intention to use ICT of the teachers***

The SEM model for teachers' found that *facilitating conditions* have a weak negative and insignificant ($p>0.05$) relationship with *behavioural intention*, implying that computing or other technological facilities in the schools do not influence the intention to use ICT in classes by teachers. There is no apparent relationship with *behavioural intention*.

Several previous studies have reported mixed results regarding this situation. Teo (2010), Teo, Lee, and Chai (2008), along with Panda and Mishra (2007) have all indicated that *facilitating conditions* might influence the adoption of new technologies, while Pynoo et al. (2011) showed *facilitating conditions* have no impact on intention to use ICT, but do affect the *actual use*. As found in the qualitative interviews, conditions are inadequate for the use of ICT in the classrooms. Teachers get little chance to use ICT in their daily activities at all. As one teacher mentioned,

> *I prefer not to use the computer available in the class rather than using it because within the limited class time this loses some time due to the outdated system. Moreover, we are not provided with a projector in every class room. For the class of moderate to a large number of students a single computer is not enough. So it complicates the process rather than making it easy and simple. (Interviewee #2, Teacher)*

Statements like this indicate that the *facilitating conditions* are probably responsible for lower *actual use* of ICT by the teachers, but had little effect on their intention to use ICT.

On the other hand, *facilitating conditions* had a very strong positive relationship with *system quality* and flexibility ($p<0.05$). This observation indicates that if the *facilitating conditions* were better, then *system quality* and flexibility would increase, with greater use of ICT by primary school teachers in Saudi Arabia. *System quality* therefore showed a statistically significant relationship with the *behavioural intention* of the teachers. *Facilitating conditions* therefore indirectly affect the intention to use ICT via poor *system quality* in Saudi primary schools.

- ***External barriers, culture and behavioural intention to use ICT***

Lack of professional training, lack of access to the internet, and not having enough time to use ICT were common observations among the teachers. In addition, they had to manage the students and also prepare for the lectures in the classes. Without proper external support, it would therefore be difficult to use ICT on a regular basis. This study found that *external barriers* to the use of ICT by primary school teachers in Saudi Arabia had a negative yet insignificant relationship with their *behavioural intention* ($p>0.05$). Additionally, *culture* had no significant relationship with *external barriers* to the use of ICT by primary school teachers ($p>0.05$).

The result shows that, despite *obstacles* to the adoption of ICT among the teachers, their intention to use ICT in school activities was not influenced by external *obstacles*. One of the teachers explained,

> *I have taken the initiative to use ICT in my classrooms for teaching from my personal interest. I use lecture notes using a computer to make them more interesting to the students. But for this I have not received any special training from the school. (Interviewee #4, Teacher)*

This offers a great insight into the Saudi primary school teachers' acceptance of ICT in their schools. Some of them (not all) explained that they were likely to use ICT despite all the *obstacles*, including not having much support from the school authority. Hence, it can be argued that, despite a considerable number of *obstacles*, the teachers' intentions were not influenced, but their *actual use* was hampered very often.

- ***Computer literacy with performance expectancy of the teachers***

Modelling the teacher data with SEM found a weak and insignificant ($p > 0.05$) relationship between *computer literacy* and *performance expectancy*, indicating *computer literacy* had no significant influence on their *performance expectancy*. The possible reason behind such a finding is that primary school teachers in Saudi Arabia think that *computer literacy* reduces the effort required to use ICT in the classroom. In addition, ICT would be easier to use with some minimum training. However, some of the teachers mentioned that their performance depended on classroom conditions and their personal mastery of subjects, not just on operating ICT facilities.

Interactive model to explore the teachers' *actual use* of ICT in class. The first SEM model for the teachers lacked the predictive capacity to explain the *actual use* of ICT in primary schools by the teachers. So, an interactive model was developed to further investigate different relationships between several independent constructs and *actual use* to find the constructs that could explain the current *actual use* of ICT in the primary schools. The new model can explain 54.10% of the variance of actual ICT use in Saudi primary schools by the teachers. In this case, *system quality*, *social influence*, *culture* and *obstacles* had a significant relationship ($p<0.05$) with *actual use* of ICT by teachers.

It has been noted at several points that *system quality* is not an attribute of ICT in Saudi primary schools; and the *actual use* of ICT is very low. Thus these constructs have a positive relationship, indicating that the poor quality of ICT systems in the schools prohibits the use of ICT in class. In addition, *social influence* also has a significant relationship with *actual use* of ICT in classes. In this instance, lower *actual use* is explained by social hindrance, as the social context is not favorable to the use of ICT yet. However, with policy direction, as discussed previously, this view is gradually changing. Negative *social influence,* therefore, reduces the *actual use* of ICT in the primary schools of Saudi Arabia. Thus, the model shows a positive relationship between these two constructs.

Furthermore, *obstacles* or barriers were found to have a positive relationship with *actual use*, while *obstacles* proved to have a negative relationship with *behavioural intention*. This clearly shows, ***there are obstacles or barriers to using ICT in classes at Saudi primary schools, thus the low level of actual use is also caused by the obstacles***. The greater the *obstacles* and barriers, the lower the use of ICT in primary classes.

Finally, *cultural factors* were also found to have a significant relationship with the *actual use* of ICT in Saudi primary schools. Saudi society is quite conservative and the use of ICT in primary classes is subject to organisational and demographic issues and related controversies. Thus, the cultural atmosphere is not favorable to the use of ICT for teaching. The model shows that Saudi *culture*, *social conditions*, *system quality*, and *obstacles* are responsible for the failure to use ICT in the schools. This new model successfully predicts and shows statistically accepted predictive relevance to explain the *actual use* of ICT in primary schools by the teachers in Saudi Arabia.

7.2.3 Summary of final model for primary school students in Saudi Arabia

The model for primary school students in Saudi Arabia consisted of seven constructs: performance expectancy, effort expectancy, social influence, facilitating conditions, computer literacy, behavioural intention and actual use. In the following section, supported and unsupported constructs are described and explained, which have been verified through hypothesis testing and qualitative interview analyses.

Supported constructs and path relationships. According to the students' model, the supported constructs and path relationships for primary school students in Saudi Arabia were *performance expectancy*, *effort expectancy*, *facilitating conditions*, *computer literacy, behavioural intention* and *actual use*. In this section the possible explanations supporting these constructs are discussed.

- ***Performance expectancy and behavioural intention***

In Saudi Arabia, students perceive technologies as useful, despite the existing problems, such as lack of access and *social conditions* (Al-Khalifa, 2010). In the study presented in this thesis, the model found that *performance expectancy* has a moderately strong positive relationship with the *behavioural intention* of students in Saudi Arabian primary schools (p<0.05). Table 7.4 (H23) also shows this result is consistent with previous studies. This indicates that the *performance expectancy* of the students increases their intention to use ICT, and that there is a consensus among students.

In the student interviews, the participants explained that they thought that using computers would be beneficial for their studies because they could access more resources. Some of them mentioned also that they liked their computer classes, and felt that if they could use the technologies more frequently, it might improve their performance as a whole.

- ***Effort expectancy and behavioural intention***

Table 7.4 (H24) demonstrates that the model found that *effort expectancy* had a weak but significant positive relationship with the *behavioural intention* of the students to use ICT in Saudi Arabian primary schools (p<0.05). Previous studies also indicated that Saudi students' intention to use ICT was encouraged by their confidence in their ability to use technology (Nassuora, 2012). Table 7.24 (H24) shows that the finding from the present study is consistent with the findings of previous studies. In the interviews, the students generally expressed their confidence in themselves, as one of the students mentioned,

> *It is obvious that I do not know how to use ICT facilities to make learning easy, or to get work done with more efficiency, but I am sure it would not be so hard to learn if the teachers just guide us how to use it. (Interviewee #10, Student)*

Both qualitative and quantitative findings showed that the students believed that it would be possible to learn how to use ICT effectively with minimum supervision, and had every intention of using ICT if they had the opportunity.

- ***Facilitating conditions and behavioural intention***

Facilitating conditions for an ICT system include the usability, availability, reliability, adaptability, and response time of the available system. This factor has a significant effect on users' *behavioural intentions*. This study found that *facilitating conditions* had a weak but significant positive relationship with the *behavioural intention* of the students to use ICT (p<0.05). That is, although Albugami and Ahmed (2015) and Al-Harbi (2011) showed that ICT facilities significantly influence the adoption of ICT among users (Table 7.4), the students in this study, who had few opportunities to use ICT, remained very positive about the potential usefulness of ICT facilities and eager for them to become available.

- ***Computer literacy, effort expectancy and performance expectancy***

Computer literacy is the term applied to an individual's understanding of how a computer works and how to use one. In Saudi Arabia, primary students' *computer literacy* significantly influences their intention to use technology, Alenezi et al., (2010) showed that higher *computer literacy* among university level students was associated with their use of ICT facilities. Most of the students in this study regarded themselves as quite computer literate. (However, it is a subjective judgment of the students, as they are self-reported.) *Computer literacy* had a very strong positive relationship with *effort expectancy* ($p<0.05$) and a moderately strong positive relationship with *performance expectancy* ($p<0.05$). Table 7.4 (H27, H28) highlights the fact that these results are somewhat similar to those of previous studies. The data made it clear that the students in the present study associated their levels of *computer literacy* with reduced effort (*effort expectancy*) and ease of use if they were ever given the opportunity to use ICT in class.

- ***Behavioural intention and actual use***

The primary school students' *behavioural intention* to use ICT does not sufficiently reconcile with its *actual use* in Saudi Arabian primary schools as the R-square value for the *actual use* is only 0.067, indicating *behavioural intention* to use ICT in class only explains 6.7% of *actual use*. This is very low, indicating that the students do not actually use ICT in class, although they would if they could.

Unsupported constructs. As per hypothesis testing, the unsupported construct and relationships for primary school students in Saudi Arabia was *social influence* and *behavioural intention*. In this section, the possible explanations for not supporting this construct are discussed.

- ***Social influence and behavioural intentions***

This study found that *social influence* had no significant relationship with *behavioural intention* to use ICT in primary schools by the student participants ($p>0.05$). This might indicate that there is no positive *social influence* in Saudi primary schools to encourage the students to use ICT facilities. However, the interviews with the students indicated that the students were restricted in their use of computers at home, while at school, there were inadequate facilities to allow the teachers to give them access to ICT. These features of their social environment in general created a negative *social influence* on the students.

7.3 Triangulation of quantitative and qualitative findings

The quantitative and qualitative findings were triangulated with evidence from the literature relating to the integration of ICT in education around the world in order to identify the similarities and differences in the factors affecting ICT integration in primary education in Saudi Arabia and other countries. Figure 7.1 depicts the triangulation of quantitative (*actual use* of ICT) and qualitative findings.

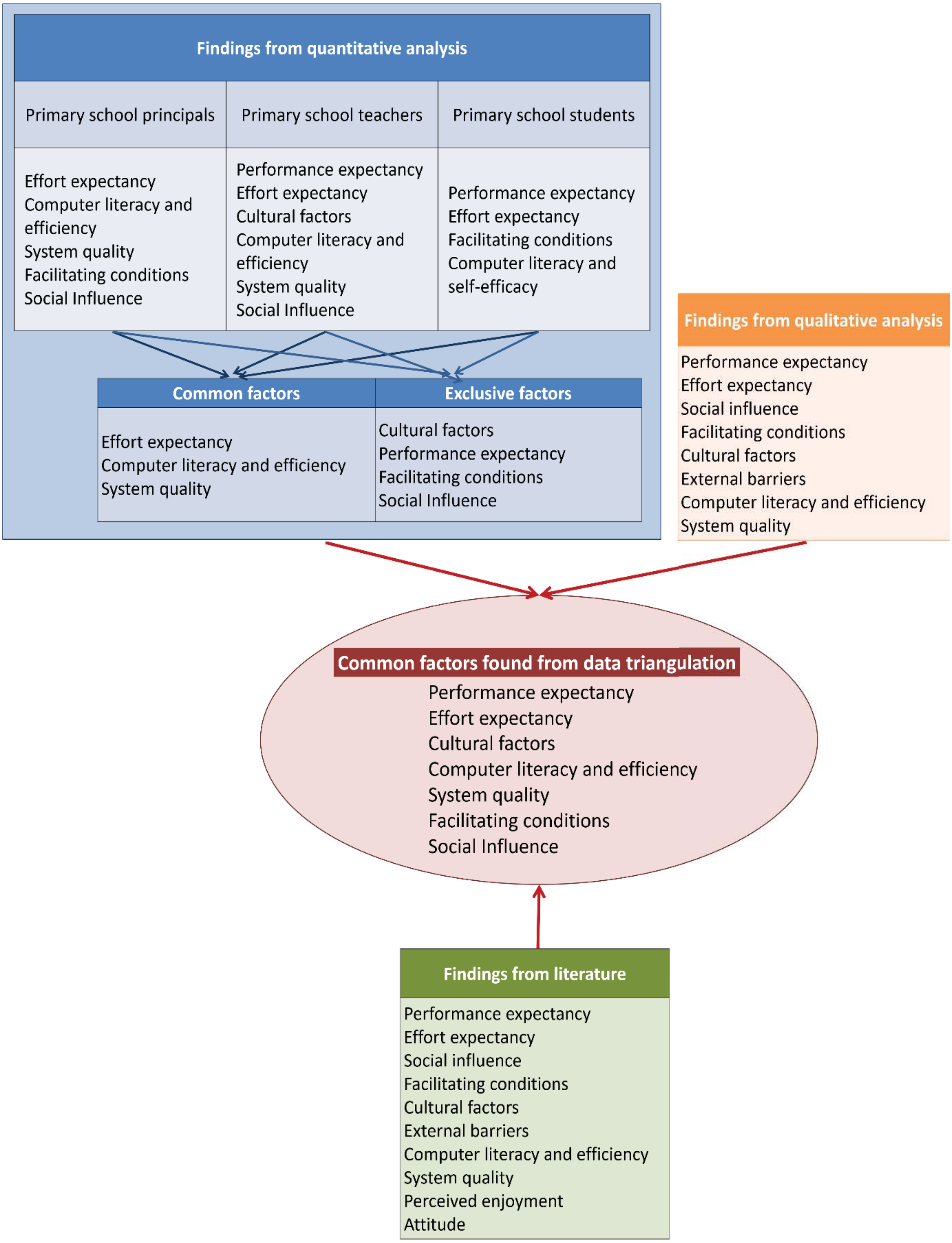


Figure 7.1 Triangulation of quantitative and qualitative findings

As presented in Figure 7.1, the common factors are *performance expectancy*, *effort expectancy*, *cultural factors*, *computer literacy*, *system quality*, *facilitating conditions* and *social influence*. These factors are most crucial for the ICT integration in primary education. Among these, *effort expectancy, computer literacy, and system quality* are the factors that most define the use and acceptance of ICT in Saudi primary schools by the principals, teachers and students.

7.4 Validation of the findings

After the triangulation, the results needed validation from the stakeholders of the research. The principals, teachers and students involved in the research were given the opportunity to validate the results through focus group discussions (FGD). Three focus groups were arranged, one each with principals, teachers and students. Each group was presented with the findings of the research, and informed about the factors this research found significant to the introduction of ICT at primary schools. The presentations, semi-structured questions and summary of the FGDs are attached in Appendices E, F, and G. In this section, based on the FGDs three priority matrices are illustrated to show to what extent the factors of the research actually coincide with the considerations of the focus groups, and which factors the groups consider most important for ICT uptake in Saudi primary schools.

7.4.1 Principals' focus group

In the focus group with the principals, they discussed the results and commented on the factors found in this research. In general, the group agreed that the factors found in the research regarding their behaviour and *actual use* were true, and they explained why they believed that. One of the principals (Principal#4) mentioned,

> *This study had real scenarios about the present state of ICT at the school, and the problems we face daily to manage the schools.*

However, they also disagreed with some of the factors found to be important in the research output. In terms of *performance expectancy*, for example, the majority of the principals expressed the idea that ICT might help the teachers, but that the principals had a lot of work to do that was still manual, and computers might not improve their performance too much, although in general it could help. The principals also agreed that *computer literacy* is important, but not so much for them.

Overall, the principals felt that the results were valid and useful, although some of the points they raised were nuanced and not accepted fully by the principals. They prioritised the factors which were most crucial for them, and composed a priority matrix (Table 7.5) for the factors they thought useful for ICT use in primary schools.

Table 7.5 Priority matrix for the factors principals agreed to be important for their ICT use (Refer to Appendix F for further details of the table construction and meaning.)

Factors	Cul	EE	Obs	SQ	SI	FC	Frequency	Rank
Cul	⊗	Cul	Obs	SQ	SI	FC	1	5
EE	Cul	⊗	Obs	SQ	SI	FC	0	6
Obs	Obs	Obs	⊗	SQ	SI	FC	2	4
SQ	SQ	SQ	SQ	⊗	SQ	FC	4	2
SI	SI	SI	SI	SQ	⊗	FC	3	3
FC	FC	FC	FC	FC	FC	⊗	5	1

Table 7.5 shows that the principals agreed that *facilitating conditions* were the most important factor among all factors. According to Principal#1,

> *Schools need proper technical support for this. Otherwise installation of some computer or device wouldn't bring any greater good.*

As far as the principals were concerned, the second most important factor was *service quality* and the third most important factor was *social influence*. With regard to *social influence*, one of the principals mentioned that (Principal#2),

> *Families of the students can help a lot to increase the acceptance of ICT among all. From family, they can get an environment supporting ICT.*

Principal#1 added

> *Also, school can create a supporting environment for the students. But, for that, they need a proper authority which can run this properly and proper support from higher authority and necessary promotional steps from the ministry of education.*

Figure 7.1 shows that these three factors were found to be common factors across the results for the three groups. This outcome indicates that the models and interviews successfully captured and presented the crucial factors that influence the ICT use by the principals.

7.4.2 Teachers' focus group

The second focus group with teachers was very detailed, and the full discussion summary can be found in Appendix F. Overall, the teachers agreed with the results and commented on some parts of the results. One of them (Teacher #3) stated,

> *Yes, the model is more or less perfect. It really explains the whole scenario of ICT in our schools.*

However, they pointed out that one of the factors really did not influence their use of ICT, and it was *obstacles* they discussed, saying that nothing is totally perfect. Teacher #9 criticised the model, saying,

> *Obstacles can come from various side. Society and school should have necessary measures to minimise these obstacles. So, this can have minimum impact, not very important.*

Nonetheless, with other important factors, the teachers then made their priority matrix (Table 7.6).

Table 7.6 Priority matrix for the factors teachers agreed to be important for their ICT use

Factors	Cul	EE	PE	SQ	SI	FC	CS	Frequency	Rank
Cul	⊗	Cul	Cul	SQ	Cul	FC	CS	3	**4**
EE	Cul	⊗	EE	SQ	EE	FC	CS	2	**5**
PE	Cul	EE	⊗	SQ	SI	FC	CS	0	**7**
SQ	SQ	SQ	SQ	⊗	SQ	SQ	SQ	6	**1**
SI	Cul	EE	SI	SQ	⊗	FC	CS	1	**6**
FC	FC	FC	FC	SQ	FC	⊗	CS	4	**3**
CS	CS	CS	CS	SQ	CS	CS	⊗	5	**2**

Table 7.6 shows that, among all the factors, the teachers agreed that *system quality* was most important for their use of ICT. While all of the teachers thought that all of the constructs were relevant, it was *system quality* and proper facilities that were of paramount importance, and the teachers would have liked to use ICT more frequently. The number of computers was not as much of an issue for them as was proper set up and maintenance.

Poor system quality is the reason, we found it hard to use ICT, so with more investments and proper care, if the system works better and does not require much effort, I am sure most of the teachers would be using ICT. (Teacher#1)

Computer literacy was quite an issue for the teachers, as well, and the second most important factor discussed. They were unsure of their capabilities over the range of ICT devices. Nor were they actually sure how to use ICT in class. Thus there is a need for training.

Finally, the third most important factor was the *facilitating conditions* for the teacher. As the teachers' model did not find this to be a significant factor, the model output might have under-predicted the factors that influence the teachers' use of ICT. However, only 20 teachers were present in the FGD, whereas 170 teachers' opinions had been considered for the model.

Furthermore, when compared with the triangulation result, the most important factors found for the teachers are listed in the common factors of the triangulation. Thus, it can be confirmed that the research outcome is valid and the FGD outcome coincided with the other results.

An important point to note here is that, despite *cultural factor* not registering as one of the top three factors in the priority matrix, the teachers were concerned about it. They mentioned that *cultural factors* are really important in general when attempting to introduce ICT in Saudi Arabia. As Saudi Arabia has a really strong Islamic culture, it exerts an influence on habits, lifestyle and day-to-day life. A teacher (Teacher#8) said,

Islam does not stop anyone to use a new technology rather encourages people to use new technology. Rather we need to use it with proper purpose and in right ways.

7.4.3 Student focus group

In order to validate the results of the research, the students listened to a presentation and discussed the research. The majority of the students agreed that they felt the same problems and potentials that had emerged in the research data. For them, ICT facilities were not just for learning. ICT is also a source of enjoyment and exploration. All of them pointed out that *culture* was not important for them, but they were more concerned about the other factors, such as *social influence* and *service quality*. Among all the valid factors, they prioritised those that they thought were the most important for them to use ICT at school and for educational purposes. The priority matrix is presented in Table 7.7.

Table 7.7 Priority matrix for the factors students agreed to be important for their ICT use

Factors	PE	EE	CS	SQ	SI	FC	Frequency	Rank
PE	⊗	PE	PE	PE	SI	FC	3	**3**
EE	PE	⊗	EE	EE	SI	FC	2	**4**
CS	PE	EE	⊗	CS	SI	FC	1	**5**
SQ	PE	EE	CS	⊗	SI	FC	0	**6**
SI	SI	SI	SI	SI	⊗	FC	4	**2**
FC	FC	FC	FC	FC	FC	⊗	5	**1**

As illustrated in Table 7.7, students agreed that *facilitating conditions* was the most important factor, which was also reflected in their previous interviews. They explained that family and school support could easily increase their use of ICT by providing facilities. The second most important factor was *social influence*. From the students' FGD, it was clear that they thought that *social influence* was closely related to *facilitating condition*. One of them mentioned that,

> *School cannot provide us enough support on devices. We don't have enough computers to practice in class. In general, in class, the instructor uses a computer to describe the topic and we can't even touch the device. We have to see it from a distant place, which is not enough to be clear about everything. (Student#3)*

In addition, the students mentioned that their families imposed restrictions on the use of ICT. This was not surprising to them. They expected their elders to monitor their use of ICT, but thought that, even with controls, more access to ICT would be beneficial to them as students. This observation is evident in Figure 7.1.

On the whole, the process of validation added depth to the research, and the three priority matrices realistically indicated which of the factors mattered the most to each participant group. The validation process suggested that the research outcomes were realistic and both quantitative and qualitative approaches had successfully identified the factors responsible for the adoption of ICT in primary schools in Saudi Arabia. The validation of the results also suggested which factors would need to be addressed by authorities if the Saudi government were to successfully introduce ICT into primary schools.

It can be concluded, therefore, that the research has successfully explored the reality and issues related to the uptake of ICT in Saudi primary schools.

7.5 Final proposed models to increase intention and actual use of ICT

Considering all models, interviews and FGDs, three final models (Figures 7.2-7.4) were formulated in this research to summarize all the important constructs that might influence the behavioral intention and actual use of ICT by principals, teachers and students. These models provided the significant constructs and their relationships have been extracted from quantitative and qualitative analysis and validated by FGDs with priorities.

The principals' model showed that to improve behavioural intention to use ICT by principals, *effort expectancy, system quality* and *flexibility* and *cultural context* need to be favourable. However, for actual use to be enhanced, apart from behavioral intention, proper *facilitating conditions*, and *social support* should be ensured.

For teachers (Figure 7.3), the final model indicated that *culture*, *system quality* and *flexibility*, *performance expectancy* and *effort expectancy* can modify the intention to use ICT. However, actual use is not only a function of intention, but requires proper social support and system facilitation. However, it should be noted that *facilitating conditions* in this case may not exert direct influence on intention or actual use, but affect *system quality* in such a way that both intention and actual use of ICT by teachers are inhibited. To improve ICT adoption in future, the priority constructs should be given more weight.

The final model for the students indicates that *effort expectancy, performance expectancy, facilitating conditions* and *computer literacy* can influence the intention to use ICT. However, actual use of ICT by students is dependent on not only the intention, but also *social influence* and *system quality*. In order to improve and implement ICT interventions and adoptions in primary education, these constructs need careful attention while formulating policies and strategies.

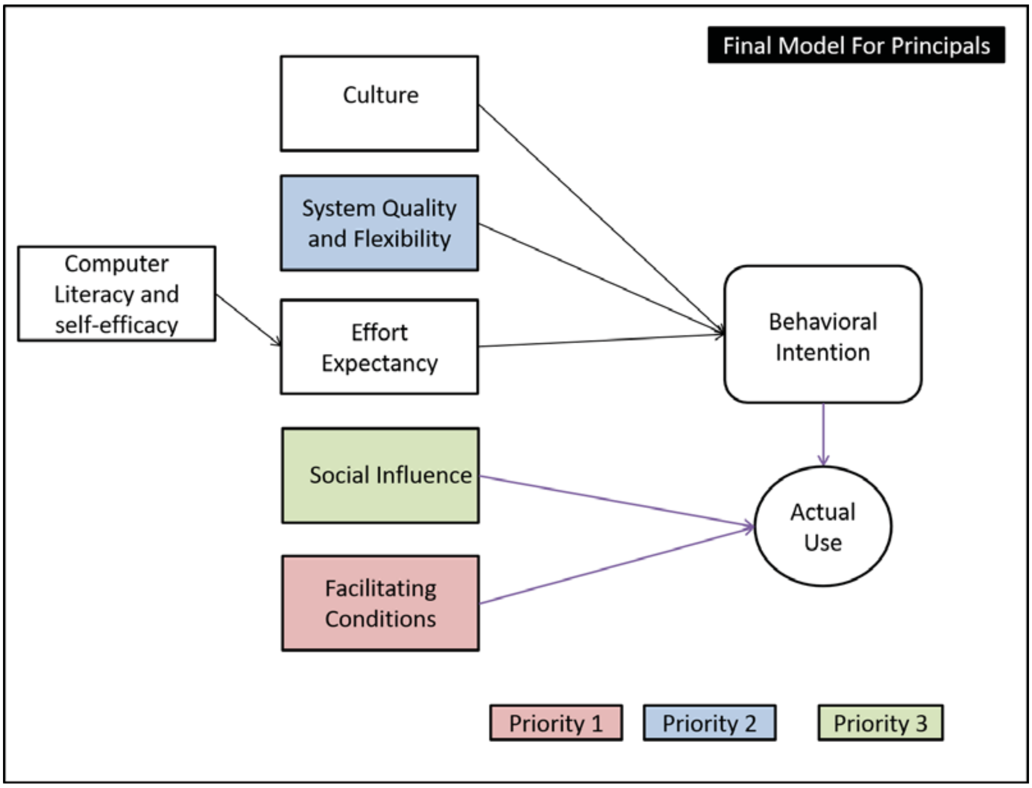


Figure 7.2 **Final proposed model to enhance ICT use by principals at primary level. Priority colour coding shows the three most important constructs needed to provide priorities when implanting ICT interventions.**

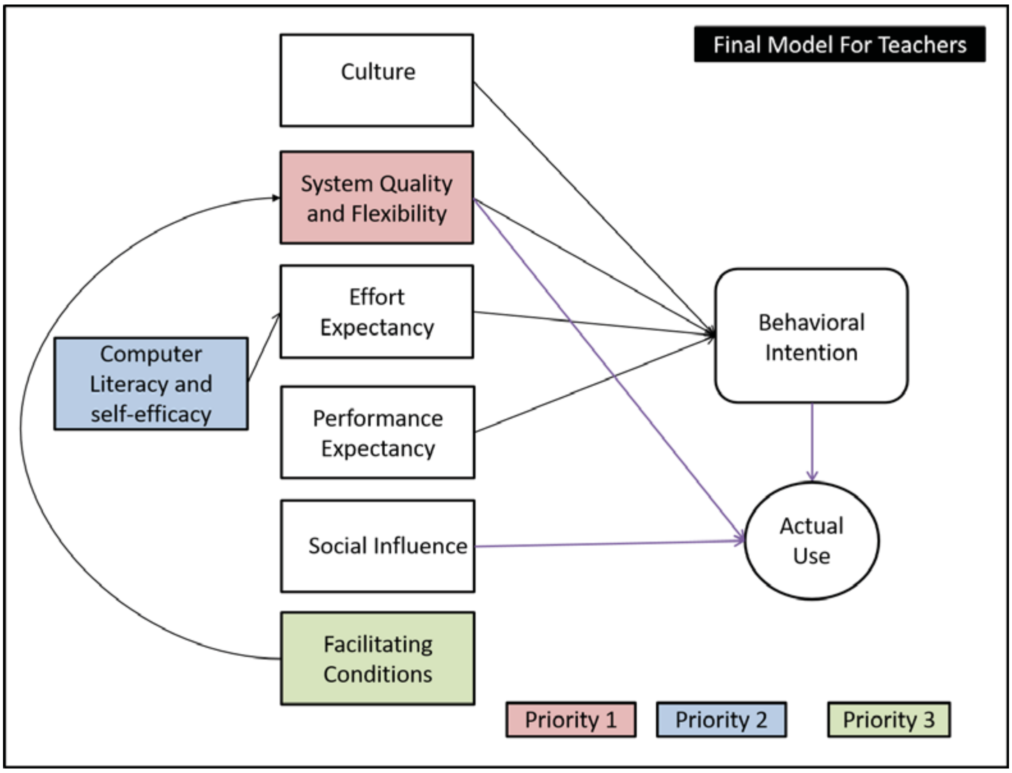


Figure 7.3 **Teachers' final model for ICT use intention and actual use in Saudi primary schools. System quality and flexibility are the first priorities, computer literacy, second, and finally, facilitating conditions is the third priority.**

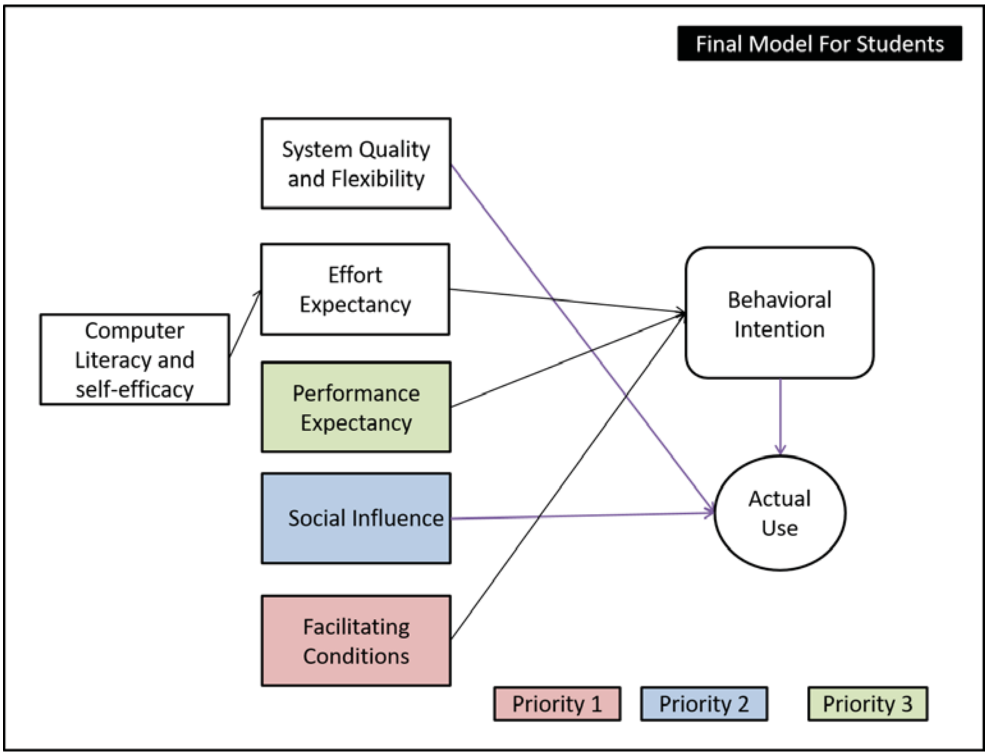


Figure 7.4 Final model for student adoption of ICT use in Saudi primary schools. Facilitating conditions is the first priority; social influence is second; and performance expectancy is the third priority.

7.6 Summary

This chapter discussed the findings of the study by comparing the qualitative data collected from interviews with the quantitative data gathered from a questionnaire survey. In addition, the results obtained from different literature and research resources were also compared for each of the findings of the descriptive statistics and hypotheses. A detailed explanation and interpretation of the results was provided in the context of ICT adoption by principals, teachers and students in Saudi Arabian primary schools. The main factors influencing the adoption of ICT by principals, teachers and students in Saudi Arabian primary schools were confirmed by triangulating the results of quantitative and qualitative discussions, along with information from the literature. This chapter concludes that *performance expectancy*, *effort expectancy*, *cultural factors*, *computer literacy* and *system quality* are the main factors which affect the *behavioural intention* and *actual use* of ICT by principals, teachers and students in Saudi Arabian primary schools. Finally, the results were validated with focus group discussions. The outcomes from the discussions and from the research coincided. In the following chapter, the contributions, implications and limitations of the study, and future research are presented.

Chapter 8

Conclusion

This chapter reflects on the research undertaken to produce this thesis. It begins by recounting the research questions and indicating how the research has addressed these issues through different observations, investigation, surveys and analyses. The academic contribution of the study is then discussed, followed by the limitations of the research and potential scope for further research. Finally, the last section of the chapter provides concluding remarks for the whole study.

8.1 Answers to research questions and achieving the research aim

This research started with the broad aim of identifying and exploring the factors that influence the adoption of ICT facilities in Saudi primary schools by principals, teachers and students. To explore this issue, several research questions were developed and investigated using a variety of tools, including surveys, interviews, observations, and focus group discussion. The research questions acted as a broad framework to guide the research, and achieve the aim of the study. In this section, the research questions are re-visited and discussed briefly to demonstrate the answers and recommendations found during analysis of the data. The research questions and the summaries of the discoveries are outlined as follows:

RQ1: *What is the current condition of ICT facilities in the Saudi Arabian education system?*

Over one third of the Saudi Arabian national budget is assigned to education. However, most of the funding is being invested in physical infrastructure rather than on the integration of ICT into the education system or the development of an advanced ICT curriculum at the secondary and primary education levels, although the government and related ministry (MoE) have been concerned about the provision of ICT facilities throughout the education system. At the time of this study, several national strategies had been formulated, but ICT facilities at each level of education in Saudi Arabia remain inadequate.

Investigations conducted as part of this research demonstrated that there were several ongoing initiatives designed to bring ICT into the curriculum, and the overall education system, but they had not been implemented. This was characteristic of a lack of drive demonstrated by authorities observed during this research. In spite of government intentions, they failed to create an accommodating social movement, or present a positive attitude of ICT acceptance and usage in the education sector. Further development of more pragmatic and realistic strategies, investment schemes, and social awareness programs for ICT integration on a national scale are required.

RQ2: *What is the current situation of ICT facilities and ICT use in Saudi Arabian primary schools?*

Data analysis indicated that ICT facilities and usage in Saudi primary schools were at a basic level; with most of the schools surveyed having none or limited provision of ICT facilities in their classrooms. The teachers rarely used ICT facilities in their teaching, and most of them were not well trained to use ICT facilities in the classroom in any case. While the principals used ICT tools for school management and communication tasks, usage was not significant for either them or the teaching staff.

With so little modelling of ICT usage among school staff, the students were not encouraged in its use for education, besides which they had almost no access to ICT facilities in the schools. Additionally, government policy and strategies did not promote ICT in primary education as a priority when compared with secondary or tertiary levels of education.

RQ3: *What are the major factors that influence the ICT behavioural intention and actual use of ICT by the principals (head of school) of Saudi Arabian primary schools?*

The principals have a major role in integrating ICT at primary schools, as they are nominally the leaders of the teachers and students. This study found that the actual usage of ICT facilities by the principals at schools was quite low, and that they lacked skill in and knowledge of the operation of ICT facilities. However, the model found that principals' *behavioural intention* to use ICT facilities was dependent upon their *computer literacy, effort expectancy, system quality, facilitating conditions* and *social influence*. Their current low level of *actual use* of ICT facilities at the schools, therefore, may be attributable to the inadequate current conditions, the lack of *system quality* and negative *social influence*.

RQ4: *What are the major factors that influence the ICT behavioural intention and actual use of ICT by the teachers of Saudi Arabian primary schools?*

For teachers, the influencing factors are more diverse, and their *behavioural intention* to use ICT facilities reflects their daily work at school. In particular, their *behavioural intention* to use ICT facilities was influenced by their *computer literacy, effort expectancy, performance expectancy, system quality, social influence,* and *cultural factors*. This clearly shows that teachers' *behavioural intention* to use ICT facilities in their teaching is dependent upon a variety of factors. Nevertheless, their actual usage level was found to be quite low and the study found their lack of skill in using ICT facilities was due to lack of training in the use of ICT at primary school level. The low level of *actual use* of ICT facilities in primary schools by the teachers is caused by poor *system quality*, negative *social influence*, cultural influence and existing *obstacles*.

RQ5*:* *What are the major factors that influence the ICT behavioural intention and actual use of ICT by the students of Saudi Arabian primary schools?*

Student use of ICT facilities is a relatively new concept for Saudi primary schools. And students' *behavioural intention*s to use ICT facilities are well-explained with the simple factors of the UTAUT model. In this case, the research found that the major constructs of the UTAUT model can successfully predict the *behavioural intention* of the students to use ICT facilities in the learning process. Other than *social influence*, students' *behavioural intention*s are highly influenced by their *performance expectancy*, *effort expectancy*, *facilitating conditions*, *computer literacy*.

In addition, the students' actual usage can also be directly explained by their *behavioural intention*s. The research concluded that primary school students, being relatively young, faced fewer issues with ICTs than their teachers or principals because the students are digital natives and have a common positive attitude towards using ICT facilities. However, their *actual use* is hampered by *social influence* as they have to follow the rules and guidelines of the teachers at schools and parents at home.

RQ6: *What are the strategies to resolve the challenges of using ICT in Saudi Arabian primary schools?*

Having identified constraints, such as inadequate ICT facilities, poor *system quality*, negative *social influence*, *external barriers*, cultural drawbacks, several improvement strategies for ICT integration in primary schools were formulated. The researcher used the observations from the models, qualitative interviews and personal discussion with different focus groups to compose suggestions for overcoming the diverse challenges that exist at present in the Saudi primary education system. The strategies are divided into following sub-sections:

Recommended strategies for policy development

- Delineation of proper budget and resource allocation methods at the national level to provide adequate supplies of ICT facilities to all primary schools. The government already has large budgets for the education system, however appropriate funding for primary school facilities needs to be a priority.
- Develop ICT infrastructure in general. That is, invest more in internet and computer based systems. Additionally, invest more in research into the needs of ICT infrastructure.
- Provide funding and pursue projects that develop targeted educational software or web services specifically for Saudi Arabian primary schools, and provide a focus on improving existing curriculum.
- Take national level initiatives to regularly monitor the service quality of existing ICT facilities at each level of education; tertiary, secondary and primary.
- Develop public-private partnerships for ICT facility procurement loans for private individuals, enabling students to access computing technologies at home.
- Provide ICT devices, such as laptops, to principals and teachers to assist with motivation and efficacy with using new technologies.
- Create ICT awareness throughout the education system and an awareness campaign throughout the nation, and implement reforms addressing the social as well as cultural perception towards the use of ICT facilities within an Islamic culture.

Recommended strategies for school development

- Prepare a framework and requirements for ICT facilities within schools and implement it through the administration of the district office of the MoE.
- Encourage collaboration and form networks among primary schools within districts to create ICT-Clubs, share different experiences and develop evangelists of technology among the schools.
- Develop and implement regular training workshops for teachers and principals in collaboration with MoE and ICT ministry offices at a local level, or through teacher training institutes.
- Create positive social motivation for continuing, self-learning of ICT and its tools to be used in school management, but especially with teaching.
- Organise workshops, inter-school competitions, and other activities to motivate students to work with and experience ICT facilities, their usefulness and effective ways to use technology.

Putting these suggestions into practice would help to create a positive attitude toward ICT and encourage acceptance among the stakeholders in the education sector. Additionally, further research can be conducted to explore the effects of implementing some of these strategies.

The current research investigated the problems related to the low integration of ICT into Saudi primary schools, and explored the factors responsible for such low adoption of ICT. The research also identified the factors that might influence the *behavioural intention* of the principals, teachers and students to use ICT facilities in primary schools for managing, teaching and the learning process. Therefore, the study has successfully achieved its aim.

8.2 Academic contributions of the research

The research was not only focused on identifying crucial factors influencing the adoption of ICT in primary education in Saudi Arabia and providing strategic recommendations to government and school authority, but also on contributing to the theoretical or academic field. The research used appropriately constructed and tested primary surveys to collect and analyse factors responsible for the adoption and use of ICT facilities at the primary level, and it has utilised critical quantitative and qualitative methods to produce valid and acceptable results. The results have contributed to the body of knowledge, and aspects of this research have been published in journals and conference proceedings (Alshmrany, & Wilkinson, 2017a; 2017b).

Some of the notable academic contributions of this research are:

- The research focused on the use of ICT in primary education, and provides detailed information about the current level of ICT use in Saudi primary schools in general. This study comprehensively surveyed the literature regarding why ICT is useful at the primary level and how ICT facilities can improve existing teaching and learning systems and outcomes. Furthermore, the research emphasises the critical factors that academics should consider when integrating ICT into a primary education system.
- The research developed a modified UTAUT model applicable to the Saudi Arabian education sector (primary level), which included the new constructs culture and *system quality*. These enrich the academic knowledgebase in two different ways. Firstly, the UTAUT model can be successfully used in ICT adoption studies and the new constructs can be used in combination with the core constructs of the UTAUT model, while being specific to the context and background of the study.
- The research contributed to the knowledgebase related to education and ICT used in education in an Islamic cultural and country context. In particular, the UTAUT or other ICT adoption models are mostly validated and used in developed countries, with heterogeneous mix of cultural background, where using the UTAUT model in an Islamic country context, particularly for the education system, is a relatively new application of the model, and, therefore, the knowledge would be valuable for the academics working in an Islamic cultural context and education system.
- The research used a partial least square (PLS) algorithm in modelling ICT *behavioural intention*s, and *actual use* in primary education, which is another relatively new approach of doing SEM modelling. In the dominance of covariance matrix based modelling, PLS modelling is becoming a new way of exploring relations, in particular for conditions where the items of the constructs often express a non-normal distribution (Hair Jr. et al., 2014). Therefore, using SEM modelling with a PLS algorithm in combination with an established UTAUT model enriches the relatively new yet very powerful PLS-SEM method. The results of the PLS-SEM method in this research demonstrates that other researchers could use this approach in diverse fields of study.
- In order to make the study more comprehensive, the research used mixed method. Additionally, in this research, to increase the authenticity of the outcome, the researcher has conducted a post-result validation process. Post validation is a relatively new approach in this kind of research, which included describing, demonstrating and explaining the results

to the focus groups of the study (principals, teachers, and students) and receiving their constructive criticism, and acceptance of the results. This method can critique the research outcomes obtained from the mixed approach and thus make the study more robust. The approach depicts the way in which researchers conducting in depth studies can validate their results with real world conditions, and can add new insight to the research. Further development of this approach would be beneficial for a wide spectrum of studies, in particular studies such as this, which use human subjects.

8.3 Limitations of the study

Careful design and a systematic process were used in the study to ensure there are as few errors as possible for the quantitative and qualitative methods and analysis. The researcher considered diversity in the sample selection in terms of geographic coverage and sample selection, while using a comprehensive analytical process to ensure the data were not misinterpreted and did in fact represent the reality of primary education in Saudi Arabia. However, like all other studies on human endeavour, this study was not free of limitations. Recognising these limitations also provides an opportunity to outline future directions for further research. The limitations of this study are discussed in this section.

The first limitation of this study is that the research failed to incorporate the response of the female primary school students in the sample of the student group. As stated in the sampling section of the methodology, access to female only schools was difficult with the school authorities not permitting the principle researcher to physically visit the female only schools to conduct the surveys and interviews. Due to Islamic regulations, and the female only schools environment, the researcher was not able to add any response from female students but acknowledges this would be another important facet of future research.

In this research, only the demand side of ICT in primary education has been investigated, that is, only the demand side of the schools, teachers and students have been critically judged and their behaviour modelled. The supply side of ICT in primary education in Saudi Arabia remains unexplored, and that is the second limitation of this study. Due to the lack of data integration from the supply side, such as the views of policy makers, and the administrators of the education ministry, the research was unable to comment on the potential for balancing the demand and supply of ICT in primary education or the education system in general. Although the requirements of the demand side, that is, the primary schools and their populations, allowed the researcher to offer specific suggestions for action from the supply side (the government policy makers), without quizzing administrators and policy makers, one cannot know how they view the situation or plan to promote the use of ICT in schools. Additionally, it may be due to this limitation that the models can explain less than 50% of the variance of ICT *behavioural intention* by the users.

Finally, the third limitation of this research is that it has used cross-sectional design (survey the target group at one time point). If it had a time series experimental design, the same variables could be tested in different years and the change over the years with the progression of ICT and its use in Saudi classrooms could be explored.

8.4 Future work

Based on the limitations discussed in the previous section there is some future work that could be explored immediately. First of all, female students from the female only primary schools should be included in the sample for future research. This would ensure that future research would capture the views of both female and male students. In addition to adding a female student sample, future research should consider the views and opinions of the supply side of ICT facilities, that is, future research needs to consider investigating the factors influencing the policy makers and administrators regarding providing ICT facilities at primary schools of Saudi Arabia. In this regard, the fiscal budget analysis, ICT equipment procurement and distribution, risk factors, and preferences of the policy makers require investigation.

Future research should try to involve the parents of the students in a comprehensive manner. The parents play a vital role in modifying the views of the children, and their support can really make a difference. More detailed research on parents' perceptions and support of ICT education within schools and for children is necessary. In future research, modelling the intention of the parents to encourage ICT use by children in Saudi Arabia can be explored.

An investigation could be conducted evaluating the reduction of *external barriers* and its impact on the *behavioural intention* and *actual use* of ICT. A study could be designed that implements professional development activities and the provision of adequate resources to particular teachers, principals and schools and evaluates whether this provision of ICT infrastructure assists in the teaching practices and the usage of ICT in primary schools.

Finally, longitudinal based research should be conducted to identify factors responsible for ICT *behavioural intention* change over a longer period of time, such as five or ten years. This design would allow the exploration of more details on the type of ICT use by principals, teachers and students over time, and it would also help to identify the effects of changes in technologies and social systems on ICT use behaviour and *actual use*.

8.5 Concluding remarks

The 21st century is the era of digital revolution, with massive investment in and usage of ICT in every aspect of our current civilization. From agriculture to sport, ICT has revolutionised the ways in which humans live their lives, including transforming the way people are educated. While developing nations are still lagging behind the pace of change spurred by ICT innovation in the developed nations, advanced use of ICT is emerging. However, the sophisticated use of ICTs in fields such as education remains aspirational. The use of ICT in the Saudi educational sector is far below the average in the developed world. More specifically, the primary education system in Saudi Arabia, has not had the benefits of ICT facilities properly introduced.

Attempts to use ICTs have been piecemeal and sporadic, and the research presented in this thesis investigated the reasons for the slow rate of ICT integration in Saudi primary schools in spite of the stated enthusiasm for improving Saudi education through innovation.

The current research investigated why Saudi primary schools were lagging so far behind in the usage of ICT Research of the integration of ICT in the Saudi secondary and tertiary education sectors has already indicated that the uptake of ICT has been slow. Very few researchers have considered the primary sector and the reasons why ICT facilities have not been introduced universally in primary schools, given that primary aged children are among the first wave of digital natives and should be quite adept at using ICTs for learning. This research explored the factors responsible for slow or low ICT use and integration in primary schools.

This study included an extensive primary data collection, quantitative modelling (SEM) and qualitative interview analysis to find the root causes of lower use of ICT at primary schools by principals, teachers and students. The research focused on exploring the factors that motivate the *behavioural intention* of the focus groups to use ICT at primary schools. Additionally, this study summarised all the results and made triangulation of results, from qualitative, quantitative and literature review findings, to establish valid reasons.

The research identified significant factors in detail and validated the research output in consultation with the focus groups. Through observations, and discussion with the focus groups, the research provided strategic guidelines to improve ICT facilities at primary schools. The research findings would help understand the reasons for the lower level of use of ICT facilities in the Saudi Arabian education system, and would help to take proper initiatives to have social reform strategies to integrate ICT more intensively in primary school education.

Appendices

A	**Ethics approval**
B	**Interview questions**
C	**Questionnaire, UTAUT with codes**
D	**Focus group presentations**
E	**Focus group questions**
F	**Focus group summaries**

Appendix A

Ethics approval

APPENDIX A

Flinders University and Southern Area Health Service

SOCIAL AND BEHAVIOURAL RESEARCH ETHICS COMMITTEE

Research Services Office, Union Building, Flinders University
GPO Box 2100, ADELAIDE SA 5001
Phone: (08) 8201 3116
Email: human.researchethics@flinders.edu.au

Project No.:	**6610**
Project Title:	An investigation of information technology usage in early education within Saudi Arabia
Principal Researcher:	Mr Sami Alshmrany
Email:	alsh0105@flinders.edu.au

Approval Date:	7 October 2014	Ethics Approval Expiry Date:	**31 October 2016**

The above proposed project has been **approved** on the basis of the information contained in the application, its attachments and the information subsequently provided with the addition of the following comment:

Additional information required following commencement of research:

1. Please ensure that copies of the correspondence requesting and granting permission to conduct the research from all companies to be involved are submitted to the Committee *on receipt.* Please ensure that the SBREC project number is included in the subject line of any permission emails forwarded to the Committee. Please note that data collection should not commence until the researcher has received the relevant permissions (item D8 and Conditional approval response – number 6).

RESPONSIBILITIES OF RESEARCHERS AND SUPERVISORS

1. Participant Documentation

Please note that it is the responsibility of researchers and supervisors, in the case of student projects, to ensure that:

- all participant documents are checked for spelling, grammatical, numbering and formatting errors. The Committee does not accept any responsibility for the above mentioned errors.
- the Flinders University logo is included on all participant documentation (e.g., letters of Introduction, information Sheets, consent forms, debriefing information and questionnaires – with the exception of purchased research tools) and the current Flinders University letterhead is included in the header of all letters of introduction. The Flinders University international logo/letterhead should be used and documentation should contain international dialling codes for all telephone and fax numbers listed for all research to be conducted overseas.
- the SBREC contact details, listed below, are included in the footer of all letters of introduction and information sheets.

This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project Number 'INSERT PROJECT No. here following approval'). 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 emailhuman.researchethics@flinders.edu.au.

2. Annual Progress / Final Reports

In order to comply with the monitoring requirements of the *National Statement on Ethical Conduct in Human Research (March 2007)* an annual progress report must be submitted each year on the **5 June** (approval anniversary date) for the duration of the ethics approval using the annual progress / final report pro forma. *Please retain this notice for reference when completing annual progress or final reports.*

If the project is completed *before* ethics approval has expired please ensure a final report is submitted immediately. If ethics approval for your project expires please submit either (1) a final report; or (2) an extension of time request and an annual report.

Your first report is due on **5 June 2014** or on completion of the project, whichever is the earliest.

3. Modifications to Project

Modifications to the project must not proceed until approval has been obtained from the Ethics Committee. Such matters include:

- proposed changes to the research protocol;
- proposed changes to participant recruitment methods;
- amendments to participant documentation and/or research tools;
- change of project title;
- extension of ethics approval expiry date; and
- changes to the research team (addition, removals, supervisor changes).

To notify the Committee of any proposed modifications to the project please submit a Modification Request Form to the Executive Officer. Download the form from the website every time a new modification request is submitted to ensure that the most recent form is used. Please note that extension of time requests should be submitted prior to the Ethics Approval Expiry Date listed on this notice.

Change of Contact Details

Please ensure that you notify the Committee if either your mailing or email address changes to ensure that correspondence relating to this project can be sent to you. A modification request is not required to change your contact details.

4. Adverse Events and/or Complaints

Researchers should advise the Executive Officer of the Ethics Committee on 08 8201-3116 or human.researchethics@flinders.edu.au immediately if:

- any complaints regarding the research are received;
- a serious or unexpected adverse event occurs that effects participants;
- an unforseen event occurs that may affect the ethical acceptability of the project.

Andrea Fiegert
Executive Officer
Social and Behavioural Research Ethics Committee

c.c Dr Robert Goodwin
Dr Denise Vries

Appendix B

Interview questions

Interview Questions for the principals

1. How many students you have in your school?
2. Howe many teachers?
3. What is the student to teacher ratio?
4. What is your concept about ICT and how it is related to education system?
5. Do you use any kind of ICT related devices (i.e. Laptop, Desktop, internet, cell phone)? If yes, to what level do you think you can operate these devices and facilities (efficiency)?
6. What kind of ICT infrastructure you have in school (i.e. Number of computers, Internet access, Number of digital projectors, school web-page) (Facilitating conditions)
7. What kind of programs do you use (i.e. MS office, Web-browser)?
8. If you have computers, internet access to your school, how do you use them to make your work? Do they have any effect on your performance (i.e. Increase your ability to work, manage the school administrative work more easily, prepare results, make communications) (performance expectancy)
9. Do you think use of ICT in primary education would increase the overall performance of school management? (performance expectancy)
10. To what extent, do you think ICT facilities are difficult to use for school works? (Effort Expectancy)
11. Do you think, use of ICT facilities in primary schools would be easy to operate? (Effort Expectancy)
12. How do you apply ICT in your role? (Effort Expectancy)
13. Does the school have any ICT strategies? What ICT strategy you have for your school?
14. Does your school have a specific policy or programme to prepare students for responsible internet behaviour? Can you provide more information about it?
15. Do you think Saudi Culture (i.e. Islamic laws, laws for women) do have effect on ICT usages among the teachers, students and you? (Culture)
16. In your ideas, is Saudi Culture ready to accept ICT in primary education?
17. Do you encourage your fellow teachers to use ICT in their teaching or do you promote use of ICT in general? If so, how do you encourage? (Social Influence)
18. Do you face any social influence (from school committee, parents) about the use of ICT facilities in school? (Social Influence)
19. Do you or any teachers of your school received ICT or ICT related training? Or how to use ICT in education?
20. If yes, please discuss in details, if no explain what you think, ICT training should include for principals and teacher.
21. Do you find barrier to use or implement ICT in primary education, at your schools? If yes please discuss in details.
22. In your suggestions, what ICT facilities or strategies should be present/implemented to make the use of ICT easy in the classroom?

Interview Questions for the students

1. Which class do you study now? And How many years you are studying in this school?
2. What is your understanding about ICT, computer and internet and how it is related to your school and education?
3. Do you use any kind of ICT related devices (i.e. Laptop, Desktop, internet, cell phone)? If yes, to what level do you think you can operate these devices and facilities (efficiency)?
4. If you used ICT facilities previously for any reason, please do explain of using these facilities?
5. If you ever used ICT facilities how to you enjoy using these?
6. Do you have ICT facilities in your classes?
7. If you have computers, internet access to your school, how do you use them for study?
8. Do you think use of computers and ICT facilities in general can have any effect on your performance (i.e. Increase your ability to learn, manage help understanding better, can do homework easily) (performance expectancy)
9. Do you think use of ICT at your level would increase your performance as student (i.e. Increase your grade, or Increase you other capabilities to use ICT)? (performance expectancy)
10. To what extent, do you think ICT facilities are difficult to use for you? (Effort Expectancy)
11. Do you think, use of ICT facilities are not that hard to learn or use if you want to use? (Effort Expectancy)
12. Do you use computers in any of your class, or at home to make your study more interesting? (Effort Expectancy)
13. Do you feel encouraged by your teachers, relatives, or friends to use ICT in your study or do you encourage others to use ICT to study? (Social Influence)
14. Do you face any social obstacles to use ICT for your study, about the use of ICT facilities in class? (Social Influence)
15. Do you think if ICT facilities are introduced in your primary schools, it would be enjoyable to use?
16. Do you like to use computers, internet of other ICT facilities in your study? (behavioural intention)

Interview Questions for the teachers

1. How Long you are teaching?
2. What Subjects do you teach?
3. Which classes (i.e. Class 5) and how many classes do you usually have to take per day?
4. What is your concept about ICT and how it is related to education system?
5. Do you use any kind of ICT related devices (i.e. Laptop, Desktop, internet, cell phone)? If yes, to what level do you think you can operate these devices and facilities (efficiency)?
6. If you used ICT facilities, please do explain your experience of using them for education.
7. Do you get ICT facilities in your classes?
8. If you have computers, internet access to your school, how do you use them to make your work? Do they have any effect on your performance (i.e. Increase your ability to work, manage the school administrative work more easily, prepare results, make communications) (performance expectancy)
9. Do you think use of ICT in primary education would increase the overall teaching performance? (performance expectancy)
10. To what extent, do you think ICT facilities are difficult to operate in class or administrative activities? (Effort Expectancy)
11. Do you think, use of ICT facilities are not that hard to learn or use? (Effort Expectancy)
12. How do you apply ICT to prepare lectures or search new information? (Effort Expectancy)
13. Do you think Saudi Culture (i.e. Islamic laws, laws for women) do have effect on ICT usages among the teachers, students and you? (Culture)
14. Do you think, Islamic rules may have influence over the use of ICT facilities in general?
15. In your ideas, is Saudi Culture ready to accept ICT in primary education?
16. Do you feel encouraged by your fellow teachers to use ICT in their teaching or do you encourage others to use ICT facilities? (Social Influence)
17. Do you face any social influence (from school committee, parents) about the use of ICT facilities in class? (Social Influence)
18. Do you or any teachers of your school received ICT or ICT related training? Or how to use ICT in education?
19. If yes, please discuss in details, if no explain what you think, ICT training should include for principals and teacher
20. Do you find barrier to use ICT in primary education, at your schools? If yes please discuss in details.
21. In your suggestions, what ICT facilities or strategies should be present/implemented to make the use of ICT easy in the classroom?

Appendix C

Questionnaire
UTAUT with codes

Section 1: Personal Information

1. What city do you currently principle in? :

2. Please state the name of your school:
……………………………………………………………………………………………

3. Please state your gender:
   [ ] Male
   [ ] Female

4. What is your age: ___________________________

5. What is your highest level of tertiary education?

   [ ] Lecturer - Bachelors' degree
   [ ] Instructor - Office Management Diploma
   [ ] Instructor - Master's degree
   [ ] Professor - Doctoral degree

School information:

6. What is the total number of students this school year (2014) in your school?

7. In your school this school year (2013), how many of the devices below are used for educational purposes?

   Desktop computer without internet access ....

   Desktop computer with internet access ....

   Non-internet-connected laptop, tablet PC, netbook or mini notebook ....

   Internet-connected laptop, tablet PC, netbook or mini notebook ....

   Digital reader (portable device to read books, newspapers, etc. on screen) ....

   Mobile phone provided by the school ....

   Interactive whiteboard ....

   Digital camera ....

   Data projector ....

8. Approximately, what proportion of this equipment (computers, interactive white boards, laptops, data projectors) is fully operational this school year?
   [ ] Less than 50%
   [ ] 50 to 75%
   [ ] 76 to 90%
   [ ] More than 90%

9. Who maintains the ICT equipment in your school?

[ ] The school's own staff
[ ] An external company contracted by the school
[ ] An external unit arranged by educational authorities (at local, regional level, etc.)
[ ] Other

10. .Do you use your computer for any of the following?

	Yes	No
School management related tasks (budgeting, planning, timetabling, etc.)	[ ]	[ ]
Searching for information	[ ]	[ ]
Making presentations	[ ]	[ ]
Communicating online with teachers (email, web site announcements, etc.)	[ ]	[ ]
Communicating online with parents (email, web site announcements, etc.)	[ ]	[ ]
Communicating by emails with educational authorities	[ ]	[ ]

Section 2: Information About Your Electronic Devices and their usage

11. How long have you had a computer at home?

[ ] Less than a year
[ ] 1-2 years
[ ] 2-5 years
[ ] 5+ years

12. What is the purpose of using your home computer? (You can choose more than one)

[ ] The Internet browsing
[ ] Chatting
[ ] Email
[ ] Games
[ ] Design
[ ] Word-processing
[ ] Programming
[ ] Others

13. Your experience using the computer is:

[ ] 1-5 years of experience
[ ] 6-10 years of experience
[ ] 11-15 years of experience
[ ] 16 or more years of experience

14. How many hours do you use the computers a week at school?
[ ] 0 hour
[ ] 4 hours
[ ] 6 hours
[ ] more than 6 hours

15. How many hours do you use the computers a week at home?
[ ] 0 hour
[ ] 4 hours
[ ] 6 hours
[ ] more than 6 hours

Section 3: ICT use in Primary school

16. Factors related to ICT use: Please choose the degree to which you agree with the following statements. There is no right or wrong answer. Thus, please give your real opinion.

Strongly disagree	**Disagree**	**Neither disagree nor Agree**	**Agree**	**Strongly agree**
1	2	3	4	5

Construct	Code	Measurement instrument	Scale
Effort expectancy	EE1	My interaction with the ICT system (i.e. Class room software, projector) would be clear and understandable	
	EE2	It would be easy for me and the teachers to become skillful at using the ICT for teaching	
	EE3	I would find the ICT easy to use in school administration	
	EE4	Learning how to use ICT system does not require a lot effort	
	EE5	Using ICT systems in school does not involve too much time doing mechanical operations (e.g. school management works, admission works)	
Performance expectancy	PE1	ICT technologies are useful in increasing the efficiency of the teacher and the officials	
	PE2	ICT technology enables me to accomplish my tasks more quickly	
	PE3	Using the ICT increases my productivity (i.e. communication, processing school activities)	
	PE4	If I use and encourage the system, I will increase my chances of getting a raise (i.e. Would give better salary)	
	PE5	ICT in class would enable teacher to make the lesson interesting and increase their acceptance in the class	
	PE6	ICT would help me to work actively in different matters using internet and school software	
Social Influence	SI1	People who influence my behavior (i.e. Friends, Family) think that I should use the system	
	SI2	People who are important (i.e. Parents, teachers, students) to me think that I should use and adapt more ICT system in the school	
	SI3	In general, the school authority has supported the use of ICT	
	SI4	My colleagues are frequently using ICT for the classes and school related activities	
	SI5	Educational authoritie (i.e. Ministry of education) encouraged me to use ICT in school	
Facilitating Conditions (FC)	FC1	The school has enough ICT resources including hardware and software for officials and teachers	
	FC2	The ICT system get continued technical support from school management and educational authorities	
	FC3	The ICT system in class room is compatible with other systems we use (in office)	
	FC4	I get trainings to use ICT in primary school teaching purpose as per requirement	
	FC5	A specific person/group is available for assistance with any difficulties related with ICT use	
	FC6	In general, I am satisfied with the facilitating conditions	

Behavioral Intention to Use (BIU)	BII1	I intend to use ICT in primary school teaching in my school when it becomes available in my school	
	BII2	I intend to use ICT in teaching as often as possible	
	BII3	I intend to use ICT in teaching on a regular basis in upcoming time	
	BII4	I intend to recommend strongly to others to use ICT in teaching	

17. How detrimental are the following barriers to your present and future use of the ICT in primary school?

Strongly disagree	Disagree	Neither disagree nor Agree	Agree	Strongly agree
1	2	3	4	5

	Scale
Lack of resources (educational software)	
Lack of policy support and funds from the ministry of education	
Lack of access to the Internet	
Lack of professional development opportunities on using ICT in teaching	
Lack of support from parents	
Lack of leadership	
Lack of wareness among teachers, parents, committee and even students	
Lack of technical support in and out side the class	

18. **Saudi Culatural Factors**

Please choose the degree to which you agree with the following statements. There is no right or wrong answer. Thus, please give your real opinion.

Question	**Scale**
Managers should be careful not to ask the opinions of subordinates too frequently; otherwise, the manager might appear to be weak and incompetent	
Managers should make most decisions without consulting subordinates	
Employees should not question their manager's decisions	
Managers should not ask subordinates for advice, because they might appear less powerful	
Individual rewards are not as important as group welfare	
Group success is more important than individual success	
Working within a team is better than working alone	
It is preferable to have a man in a high-level position rather than a woman	
Men usually solve problems with logical analysis	
Women usually solve problems with intuition	
Solving organisational problems usually requires an active forcible approach that is typical of men	
It is important to have job requirements and instructions spelt out in detail so that people always know what they are expected to do	
Rules and regulation are important because they inform workers what the organisation expects of them	
Order and structure are very important in a work environment.	
Working in a structured environment is better than working (rules and regulations) in an unstructured work environment.	

19. Actual Use of ICT in primary school class rooms in Saudi Arabia

Did Not use	1 Lesson	2-5 Lesssons	6-9 lessons	More than 10 lesson
1	2	3	4	5

	Answer
On an averegae how many lessons did you use ICT in your teaching in a month?	

20. On an avareg how many hours you work in ICT system of the school to perfrom your activities:
[ ] 0 hour
[ ] 4 hours
[ ] 6 hours
[ ] 6-8 hours
[ ] more than 8 hours

Section 1: Personal Information

1. What city do you currently study in? :

2. Please state the name of your school:

………………………………………………………………………………………………

3. Please state what level (year) you are currently in:

4. Please state your gender:

[ ] Male
[ ] Female

5. What is your age: ___________________________

6. School year

□ 1
□ 2
□ 3
□ 4
□ 5

Section 2: Information About Your Electronic Devices and their useage

7. Do you have a personal computer at home?

[ ] NO
[ ] Desktop
[ ] Laptop
[ ] Smartphone
[ ] Tablet computers

8. How long have you had a computer at home?

[ ] Less than a year
[ ] 1-2 years
[ ] 2-5 years
[ ] 5+ years

9. What is the purpose of using your home computer? (You can choose more than one)

[ ] The Internet browsing
[ ] Chatting
[ ] Email
[ ] Games
[ ] Design
[ ] Word-processing
[ ] Programming
[ ] Others

10. Do you have computer access in your classroom?

[ ] Yes
[ ] No

11. Do you have access to the Internet in your classroom?

    [ ] Yes
    [ ] No

12. Please indicate whether you use a computer? Please tick as many as apply

    [ ] I use a computer at home
    [ ] I use a computer at school
    [ ] I have access to a computer that I use away from School/Home
    [ ] I do not use a computer

13. How many hours do you use the computers a week at school?
    [ ] 0 hour
    [ ] 4 hours
    [ ] 6 hours
    [ ] more than 6 hours

14. How many hours do you use the computers a week at home?
    [ ] 0 hour
    [ ] 4 hours
    [ ] 6 hours
    [ ] more than 6 hours

15. If you use the Internet, please indicate the hours for using Internet I a week at class and home?

    [ ] 25+ hours
    [ ] 20-25 hours
    [ ] 10-20 hours
    [ ] 5-10 hours
    [ ] 0 hours

Section 3: ICT use in Primary school

16. Factors related to ICT use: Please choose the degree to which you agree with the following statements. There is no right or wrong answer. Thus, please give your real opinion.

Strongly disagree	**Disagree**	**Neither disagree nor Agree**	**Agree**	**Strongly agree**
1	2	3	4	5

Construct	Code	Measurement instrument	Scale
Effort expectancy	EE1	My interaction with the ICT system (i.e. Class room software, computers) would be clear and understandable	
	EE2	It would be easy for me to become skillful at using the ICT for learning	
	EE3	I would find the ICT easy to use	
	EE4	Learning how to use ICT system does not require a lot effort	
	EE5	Using ICT systems in class does not involve too much time doing mechanical operations	
Performance expectancy	PE1	ICT technologies are useful for the courses	
	PE2	I could improve my learning performance and productivity by using ICT (i.e. Computer, Internet)	

	PE3	Using the system will enable me to accomplish tasks (i.e. Home work, quiz, exams) more quickly	
	PE4	If I use the system, I will increase my chances of getting a high grade	
	PE5	ICT in class would help to make lesson interesting	
	PE6	ICT would help me to get connected with the teachers and friends efficiently to work as group for studies	
Social Influence	SI1	People who influence my behavior (i.e. Friends, Family) think that I should learn and use ICT for my learning process	
	SI2	People who are important (i.e. teachers, principles) to me think that I should know to use ICT for self understanding and better learning	
	SI3	In general, the school authority (i.e. teachers, principles) has supported the use of ICT for my study	
	SI4	My school friends, students from other schools are frequently using ICT for their studies and courses	
	SI5	My teachers encouraged me to use ICT for my study	
Facilitating Conditions (FC)	FC1	The school has enough ICT resources including hardware and software for the students	
	FC2	The students are provided with continued technical supports in and outside class	
	FC3	The ICT system in class room is compatible with other systems I use (in home)	
	FC4	I get general ideas how to use ICT for my studies at class and home (i.e. Familiarity with educational software, searching internet)	
	FC5	A specific person/group is available for assistance with any difficulties related with ICT use	
	FC6	In general, I am satisfied with the facilitating conditions	
Computer literacy and self efficiency	CS1	I feel confident while learning through ICT in classroom	
	CS2	I feel confident that I can select and use educational software for my study and would understand when the teacher use them	
	CS3	I feel confident that I would learn the use of ICT in my studies quickly due to my basic knowledge of computer	
	CS4	I feel confident that I can handle minor problems in using the system and can solve problems to run the system efficiently	
Behavioral Intention to Use (BIU)	BII1	I intend to use ICT for my courses to learn at home and school	
	BII2	I intend to use ICT in learning as often as possible	
	BII3	I intend to use ICT in learning on a regular basis in upcoming time	
	BII4	I intend to recommend strongly to others classmates to use ICT for studies	

17. Actual Use of ICT in primary school class rooms in Saudi Arabia

Did Not use	1 Lesson	2-5 Lesssons	6-9 lessons	More than 10 lesson
1	2	3	4	5

	Answer
How many lessons did you use ICT in your learning in the week 1&2 of the last month?	
How many lessons did you use ICT in your learning in the week 3&4 of the last month?	
On an averegae how many lessons you get help to learn using ICT in a month?	

Section 1: Personal Information

1. What city do you currently teach in? :

2. Please state the name of your school:

………………………………………………………………………………………

3. Please indicate topics that you are teaching: (select more than one if appropriate)

[ ] All subjects or almost (early stages of compulsory education)
[ ] Language (mother tongue, not foreign languages)
[ ] Mathematics
[ ] Sciences
[ ] computing
[ ] Geography
[ ] Religions studies
[ ] History
[ ] Other, if other please describe: ……………………………..

---

4. Please state your gender:

[ ] Male
[ ] Female

5. What is your age: ___________________________

6. What is your highest level of tertiary education?

    [ ] Lecturer - Bachelors' degree
    [ ] Instructor - Office Management Diploma
    [ ] Instructor - Master's degree
    [ ] Professor - Doctoral degree

7. When you use computers during class teaching in front of the students, which equipment is available?
   Tick one box for each row

	Yes	No
Students are equipped with computers and/or Internet	[ ]	[ ]
Only the teacher uses a computer and/or Internet	[ ]	[ ]
Both, teacher and students use computers and/or Internet	[ ]	[ ]
Interactive white board	[ ]	[ ]
Computer projection screen	[ ]	[ ]

8. Has the school provided students of the main class with a laptop (or tablet PC, netbook, notebook) for their own use this school year (1 to 1 type of initiatives)?
   [ ] Yes
   [ ] No

9. Are the main class students allowed to use their personally owned devices listed below at school for learning?

	Yes	No
Laptops, netbook, notebook	[ ]	[ ]
Tablets	[ ]	[ ]
Mobile or smartphone	[ ]	[ ]

10. Do you share with your colleagues, the school head and other staff, the same vision about integrating ICT in teaching and learning at your school?

    [ ] Yes
    [ ] No

Section 2: Information About Your Electronic Devices

11. How long have you had a computer at home?

[ ] Less than a year
[ ] 1-2 years
[ ] 2-5 years
[ ] 5+ years

12. What is the purpose of using your home computer? (You can choose more than one)

[ ] The Internet browsing
[ ] Chatting
[ ] Email
[ ] Games
[ ] Design
[ ] Word-processing
[ ] Programming
[ ] Others

13. Do you have computer access in your classroom?

    [ ] Yes
    [ ] No

14. Do you have access to the Internet in your classroom?

    [ ] Yes
    [ ] No

15. Your experience using the computer is:

[ ] 1-5 years of experience
[ ] 6-10 years of experience
[ ] 11-15 years of experience
[ ] 16 or more years of experience

Section 3: Information About Your Electronic Devices

16. How many hours do you use the computers a week at school?
    [ ] 0 hour
    [ ] 4 hours
    [ ] 6 hours
    [ ] more than 6 hours

17. How many hours do you use the computers a week at home?
    [ ] 0 hour
    [ ] 4 hours
    [ ] 6 hours
    [ ] more than 6 hours

18. If you use the Internet, please indicate the frequency for using computer in the class to assist your teaching?

    [ ] 40+ hours
    [ ] 30-39 hours
    [ ] 20-29 hours
    [ ] 10-19 hours
    [ ] 0 hours

<u>Section 4: ICT use in Primary school</u>

19. Factors related to ICT use: Please choose the degree to which you agree with the following statements. There is no right or wrong answer. Thus, please give your real opinion.

Strongly disagree	**Disagree**	**Neither disagree nor Agree**	**Agree**	**Strongly agree**
1	2	3	4	5

Construct	Code	Measurement instrument	Scale
Effort expectancy	EE1	My interaction with the ICT system (i.e. Class room software, projector) would be clear and understandable	
	EE2	It would be easy for me to become skillful at using the ICT for teaching	
	EE3	I would find the ICT easy to use	
	EE4	Learning how to use ICT system does not require a lot effort	
	EE5	Using ICT systems in class does not involve too much time doing mechanical operations (e.g. Digital lecture preparation, class projector adjustment)	
Performance expectancy	PE1	ICT technologies are useful in my teaching	
	PE2	ICT technology enables me to accomplish my tasks more quickly	
	PE3	Using the ICT increases my productivity (i.e. collect information quickly, make multimedia presentation)	
	PE4	If I use the system, I will increase my chances of getting a raise (i.e. Would give better salary)	
	PE5	ICT in class would enable me to make the lesson interesting and increase my acceptance in the class	
	PE6	ICT would help me to give and take homework and examination more efficiently using internet and school software	
Social Influence	SI1	People who influence my behavior (i.e. Friends, Family) think that I should use the system	
	SI2	People who are important (i.e. Parents, students) to me think that I should use the system	
	SI3	In general, the school authority has supported the use of ICT	
	SI4	My colleagues are frequently using ICT for the classes and school related activities	
	SI5	My principle encouraged me to use ICT in class	
Facilitating Conditions (FC)	FC1	The school has enough ICT resources including hardware and software for me	
	FC2	I am provided with continued technical support	
	FC3	The ICT system in class room is compatible with other systems I use (in home or office)	

	FC4	I get trainings to use ICT in primary school teaching purpose as per requirement	
	FC5	A specific person/group is available for assistance with any difficulties related with ICT use	
	FC6	In general, I am satisfied with the facilitating conditions	
System Flexibility (SQ)	SQ1	The ICT system of the school is easily available	
	SQ2	The ICT system of the school is reliable	
	SQ3	The ICT system of the school is adaptable	
	SQ4	Response time of ICT system of the school is acceptable due to the functions, speed, features, contents, interaction capability of the technology	
	SQ5	In general, I am satisfied with the system quality of ICT of this school	
Computer literacy and self efficiency	CS1	I feel confident that I can evaluate appropriately students' activities and tasks using ICT systems	
	CS2	I feel confident that I can select and use educational software for a defined task	
	CS3	I feel confident that I can teach students how to locate, retrieve, and retain content-related information from different sources	
	CS4	I feel confident that I can handle minor problems in using the system and can solve problems to run the system efficiently	
Behavioral Intention to Use (BIU)	BII1	I intend to use ICT in primary school teaching in my school when it becomes available in my school	
	BII2	I intend to use ICT in teaching as often as possible	
	BII3	I intend to use ICT in teaching on a regular basis in upcoming time	
	BII4	I intend to recommend strongly to others to use ICT in teaching	

20. How detrimental are the following barriers to your present and future use of the ICT in primary school?

Strongly disagree	Disagree	Neither disagree nor Agree	Agree	Strongly agree
1	2	3	4	5

	Scale
Lack of resources (educational software)	
There is not enough time in class to implement technology-based lessons	
Lack of access to the Internet	
Lack of professional development opportunities on using ICT in teaching	
Lack of support from school administrators, parents, or other teachers	
Lack of leadership	
Lack of using ICT to measure student learning through high-stakes examinations	
Lack of technical support in and out side the class	

21. **Saudi Culatural Factors**

Please choose the degree to which you agree with the following statements. There is no right or wrong answer. Thus, please give your real opinion.

Strongly disagree	Disagree	Neither disagree nor Agree	Agree	Strongly agree
1	2	3	4	5

Question	**Scale**
Managers should be careful not to ask the opinions of subordinates too frequently; otherwise, the manager might appear to be weak and incompetent	
Managers should make most decisions without consulting subordinates	
Employees should not question their manager's decisions	
Managers should not ask subordinates for advice, because they might appear less powerful	
Individual rewards are not as important as group welfare	
Group success is more important than individual success	
Working within a team is better than working alone	
It is preferable to have a man in a high-level position rather than a woman	
Men usually solve problems with logical analysis	
Women usually solve problems with intuition	
Solving organisational problems usually requires an active forcible approach that is typical of men	
It is important to have job requirements and instructions spelt out in detail so that people always know what they are expected to do	
Rules and regulation are important because they inform workers what the organisation expects of them	
Order and structure are very important in a work environment.	
Working in a structured environment is better than working (rules and regulations) in an unstructured work environment.	

22. Actual Use of ICT in primary school class rooms in Saudi Arabia

Did Not use	1 Lesson	2-5 Lesssons	6-9 lessons	More than 10 lesson
1	2	3	4	5

	Answer
How many lessons did you use ICT in your teaching in the week 1&2 of the last month?	
How many lessons did you use ICT in your teaching in the week 3&4 of the last month?	
On an averegae how many lessons did you use ICT in your teaching in a month?	

Appendix D

Focus group presentations

ICT in primary education: A case study of Saudi Arabia

Workshop and Focus group discussion to validate research results and get recommendations. (Group: principal)

By

Sami Alshmrany

Introduction

- **Information and Communication Technology (ICT)** has advanced the development process by integrating technologies in communication system.
- Integration of ICT in education system **ensures competence with modern technology** and thus leads to further advancement of development process (Kozma; 2008).
- ICT offers a good opportunity for teachers to **participate fully** in the learning process (Coupe, 2004).

Introduction

- ICT cannot solve the problems in education system, but rather can provide **alternative solutions** to the obstacles encountered in the traditional educational system by providing education and knowledge in a wider reach (Watson, 2001; Coupe, 2004).
- The use of ICT offers an **opportunity for the children** to change the way they are acquiring information, such as constructive learning environment, i.e. organize the information and construct a meaning from that information (Skryabin et al., 2015).

Methodology – What I Did?

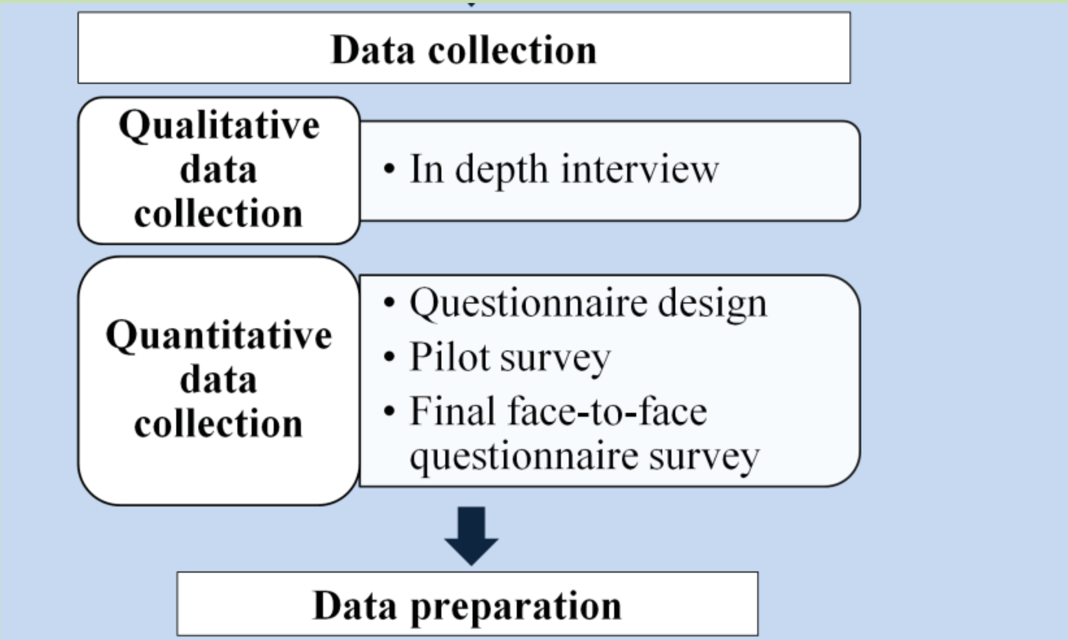
- **<u>Stage 1:</u>** Developing research background and framework

What has been identified:

- **Why ICT not been used?**
- **What are the difficulties at present?**
- **Who are involved in using ICT at primary schools?**
- **What are the potentials of using ICT at primary level?**

Methodology – What I Did?

- **Stage 2:** Data collection and processing



How it worked?

➢Collected the views of **primary school principals, teachers, and students?** (Target groups)

➢Collected in **three major cities** (Cover major geographic variation)

➢Do interviews (understand what people feel, talked with **10 principals, 10 teachers and 10 students**)

➢Questionnaire survey (to measure different issues related to use of ICT at primary schools)

➢Collected responses of **40 principals, 170 teachers, 500 students** (used proper sampling)

Methodology – What I Did?

- **Stage 3:** Data analysis and dissertation preparation

Data analysis

Qualitative data analysis	Quantitative data analysis
• Interview analysis using Hermeneutic cycle	• Descriptive data analysis • CFA • Reliability and validity • PLS-SEM • Evaluation of structure model • Hypothesis testing

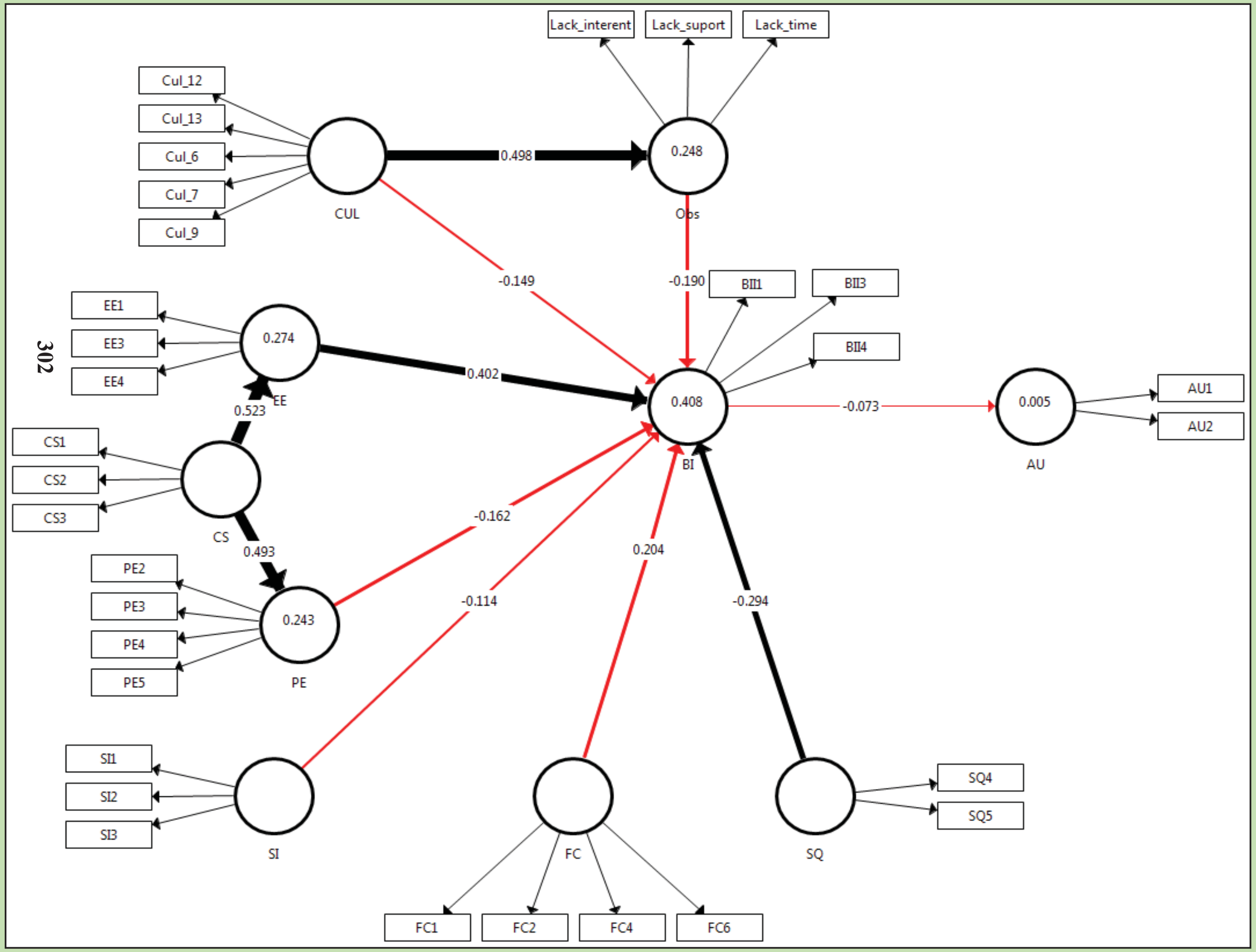
How get the results:

- Make rigorous analysis
- Ensure validity and reliability
- Make results cross-referenced
- Used multiple methods
- Make discussion about this results

What are the factors?

Factors I considered? For Principals	What are their Impact on ICT at primary schools
Service Quality (SQ)	**Important**
Facilitating Conditions (FC)	Not important
Social Influence (SI)	Not important
Performance Expectancy (PE)	Not important
Computer literacy and literacy and self efficiency (CS)	**Important**
Effort Expectancy (EE)	**Important**
Cultural Factors (CF)	Not important
Obstacles (Obs.)	Not important

The results I got: Model to explore the factors influence principals intention to use ICT



Model Result shows the important and unimportant factors, that influence the behavior.

- ***Red arrows not important***
- ***Black arrows important***

Factors influence the principals intention to use ICT

	Description
Service Quality (SQ)	The ICT system of the school is reliable
	The ICT system of the school is adaptable
	Response time of ICT system of the school is acceptable due to the functions, speed, features, contents, interaction capability of the technology
	In general, I am satisfied with the system quality of ICT of this school
Effort Expectancy (EE)	My interaction with the ICT system (i.e. Class room software, projector) would be clear and understandable
	It would be easy for me to become skillful at using the ICT for teaching
	I would find the ICT easy to use
	Learning how to use ICT system does not require a lot effort
	Using ICT systems in class does not involve too much time doing mechanical operations (e.g. Digital lecture preparation, class projector adjustment)

Factors influence the principals intention to use ICT

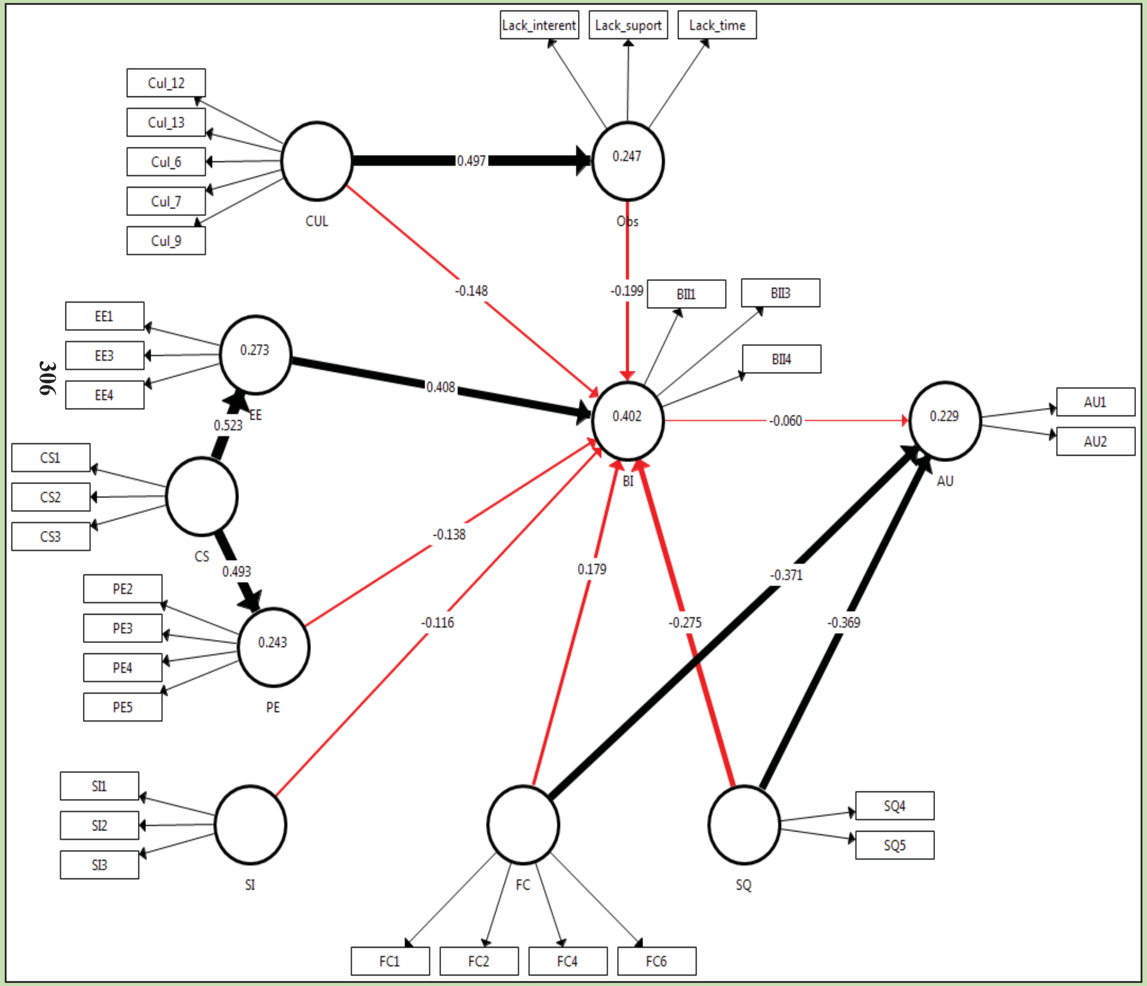
Behavioral Intention to Use (BIU)	I intend to use ICT in primary school teaching in my school when it becomes available in my school
	I intend to use ICT in teaching as often as possible
	I intend to use ICT in teaching on a regular basis in upcoming time
	I intend to recommend strongly to others to use ICT in teaching
Computer literacy and self efficiency	I feel confident that I can evaluate appropriately students' activities and tasks using ICT systems
	I feel confident that I can select and use educational software for a defined task
	I feel confident that I can teach students how to locate, retrieve, and retain content-related information from different sources

Actual Use Factors

BUT

- Previous factors showed, what influence the behavior of the **principals** to use ICT
- But **they are not directly related to actual use**
- **Actual Use is very low**

Actual Use dependent on the following factors!!!



Factors	Impact
Service Quality (SQ)	Important
Facilitating Conditions (FC)	Important

So, Let us discuss

- Do you agree with the results?
- Do you disagree with the results?
- Discuss in details about the reasons

ICT in primary education: A case study of Saudi Arabia

Workshop and Focus group discussion to validate research results and get recommendations. (Group: teachers)

By

Sami Alshmrany

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- The use of ICT offers an **opportunity for the children** to change the way they are acquiring information, such as constructive learning environment, i.e. organize the information and construct a meaning from that information (Skryabin et al., 2015).

Methodology – What I Did?

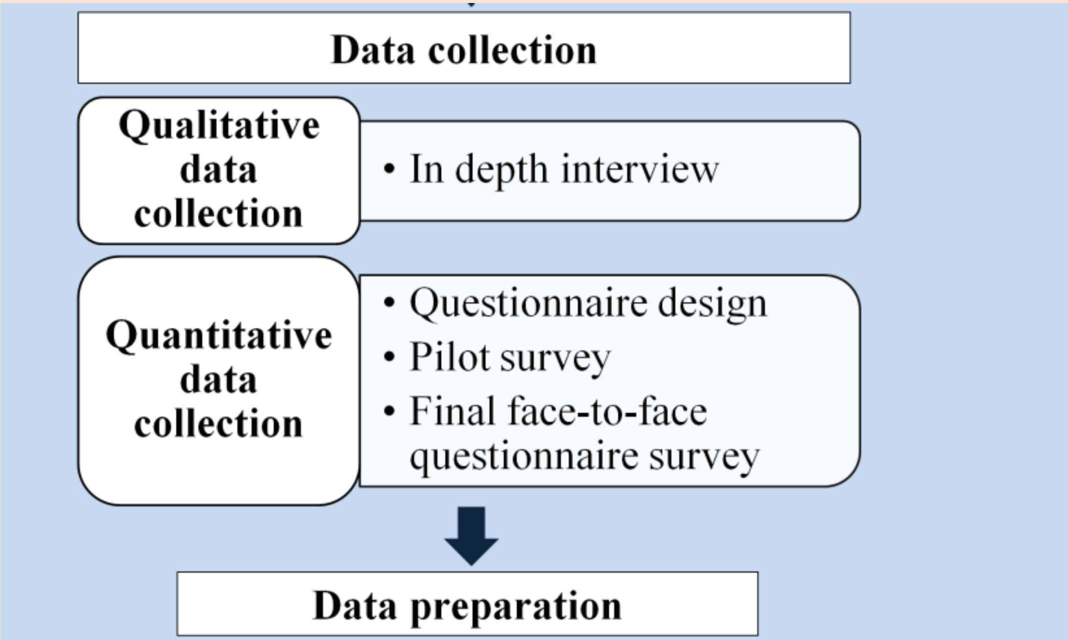
- **Stage 1:** Developing research background and framework

What has been identified:

- **Why ICT not been used?**
- **What are the difficulties at present?**
- **Who are involved in using ICT at primary schools?**
- **What are the potentials of using ICT at primary level?**

Methodology – What I Did?

- **<u>Stage 2:</u>** Data collection and processing



How it worked?

➢Collected the views of **primary school principals, teachers, and students?** (Target groups)

➢Collected in **three major cities** (Cover major geographic variation)

➢Do interviews (understand what people feel, talked with **10 principals, 10 teachers and 10 students**)

➢Questionnaire survey (to measure different issues related to use of ICT at primary schools)

➢Collected responses of **40 principals, 170 teachers, 500 students** (used proper sampling)

Methodology – What I Did?

- **Stage 3:** Data analysis and dissertation preparation

Data analysis	
Qualitative data analysis	**Quantitative data analysis**
• Interview analysis using Hermeneutic cycle	• Descriptive data analysis • CFA • Reliability and validity • PLS-SEM • Evaluation of structure model • Hypothesis testing

How get the results:

➢Make rigorous analysis

➢Ensure validity and reliability

➢Make results cross-referenced

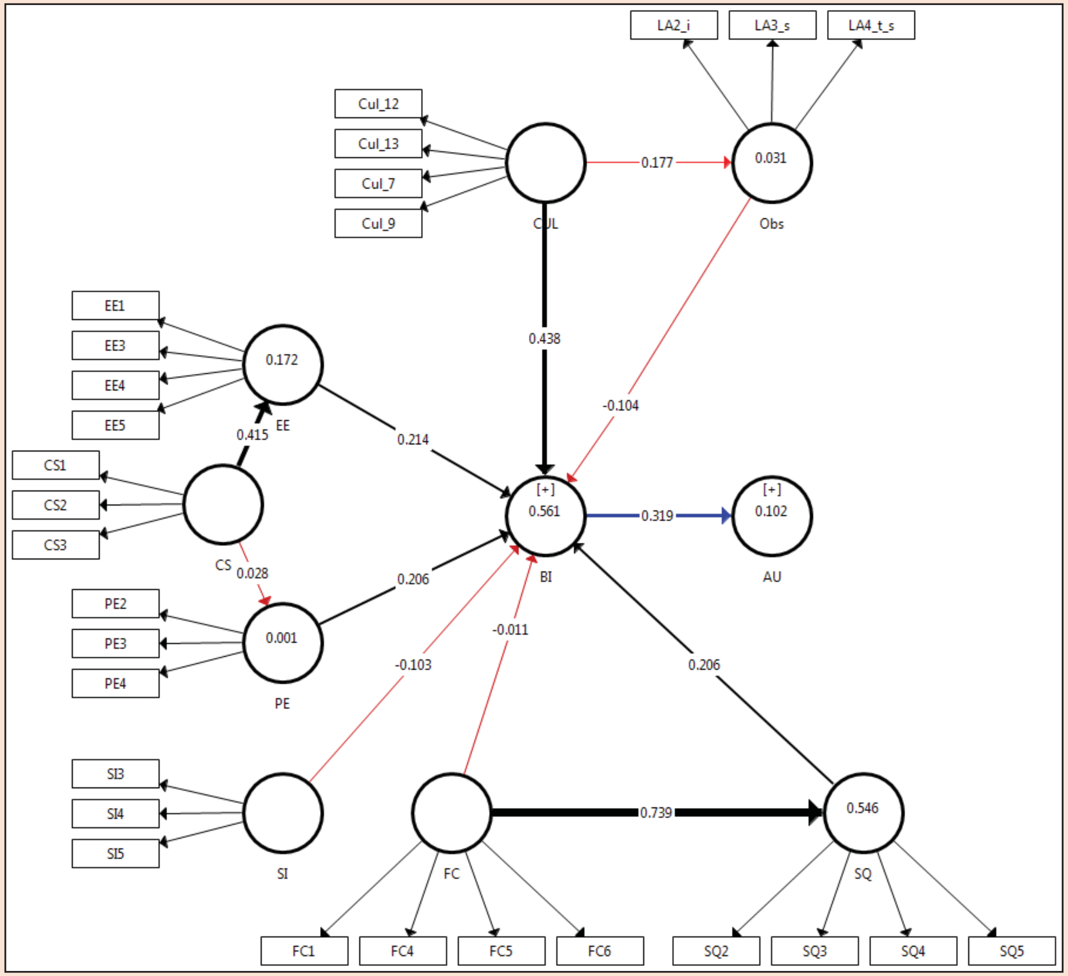
➢Used multiple methods

➢Make discussion about this results

What are the factors?

Factors I considered? For teachers.	What are their Impact on ICT at primary schools
Service Quality (SQ)	Important
Facilitating Conditions (FC)	Not important
Social Influence (SI)	Not important
Performance Expectancy (PE)	Important
Computer literacy and literacy and self efficiency (CS)	Important for effort expectancy
Effort Expectancy (EE)	Important
Cultural Factors (CUL)	Important
Obstacles (Obs.)	Not important

The results I got: Model to explore the factors influence teachers intention to use ICT



Model Result shows the important and unimportant factors, that influence the behavior.

- ➢ *Red arrows not important*
- ➢ *Black and blue arrows important*

Factors influence the teachers intention to use ICT

	Description
Service Quality (SQ)	The ICT system of the school is reliable
	The ICT system of the school is adaptable
	Response time of ICT system of the school is acceptable due to the functions, speed, features, contents, interaction capability of the technology
	In general, I am satisfied with the system quality of ICT of this school
Effort Expectancy (EE)	My interaction with the ICT system (i.e. Class room software, projector) would be clear and understandable
	It would be easy for me to become skillful at using the ICT for teaching
	I would find the ICT easy to use
	Learning how to use ICT system does not require a lot effort
	Using ICT systems in class does not involve too much time doing mechanical operations (e.g. Digital lecture preparation, class projector adjustment)

Factors influence the teachers intention to use ICT

Behavioral Intention to Use (BIU)	I intend to use ICT in primary school teaching in my school when it becomes available in my school
	I intend to use ICT in teaching as often as possible
	I intend to use ICT in teaching on a regular basis in upcoming time
	I intend to recommend strongly to others to use ICT in teaching
Performance Expectancy (PE)	ICT technologies are useful in my teaching
	ICT technology enables me to accomplish my tasks more quickly
	Using the ICT increases my productivity (i.e. collect information quickly, make multimedia presentation)
	If I use the system, I will increase my chances of getting a raise (i.e. Would give better salary)
	ICT in class would enable me to make the lesson interesting and increase my acceptance in the class
	ICT would help me to give and take homework and examination more efficiently using internet and school software

Factors influence the teachers intention to use ICT

Cultural Factors (CUL)	ICT technologies are useful in my teaching
	ICT technology enables me to accomplish my tasks more quickly
	Using the ICT increases my productivity (i.e. collect information quickly, make multimedia presentation)
	If I use the system, I will increase my chances of getting a raise (i.e. Would give better salary)
	ICT in class would enable me to make the lesson interesting and increase my acceptance in the class
	ICT would help me to give and take homework and examination more efficiently using internet and school software
	ICT technologies are useful in my teaching
	ICT technology enables me to accomplish my tasks more quickly

Factors influence the teachers intention to use ICT

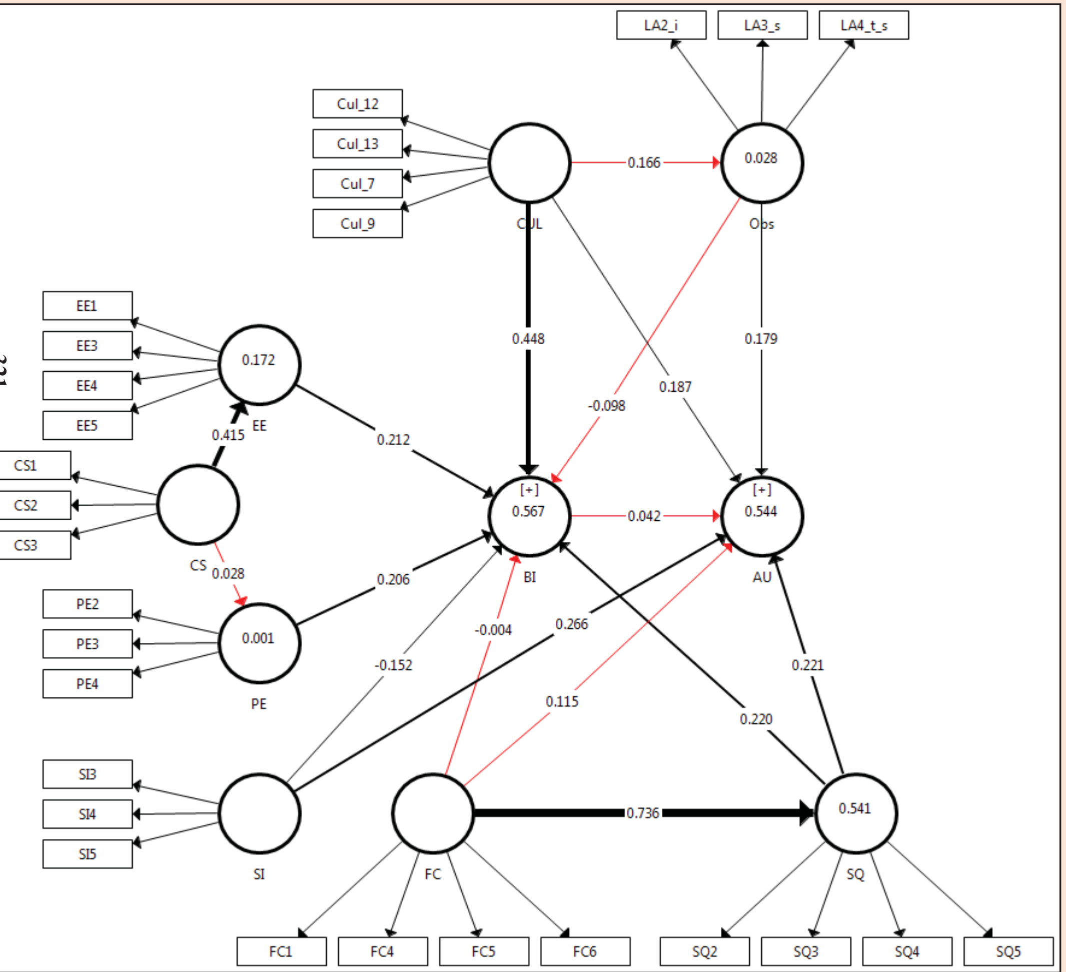
Social Influence (SI)	People who influence my behavior (i.e. Friends, Family) think that I should use the system
	People who are important (i.e. Parents, students) to me think that I should use the system
	In general, the school authority has supported the use of ICT
	My colleagues are frequently using ICT for the classes and school related activities
	My principle encouraged me to use ICT in class

Actual Use Factors

BUT

- Previous factors showed, what influence the behavior of the **teachers** to use ICT
- But **they are not directly related to actual use**
- **Actual Use is very low**

Actual Use dependent on the following factors!!!



Factors	Impact
Service Quality (SQ)	Important
Social Influence (SI)	Important
Performance Expectancy (PE)	Important
Cultural Factors (CUL)	Important
Obstacles (Obs.)	Not important

So, Let us discuss

- ➢Do you agree with the results?
- ➢Do you disagree with the results?
- ➢Discuss in details about the reasons

ICT in primary education: A case study of Saudi Arabia

Workshop and Focus group discussion to validate research results and get recommendations. (Group: Students)

By

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What is ICT??

- Diverse set of **technological tools and resources** used to communicate, and to create, disseminate, store, and manage information

- This learning method can promote an **easy way of sharing different ideas**

Why ICT at Primary School??

- ICT becomes immensely important in primary education.
- ICT has been introduced in primary schools in many countries, which has led to an improvement in education service.

How we worked??

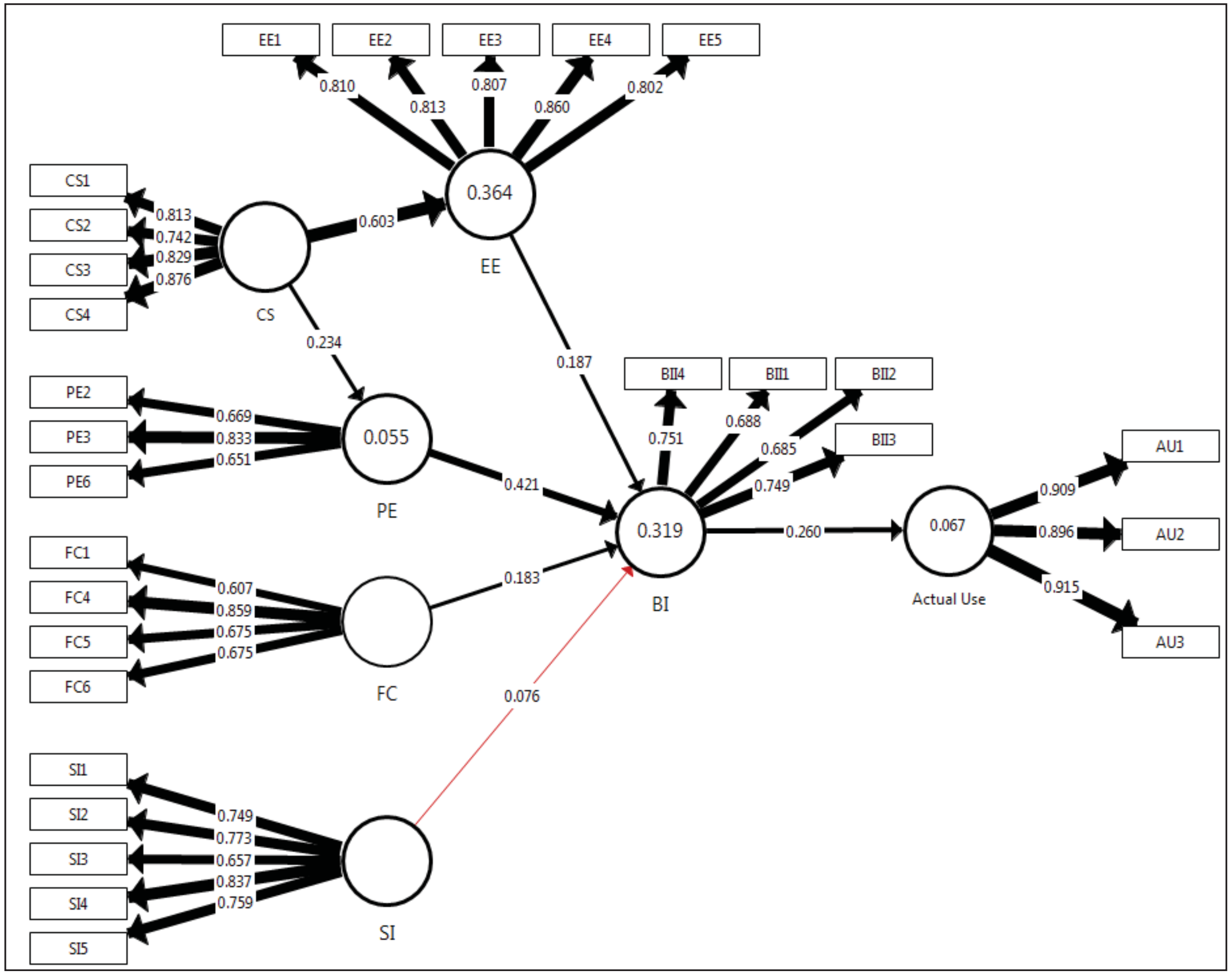
- Sampling (Selected you)
- Face to face questionnaire survey

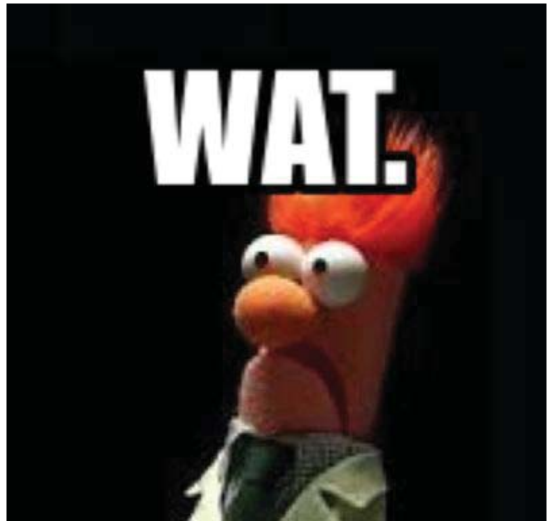
  (Interviewing you)
- Data analysis

What we found??

What I considered? For You !!!!	What I found their Impact on ICT at your education
Service Quality (SQ)	Important
Facilitating Conditions (FC)	Important
Social Influence (SI)	Not important
Performance Expectancy (PE)	Important
Computer literacy and literacy and self efficiency (CS)	Important for effort expectancy & Performance Expectancy
Effort Expectancy (EE)	Important
Cultural Factors (CUL)	Important
Obstacles (Obs.)	Not important

What we found??





What are these factors??

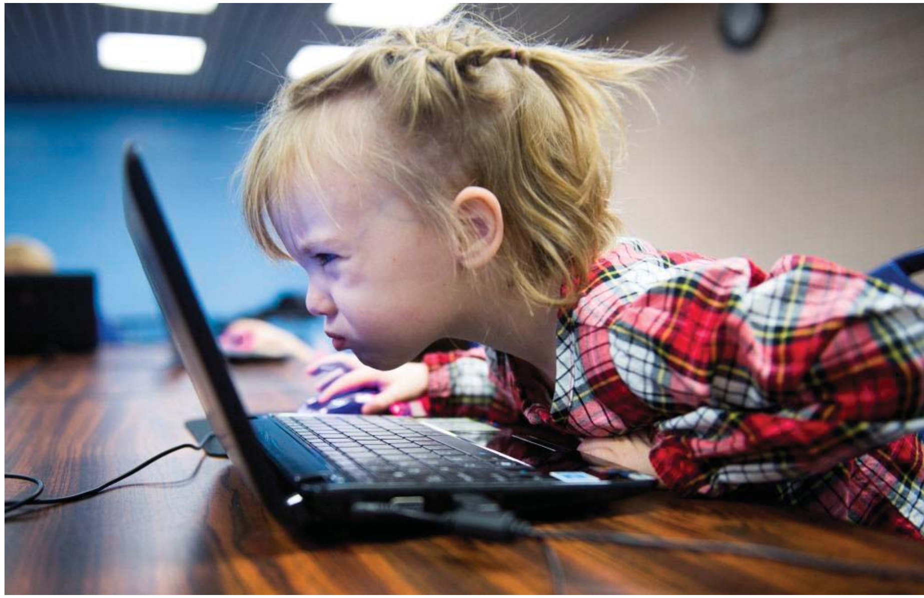
Facilitating Conditions (FC)	Your school has **enough computers and software for the students**.
	The teachers can give enough support learning Computers.
	Computer at class and at home are quite similar.
	I get general ideas how to use ICT for my studies at class and home (i. e. Familiarity with educational software, searching internet)
	I get **enough assistance** for any difficulties related with ICT use
	I am satisfied with all supports

What are these factors??

Performance Expectancy (PE)	ICT technologies are **useful for the courses**
	I could learn **easily by using ICT** (i. e. Computer, Internet)
	I will enable to home work & prepare for quiz, exams more easily & quickly
	I will **increase my grade**
	ICT in class would make **lesson interesting**
	ICT would help me to get connected with the teachers and friends efficiently to work as group for studies

What are these factors??

Effort Expectancy (EE)	I will **clearly understand the ICT** system (i. e. Class room software, computers)
	It would be easy for me to **become skillful** at using the ICT for learning
	I would find the ICT easy to use
	Learning how to use ICT does not require a lot effort
	Using ICT systems in class does not involve too much time



So, Let us discuss

- What do you think??
- Do you agree with the results?
- Do you disagree with the results?
- Discuss in details about the reasons

Appendix E

Focus group questions

<u>Focus Group Discussion (FGD) in Saudi Primary schools</u>

After presenting the results to the students, focus group discussion would be conducted.

Students:

- What are the problems the student found in class, due to not using ICT?
- If ICT introduced in class, what it would look like (a virtual example)?
- What are the problems students' faces, at class rooms or homes by the teachers or parents?
- How they can help promoting ICT?
- What would be the benefits for students if ICT introduced in class?
- What are their feeling if the problems they face are reduced, and ICT become part of their education system?

Focus Group Discussion (FGD) in Saudi Primary schools

After presenting the results to the principals and teacher, focus group discussion would be conducted. There would be two sessions, one with the principals and teacher together. Another would be with the teachers only.

Principal and teachers discussion (Session 1):

Discussion questions:

- The factors found significant for principals, to what extent you agree or disagree with those factors?
- What are your experience regarding these factors? (Did you ever face these?)
- Any particular example of these in your experience?
- Do you think, any other factors more important than these for the principals (what I found), if yes, please do discuss them, and provide valid support for those factors?
- Please prioritize the factors from highest to lowest (and discuss why some are more important than others, would make a priority matrix at this stage)?

Suggestions:

- What are the possible solutions for better ICT at primary school for the principals?
- What support would you need to solve these problems?
- If ICT intervention proposed, what would be the administrative and official process?
- What would be the best ways to integrate ICT in their school?

Only teachers' discussion (Session 2):

After the first session, the principals would be requested to leave, and a session would be conducted for the teachers only. It would have the following questions:

Discussion questions:

- The factors found significant for teachers, to what extent you agree or disagree with those factors?
- What are your experience regarding these factors?
- Any particular example of these in your experience, while teaching at classes?

- Do you think, any other factors more important than these for the teachers (what I found), if yes, please do discuss them, and provide valid support for those factors?
- Please prioritize the factors from highest to lowest (and discuss why some are more important than others, would make a priority matrix at this stage)?
- For teachers why the highest prioritized factors (first 3 factors) is most important?

Suggestions:

- What are the possible solutions for better ICT at primary school for the teachers?
- How you can use ICT at classes and your personal development?
- If ICT intervention proposed, what would be the system required for class rooms?
- What would be the best ways to integrate ICT in their school?

Appendix F

Focus group summaries

FGD with principals

After questionnaire survey of principals and teachers', researcher analyzes the data. Based on the data, researcher developed a model to explain the factors behind actual use of internet. With the results from quantitative analysis researcher presented the results and explained these models to the focus group. Following the presentation and explanation, the focus Group Discussion (FGD) has been conducted. The discussion was lively and the participants shared their views and opinions about the results and to what extent they feel these are realistic and important to them for the use of ICT at primary education.

The FGD was done through a structured questionnaire, with open ended questions to keep track the discussion session. Here based on some questions participants discussed the whole session, the questions are attached in Appendix (E). In the FGD session, there were five principals for five different primary schools and ten teachers were also present in the session.

In the discussion, the participants mostly agreed with the results. They agreed on the importance of using ICT in classroom. One of the principles (Principal#3) stated, *"Yes, I agree to all of them and it is too important to use ICT in classroom and it is beneficial and helpful for both students and teachers"*. As, there were some teachers in the discussion session with the principals, some of them really appreciated this research and totally agreed on the result of this research, and supported the statement of the principal. Principal#4 mentioned, *"This study has real scenarios about how the present state of ICT at the school, and what are the problems we face daily to manage the schools"*.

Some principals mentioned that, they tried to introduce use of ICT in the classroom but it didn't work just because of the lack of technical support or facilities. Among them, one Principal#1 mentioned that *"Schools need proper technical support for this. Otherwise installation of some computer or device wouldn't bring any greater good"*. All other principals agreed on this comment, and Principal#5 added that, "*the facilities we got are not adequate, nor even close to enough. I am not sure with 2 computers in the whole schools, where should I put, and who should use those. We do not get what we need; in contrast computers are more available to higher education instituted, more than they needed*".

The discussion found social influence as an important factor for the principals. In Saudi Arabia, ICT should incorporate in the socialization process of the primary school students. Elaborating this process, principal#2 added*, "Families of the students can help a lot to increase the acceptance of ICT among all. From family, they can get an environment supporting ICT"*. On this comment, principal#1 added *"also, school can create a supporting environment for the students. But, for that, they need a proper authority which can run this properly and proper support from higher authority and necessary promotional steps from the ministry of education"*.

In addition to social influence, principals also talked about the cultural and religions aspects. Being Islamic Republic country, with strict rules and regulations of Islam, many people consider using ICT is not a good thing, and it might contradict with the values of Islam. However, principal#2 mentioned it is not the case, rather, *"Islam is encouraging people to use anything if they know how to use it in the right way, and for example, using ICT in the school, if teachers and students know how to use them in the right way with no intention to miss use, no one can protest and say it is prohibited and illegal to use them"*. Therefore, it seems, the principlas agreed with the influence of cluture on their intetion to use ICT facilities at their schools.

In general, all the principals really apprise that, the research found, Service quality as an important factor. They stated, without proper service quality of ICT facilities, it become ineffective to use and they find it difficult to maintain. Therefore, all of them agreed that, service quality is a prime concern if ICT should be implemented in primary schools. Additionally, principals also agreed that, they face lots of obstacles, Principal#4 mentioned, "*I face questions from the parents about, how I make sure computers would not spoil their children, and restrictions from the authorities concerning, how can I manage the whole thing if ICT been accessed by everyone*".

However, while agreeing with most of the findings, the principals do not seem convinced that, ICT might increase their performance. Majority of them expressed the idea that, yah it might help the teachers mostly, but we have lots of works to do manually, thus computers might not improve my performance too much, but in general it would help. In addition to these, the principals also agreed that, self efficiency is important, but not too much. Considering their statement, these two factors finally not carried out to the last stage of the discussion session.

At the last stage of discussion session, the participants were requested to prepare a priority matrix on common consensus. Hence, they discussed which factor they would prioritize, and compare each to factor at a time. After comparing each factor with anther, the principals come to an agreement and the result is presented in the following table,

Factors	**Cul**	**EE**	**Obs**	**SQ**	**SI**	**FC**	**Frequency**	**Rank**
Cul	$\otimes$	Cul	Obs	SQ	SI	FC	1	**5**
EE	Cul	$\otimes$	Obs	SQ	SI	FC	0	**6**
Obs	Obs	Obs	$\otimes$	SQ	SI	FC	2	**4**
SQ	SQ	SQ	SQ	$\otimes$	SQ	FC	4	**2**
SI	SI	SI	SI	SQ	$\otimes$	FC	3	**3**
FC	FC	FC	FC	FC	FC	$\otimes$	5	**1**

The table shows that, they agreed that, facilitating conditions are the most important factor among all factors. The second most important factor is Service quality and for them, the third most important factor is social influence. At the end of the discussion, it has been found that, the principals verified most of the factors in the model are right and they agreed that, with proper take care, if the problems are solved, ICT would be a great asset for primary education system. Finally, the researcher provided a concluding speech, and thanked all the principals for their valuable time and input in the research, they were also presented with some snacks and tea during the session.

FGD with Teachers

After questionnaire survey of principals and teachers', researcher analyzes the data. Based on the data, researcher developed a model to explain the factors behind actual use of internet. With the results from quantitative analysis researcher presented the results and explained these models to the focus group. Following the presentation and explanation, the focus Group Discussion (FGD) has been conducted. In the discussion principals and teachers from different school of three major cities of Saudi Arabia were present. After that, having a little break, another FGD was held in the same place with same format but only teachers were participant this time. Same as the previous FGD, this discussion was also lively and the participant teachers shared their views and opinions about the results and to what extent they feel these are realistic and important to them for the use of ICT at primary education.

The FGD was done using a structured questionnaire, with open ended questions to keep track the discussion session. Based on some questions, participants discussed the whole session, the questions are attached in Appendix (E). In the FGD session, there were ten teachers present in the session.

In the discussion, the participants mostly agreed with the results. They agreed on the importance of using ICT in classroom. One of them (Teacher #3) stated, *"Yes, the model is more or less perfect. It really explains the whole scenario of ICT in our schools"*. Another teacher (teacher # 6) mentioned, *"to face the challenges of the current world, we really need to build the next generation. They have to know the use of technology. So, ICT in classroom will build them for the next world"*.

Cultural factor is an important and obvious factor in promoting ICT at class. Saudi Arabia has a really strong religious culture which has a strong influence on their habit, lifestyle and day-to-day life. A teacher (teacher # 8) said, *"Islam doesn't stop anyone to use a new technology rather encourages people to use new technology. Rather we need to use it with proper purpose and in right ways"*.

Also, families can play a great role in helping their children to learn ICT. A teacher (teacher # 1) mentioned, *"students spend weekly around 25 hours at school, which is just around 15% time of* *the total time. The rest of the time they spend with their family members. So, to make them used to with ICT families have to play an important role. Only school cannot change this situation."*

Supplementing the comment of teacher#1, another teacher (teacher#7) added, *"families can play a great role. But govt. also has to play a role of facilitator. They have to take policy to promote ICT in the classroom and give necessary support to the school authority. Without govt. promotion, only families supporting condition will not change the greater scenario of the country."*

The teachers discussed a lot about system quality and its potential effect on their intention and actual use of ICT. They agreed that, this is one of the most important factor that need to be taken seriously. Without proper system, it is now difficult to use ICT at present, teacher#7 mentioned, "*The existing system does not work mostly, most of the computers are not usable and thus it is hard to use these systems for any activities, and if this remain such; how we would be able to use ICT?*"

In addition to his comment, another teacher mentioned (teacher#1), "*Poor system quality is the reason, we found it hard to use ICT, so with more investments and proper care, if the system works better and does not require much effort, I am sure most of the teachers would be using ICT*".

As nothing is totally perfect, this model was also criticized in some points. A teacher (teacher # 9) criticizing this model said, *"Obstacles can come from various side. Society and school should have necessary measures to minimize these obstacles. So, this can have minimum impact, not very important"*. Thus, obstacles have not been considered for the last stage of the discussion session.

At the last stage of discussion session, the participants were requested to prepare a priority matrix on common consensus. Hence, they discussed which factor they would prioritize, and compare each to factor at a time. After comparing each factor with another the teachers came to an agreement and the result is presented in the following table,

Factors	**Cul**	**EE**	**PE**	**SQ**	**SI**	**FC**	**CS**	**Frequency**	**Rank**
Cul	⨂	Cul	Cul	SQ	Cul	FC	CS	3	**4**
EE	Cul	⨂	EE	SQ	EE	FC	CS	2	**5**
PE	Cul	EE	⨂	SQ	SI	FC	CS	0	**7**
SQ	SQ	SQ	SQ	⨂	SQ	SQ	SQ	6	**1**
SI	Cul	EE	SI	SQ	⨂	FC	CS	1	**6**
FC	FC	FC	FC	SQ	FC	⨂	CS	4	**3**
CS	CS	CS	CS	SQ	CS	CS	⨂	5	**2**

The table shows that, they agreed that, System quality the most important factor among all factors. The second most important factor is Computer Literacy and Self-efficiency for them, the third most important factor is Facilitating Condition. At the end of the discussion, it has been found that, the teachers verified most of the factors in the model are right and they agreed that, with proper care, if the problems are solved, ICT would be a great asset for primary education system. It can be helpful to create a nation for the upcoming challenging world. Finally, the researcher provided a concluding speech, and thanked all the teachers for their valuable time and input in the research, they were also presented with some snacks and tea during the session.

FGD with Students

After questionnaire survey of students', researcher analyzes the data. Based on the data, researcher developed a model to explain the factors behind actual use of ICT for the primary students. With the results from quantitative analysis researcher prepared a model and arranged a discussion session with the students to present the result. In the discussion session, the researcher presented and explained the results to the students in simple words. The researcher tried his best to make them understand the results and what it explains. And after being satisfied about their understanding the results a focus Group Discussion (FGD) has been conducted. The discussion was really enjoyable with the children. They were too much courageous to share their views about ICT and their family and schools support regarding this. The researcher was not a contributor in this session rather worked as a facilitator.

The FGD was previously planned to be done using a structured questionnaire, with open ended questions to keep track in the discussion session. But, it was really challenging for the researcher to bound them in a structured framework, as they were really eager to express their opinion and views.So, though there was a structured questionnaire, but the session did not strictly follow that structure. And breaking the structure was useful to get the views of the students. The questions are attached in Appendix (E). In the FGD session, there were twenty-five students present in the session.

As the participants were too much interactive, it was difficult to keep track of their discussion. That made difficult to make a regular note as per someone's quote. So, the overall view of the participants are as follows:

They think ICT can be major source of education. One student said, *"I love browsing on the internet. I can found related things in the internet. It is too much helpful to learn new thing (Student 2)."* They want enough scope to use and learn about ICT. Another student said, *"I have come to know about programming. To learn programming, I have to spend too much time in front of computer. But my mom and daddy don't want to let me spend that my time in front of computer (Student#7)."* It is also a major source of recreation. One student pointed, *"I love to play games but my mom doesn't give me the scope playing. She doesn't want to buy new video games and let me play.(Student # 1)"* Here, they strongly argued they need a facilitating condition or a supporting environment to use and learn more about ICT. One student said, *"I always dream that day when my mom wouldn't stop me using computer, rather she would gave me time and space for that. (Student 5)"*

According to them, behavioral impact is directly related to actual use of ICT. Mainly, it influences the actual use of ICT. Other factors contribute to behavioral impact.

Some of them said in their own word, *"if families give us that much support, we can learn ICT much better, which can help us more to build our quality. (Student 9)"*Another student told, *"School cannot provide us enough support on devices. We don't have enough computer to practice at class. In general, in class, the instructor uses a computer to describe the topic and we can't even touch the device. We have to see it from a distant place, which is not enough to be clear everything. (Student 3)"*

Students do not face too much technical obstacles in using ICT, rather obstacles from the family members. And to them culture is not that important.

At the last stage of discussion session, the students were asked to make a decision on which factor is more important over another factor. And from that discussion, the researcher made a priority matrix there based on the common consensus of all students. The priority matrix is here in below:

Factors	**PE**	**EE**	**CS**	**SQ**	**SI**	**FC**	**Frequency**	**Rank**
PE	⊗	PE	PE	PE	SI	FC	3	**3**
EE	PE	⊗	EE	EE	SI	FC	2	**4**
CS	PE	EE	⊗	CS	SI	FC	1	**5**
SQ	PE	EE	CS	⊗	SI	FC	0	**6**
SI	SI	SI	SI	SI	⊗	FC	4	**2**
FC	FC	FC	FC	FC	FC	⊗	5	**1**

The table shows that, they agreed that, facilitating condition is the most important factor which was also reflected in their previous group discussion. They opinioned that, family and school support easily can increase their use of ICT. As important factor, social influence, they placed it in the second position. From their discussion, it was clear they think social influence is highly related with facilitating condition, and they think service quality is the least important factor. At their age, it may not be seemed to be that much important factor.

This session was the most challenging and also most enjoyable session for the researcher. On the other two sessions, the researcher part in discussion but, in this session joined as just a facilitator. Because, it was already a lively session.

References

References

Abu-Al-Aish, A., & Love, S. (2013). Factors influencing students' acceptance of m-learning: An investigation in higher education. *The International Review of Research in Open and Distributed Learning*, *14*(5), 83–108.

Adegbija, M. V. (2013). Information and communication technology and e-learning education in Nigeria: A paradigm shift. *Global Media Journal: Pakistan Edition, 6*(1), 27-36.

Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., & Fooi, F. S. (2009). Factors affecting teachers' use of information and communication technology. *International Journal of Instruction 2*(1), 77-104. Retrieved from https://www.researchgate.net/publication/26571454_Factors_affecting_teachers'_use_of_information_and_communication_technology.

Ageel, M. (2011). The ICT proficiencies of university teachers in Saudi Arabia: A case study to identify challenges and encouragements. *Hummingbird, 8*(2), 55-60.

Agudo-Peregrina, Á. F., Hernández-García, Á., & Pascual-Miguel, F. J. (2014). Behavioral intention, use behavior and the acceptance of electronic learning systems: Differences between higher education and lifelong learning. *Computers in Human Behavior*, *34*, 301-314.

Agyei, D. D., & Voogt, J. (2014). Examining factors affecting beginning teachers' transfer of learning of ICT-enhanced learning activities in their teaching practice. *Australasian Journal of Educational Technology, 30*(1).

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl, & J. Beckmann (eds). *Action control*. SSSP Springer Series in Social Psychology. Springer, Berlin, Heidelberg.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Ajzen, I. (2002). Constructing a theory of planned behavior questionnaire. Available at http://people.umass.edu/~aizen/pdf/tpb.measurement.pdf. [Based on Appendix A in Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach.* New York: Psychology Press.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior.* Englewoods Cliffs, NJ: Prentice Hall.

Al Mulhim, E. (2013). The current use of ICT by novice female teachers in Saudi primary schools and their perceived training needs. 30th ASCILITE Conference 2013, *Proceedings*, 597-601.

Al Mulhim, E. (2014). The barriers to the use of ICT in teaching in Saudi Arabia: A review of literature. *Universal Journal of Educational Research, 2*(6), 487-493.

Al Sharija, M., & Watters, J. J. (2012). Innovative leadership by school principals: Embedding information communication and technology in Kuwaiti schools. *Journal of International Education Research, 8*(4), 425.

Al Shemmari, Joza M. H. (2015). *Information and communication technology acceptance model for empirically testing primary science teachers' use of ICT in Kuwait*. [Thesis (PhD/Research)]. University of Southern Queensland.

Alabbasi, D. (2016). WhatsApp, agency and education: The case of female Saudi teachers. In *There and back: Charting flexible pathways in open, mobile and distance education* (219-223). Conference proceedings of the DEANZ Biennial Conference The University of Waikato Hamilton New Zealand April 17-20 2016.

Aladesote, O. I., Olutola, A., & James, O. O. (2014). Significant factors affecting the use and integration of information technology (IT) tools in teaching in south western Nigerian polytechnics. *International Journal of Computer Science and Information Security, 12*(3), 50.

Al-Adwan, A., Al-Adwan, A., & Smedley, J. (2013). Exploring students acceptance of e-learning using Technology Acceptance Model in Jordanian universities. *International Journal of Education and Development Using Information and Communication Technology, 9*(2), 4.

Alajmi, S. (2011). Factors influencing information and communication technology implementation in government secondary schools in Kuwait. PhD thesis, University of Exeter.

Al-Asmari, A. M., & Rabb Khan, M. S. (2014). E-learning in Saudi Arabia: Past, present and future. *Near and Middle Eastern Journal of Research in Education*, 2.

Albion, P. R., Tondeur, J., Forkosh-Baruch, A., & Peeraer, J. (2015). Teachers' professional development for ICT integration: Towards a reciprocal relationship between research and practice. *Education and Information Technologies, 20*(4), 655-673.

Albugami, S., & Ahmed, V. (2015). Towards successful implementation of ICT in Saudi schools (literature review). The 12th International Postgraduate Research Conference (IPGRC15). The University of Salford, Media City, UK.

Aldhafeeri, F., Almulla, M., & Alraqas, B. (2006). Teachers' expectations of the impact of e-learning on Kuwait's public education system. *Social Behavior and Personality: An International Journal, 34*(6), 711-728.

Aldiab, A., Chowdhury, H., Kootsookos, A., & Alam, F. (2017). Prospect of eLearning in higher education sectors of Saudi Arabia: A review. *Energy Procedia, 110*, 574-580.

Aldraehim, M., Edwards, S. L., Watson, J. A., & Chan, T. (2013). Cultural impact on e-service use in Saudi Arabia: The need for interaction with other humans. *International Journal of Advanced Computer Science, 3*(2).

Aldunate, R., & Nussbaum, M. (2013). Teacher adoption of technology. *Computers in Human Behavior, 29*(3), 519-524.

Alenezi, A. (2015). Influences of the mandated presence of ICT in Saudi Arabia secondary schools. *International Journal of Information and Education Technology*, *5*(8), 638.

Alenezi, A. R., Karim, A., Malek, A., & Veloo, A. (2010). An empirical investigation into the role of enjoyment, computer anxiety, computer self-efficacy and internet experience in influencing the students' intention to use e-learning: A case study from Saudi Arabian governmental universities. *Turkish Online Journal of Educational Technology-TOJET, 9*(4), 22-34. Retrieved from https://www.researchgate.net/publication/286003759_An_empirical_investigation_into_the_role_of_enjoyment_computer_anxiety_computer_self-efficacy_and_Internet_experience_in_influencing_the_students'_intention_to_use_e-learning_a_case_study_from_Saudi_A.

Alfahad, F. N. (2012). Effectiveness of using information technology in higher education in Saudi Arabia. *Procedia-Social and Behavioral Sciences, 46*, 1268-1278.

Al-Gahtani, S. S. (2004). Computer technology acceptance success factors in Saudi Arabia: an exploratory study. *Journal of Global Information Technology Management, 7*(1), 5-29.

Alharbi, E. (2014). A study on the use of ICT in teaching in secondary schools in Kuwait. Doctoren Educación (PhD). Cardiff Metropolitan University, Cardiff, Wales.

Alharbi, G. (2012). Primary school teachers' perceptions regarding ICT usage and equipment in Kuwait. *Journal of International Education Research, 8*(1), 55.

Al-Harbi, K. A.-S. (2011). E-Learning in the Saudi tertiary education: Potential and challenges. *Applied Computing and Informatics, 9*(1), 31-46.

Alhawiti, M. M. (2013). Strategies and action plans for integrating ICT into Saudi elementary schools curricula: The case of Tabuk District of Education. *International Journal of Information and Education Technology, 3*(2), 77-184.

Alkahtani, A. (2017). The challenges facing the integration of ICT in teaching in Saudi secondary schools. *International Journal of Education, & Development using Information, & Communication Technology* 13(1), 32-51.

Alkanani, T. Y. (2012). *The reality and the barriers of using educational technology in teaching social subjects in intermediate stage in boys schools in Al-Qunfoda province* (Masters dissertation). Umm Al-Qura University.

Alkhalaf, S., Drew, S., AlGhamdi, R., & Alfarraj, O. (2012). E-learning system on higher education institutions in KSA: Attitudes and perceptions of faculty members. *Procedia-Social and Behavioral Sciences, 47*, 1199-1205.

Alkhalaf, S., Nguyen, A., & Drew, S. (2010). *Assessing e-learning systems in the Kingdom of Saudi Arabia's higher education sector: An exploratory analysis. Paper presented at the 2010 International Conference on Intelligent Network and Computing (ICINC 2010), Kuala Lumpur, Malaysia.*

Al-Khalifa, H. S. (2010). E-learning and ICT integration in colleges and universities in Saudi Arabia. *eLearn Magazine, 2010*(3), 3.

Al-Madani, F. M., & Allaafiajiy, I. A. (2014). Teachers' professional development on ICT use: A Saudi sustainable development model. *Journal of Modern Education Review*, *4*(6), 448-456.

Al-Maini, Y. H. (2013). Issues in Integrating Information Technology in Learning and Teaching EFL: The Saudi Experience. *The EUROCALL Review*, *21*(2), 49-55.

Almalki, G., & Williams, N. (2012). A strategy to improve the usage of ICT in the kingdom of Saudi Arabia primary school. *International Journal of Advanced Computer Science, & Application, 3(*10), 42-49.

Alotaibi, W. S. A. (2011). *The reality of the usage of educational technology in teaching science curricula in teaching science curricula in secondary stage as perceived by female teachers in Haiel city*. Master dissertation, Umm Al-Qura University. Thesis / Dissertation. [In Arabic]. [Online]. Available at: >http://search.shamaa.org/arFullRecord.aspx?ID=92924.

Al-Rashed A. (2002). Teachers and information communication technology in Saudi Arabia: Current use and training needs. PhD Thesis. University of Hull, UK.

Alreck, P. L., & Settle, R. B. (1994). The survey research handbook. Irwin: Toronto, Canada.

Alsahli, E. E. (2012). *Educational technology training needs of geography teachers in secondary stage in Jeddah City* (Masters dissertation). Umm Al-Qura University.

Al-Senaidi, S., Lin, L., & Poirot, J. (2009). Barriers to adopting technology for teaching and learning in Oman. *Computers, & Education, 53*(3), 575-590.

Alshmrany, S., & Wilkinson, B. (2014, August). Evaluating ICT use in Saudi Arabian secondary schools. In the *Proceedings of the 2014 International Conference on Advanced ICT (ICAICTE-2014).* Atlantis Press.

Alshmrany, S., & Wilkinson, B. (2017a). Factors influencing the adoption of ICT by teachers in primary schools in Saudi Arabia: Teachers' perspectives of the integration of ICT in primary education. *International Journal of Advanced Computer Science and Applications (IJACSA), 8*(12).

Alshmrany, S., & Wilkinson, B. (2017b). ICT and education in Saudi Arabia: Current issues impacting adoption in primary education. In the *Proceedings of the 2018 International Conference on e-Commerce, e-Administration, e-Society, e-Education, and e-Technology, Osaka, Japan, April 1-3, 2018.* In-press.

Al-Sulaimani, A. A. (2010). *The importance of teachers in integrating ICT into science teaching in intermediate schools in Saudi Arabia: A mixed methods study* (Doctoral dissertation). RMIT.

Al-Tawil, K. M. (2001). The internet in Saudi Arabia. *Telecommunications Policy, 25*(8-9), 625-632. doi: 10.1016/S0308-5961(01)00036-2.

Alwani, A. E. S., & Soomro, S. (2010). *Barriers to effective use of information technology in science education at Yanbu Kingdom of Saudi Arabia*: INTECH Open Access Publisher. Retrieved from http://www.intechopen.com/books/e-learning-experiences-and-future/barriers-to-effective-use-of-information-technology-in-science-education-at-yanbu-kingdom-of-saudi-a.

Alyami, R. H. (2014). Educational reform in the Kingdom of Saudi Arabia: *Tatweer* schools as a unit of development. *Literacy Information and Computer Education Journal*, *5*(2), 1424-1433.

Alzahrani, A. (2011) *An acceptance model for citizen adoption of web-based e-government services in developing countries: A field survey and a case study in Saudi Arabia*. (Doctoral dissertation). De Montfort University: Leicester, UK.

Alzahrani, M. G. (2017). The developments of ICT and the need for blended learning in Saudi Arabia. *Journal of Education and Practice*, *8*(9), 79-87.

Al-Zahrani, A. (2015). The place of technology integration in Saudi pre-service teacher education: Matching Policy with practice. *Turkish Online Journal of Educational Technology-TOJET*, *14*(1), 151-162.

Alzoman, A. (2002). *Internet guide book.* Riyadh: King Abdulaziz City for Science and Technology: Internet Services Unit.

Amoudi, K. K., & Sulaymani, O. (2014). The integration of educational technology in girls'classrooms in Saudi Arabia. *European Journal of Training and Development Studies*, *1*(2), 14-19.

Andersson, E., & Togelius, L. (2011). *Women oppressed in the name of culture and religion.* (Doctoral dissertation). Malmö University, Sweden.

Ansary, A. F. (2008). *A brief overview of the Saudi Arabian legal system*. Retrieved from: http://www.nyulawglobal.org/globalex/Saudi_Arabia.html.

Aruch, M., Loja, A., & Sanders, J. B. (2014). *Social entrepreneurship and information and communication technologies in Ecuador: Examples and opportunities.* In Dr Alexander Wiseman (Ed.), *International Educational Innovation and Public Sector Entrepreneurship* (pp. 157-188). Emerald Group Publishing Limited.

Asiri, M. J. S., bt Mahmud, R., Bakar, K. A., & bin Mohd Ayub, A. F. (2012). Factors influencing the use of learning management system in Saudi Arabian higher education: A theoretical framework. *Higher Education Studies*, *2*(2), 125.

Atieno, O. P. (2009). An analysis of the strengths and limitation of qualitative and quantitative research paradigms. Problems of Education in the 21st Century, 13(1), 13-38.

Attuquayefio, S. N., & Addo, H. (2014). Using the UTAUT model to analyze students' ICT adoption. *International Journal of Education and Development using Information and Communication Technology, 10*(3), 75.

Auld, G., Holkner, B., Fernando, A., Henderson, M., Romeo, G., Russell, G., & Edwards, S. (2008). *Exemplar schools using innovative learning technologies.* Paper presented at the Australian Computers in Education Conference.

Baek, Y., Jung, J., & Kim, B. (2008). What makes teachers use technology in the classroom? Exploring the factors affecting facilitation of technology with a Korean sample. *Computers, & Education, 50*(1), 224-234.

Balanskat, A., & Blamire, R. (2007). ICT in schools: Trends, innovations and issues in 2006-2007. European SchoolNet, Brussels.

Bandura, A. (1986). *Social foundations of thoughts and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bate, F. (2010). A bridge too far? Explaining beginning teachers' use of ICT in Australian schools. *Australasian Journal of Educational Technology, 26*(7), 1042-1061.

Bates, D. T. (2001). 3-The continuing evolution of ICT capacity: The implications. In G.M. Farrell (ed.), *The changing faces of virtual education*. The Commonwealth of Learning, Vancouver, Canada, 29.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report,13*(4), 544-559.

Bel, M., & Fernandez, M. J. (2014). *First European experience in PCP process applied to education: Imaile* (Innovative Methods for Award Procedures of ICT Learning in Europe). Edulearn14 *Proceedings*, 3124-3125.

Ben-Ari, M. (2001). Constructivism in computer science education. *Journal of Computers in Mathematics and Science Teaching, 20*(1), 45-73.

Bervell, B., & Umar, I. N. (2017). Validation of the UTAUT model: Re-considering non-linear relationships of exogeneous variables in higher education technology acceptance research. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(10), 6471-6490.

Bikas, C. (2001). New functions of higher education and ICT to achieve education for all. University and Technology-for-Literacy/Basic Education Partnership in Developing Countries. International Institute for Educational Planning, UNESCO. Disponible en (octubre 2005): http://literacy. org/products/ili/pdf/UTLPsanyal. pdf.

Bingimlas, 2010. *Evaluating the quality of science teachers' practices in ICT supported learning and teaching environments in Saudi primary schools*. PhD thesis, RMIT University, Melbourne, Vic.

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science, & Technology Education, 5*(3), 235-245.

Bingimlas, K. A. (2017). Learning and teaching with Web 2.0 applications in Saudi K-12 Schools. *Turkish Online Journal of Educational Technology*, *16*(3). Available at: http://www.tojet.net/articles/v16i3/16310.pdf

Birch, A., & Irvine, V. (2009). Preservice teachers' acceptance of ICT integration in the classroom: applying the UTAUT model. *Educational Media International, 46*(4), 295-315.

Bjekic, D., Krneta, R., & Milosevic, D. (2010). Teacher education from e-learner to e-teacher: Master curriculum. TOJET: *The Turkish Online Journal of Educational Technology, 9*(1).

Blatchford, P., Pellegrini, A. D., & Baines, E. (2015). *The child at school: Interactions with peers and teachers.* From the series International Texts in Developmental Psychology. Routledge: UK.

Blignaut, A. S., Hinostroza, J. E., Els, C. J., & Brun, M. (2010). ICT in education policy and practice in developing countries: South Africa and Chile compared through SITES 2006. *Computers, & Education, 55*(4), 1552-1563.

Bloomberg, B., Cooper, D., & Schindler, P. (2008). Business research methods. McGraw-Hill Higher Education: New York, United States.

Blurton, C. (1999). New directions of ICT-use in education. [First on-line version of the original contribution to UNESCO's World Communication and Information Report 1999 written by Prof C. Blurton from the University of Hong Kong]. Available at http://www.unesco.org/education/lwf/dl/edict.pdf.

Boell, S. K., & Cecez-Kecmanovic, D. (2010). Literature reviews and the hermeneutic circle. *Australian Academic, & Research Libraries, 41*(2), 129-144.

Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior, 36*(1), 3-15.

Bovée, C., Voogt, J., & Meelissen, M. (2007). Computer attitudes of primary and secondary students in South Africa. *Computers in Human Behavior, 23*(4), 1762-1776.

Brannen, J. (2005). Mixed methods research: A discussion paper. ESRC National Centre for Research Methods, Methods Review Paper (NCRM). Available at https://www.researchgate.net/publication/251776164_Mixed_Methods_Research_A_Discussion_Paper

Braslavsky, C., & Fumagalli, L. (2004). *Technology and educational change at the local level: The case of the Campana schools network in Argentina.* International Institute for Educational Planning, UNESCO. Retrieved from www.unesco.org/iiep.

British Educational Communications and Technology Agency (BECTA). 2005. Open source software in schools: A study of the spectrum of use and related ICT infrastructure costs. Coventry, UK: BECTA. http://www.becta.org.uk/corporate/publications/documents/BEC5606_Full_report18.pdf (accessed August 26, 2006).

Brooks, E. P., Borum, N., & Rosenørn, T. (2014). Designing creative pedagogies through the use of ICT in secondary education. *Procedia-Social and Behavioral Sciences*, 112, 35-46.

Brown, A., & Al-Khayal, Z. (2006). Validity and reliability of the Arabic translation of the child oral-health-related quality of life questionnaire (CPQ11− 14) in Saudi Arabia. *International Journal of Paediatric Dentistry,16*(6), 405-411

Brown, N. C. C., Kölling, M., Crick, T., Peyton Jones, S., Humphreys, S., & Sentance, S. (2013, March). Bringing computer science back into schools: Lessons from the UK. In *Proceedings of the 44th ACM Technical Symposium on Computer Science Education*, 269-274.

Bryman, A. (2015). *Social research methods*. Oxford University Press: Oxford.

Bryman, A., & Bell, E. (2015). *Business research methods*. Oxford University Press: USA.

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development Using Information and Communication Technology, 8*(1), 136.

Buabeng-Andoh, C. (2015). ICT implementation and practices: Factors influencing students' pedagogical use of ICT in Ghanaian secondary schools. *International Journal of Information and Communication Technology Education (IJICTE), 11*(2), 1-13.

Buchanan, R., Holmes, K., Preston, G., & Shaw, K. (2012, March). Shifting horizons: A critical examination of projects, policy and progress towards digital education in Australia. In the *Proceedings of the Welcome to the Learning with New Media Inaugural Conference, 23 March 2012* (Vol. 1, p. 43).

Byrne, B. M. (2013). *Structural equation modeling with AMOS: Basic concepts, applications, and programming.* Routledge: UK.

Campbell, C. (2009). The role of the internet in the primary school classroom: From a learning and teaching perspective. Saarbrucken, Germany: VDM Publishing. Retrieved from http://researchonline.nd.edu.au/cgi/viewcontent.cgi ?article= 1 OOO&context=edu _ books.

Capper, J. (2001). E-learning growth and promise for the developing world. *TechKnowLogia, 2*(2), 7-10.

Cardellino, P., & Leiringer, R. (2014). Facilitating change in primary education: The role of existing school facilities in ICT initiatives. *Facilities, 32*(13/14), 845-855.

Carvalho, J. O., Ready, R. E., Malloy, P., & Grace, J. (2013). Confirmatory factor analysis of the frontal systems behavior scale (FrSBe). *Assessment, 20*(5), 632-41.

Cassell, M. A., & Blake, R. J. (2012). Analysis of Hofstede's 5-D model: The implications of conducting business in Saudi Arabia. *International Journal of Management, & Information Systems* (Online), *16*(2), 151.

Cassim, K. M., & Obono, S. E. (2011). On the factors affecting the adoption of ICT for the teaching of word problems. In *Proceedings of the World Congress on Engineering and Computer Science, 1*, 19-21.

Cavendish, M. (2006). *World and its peoples: The Middle East, Western Asia, and Northern Africa*. Tarrytown, New York.

Central Intelligence Agency. (2015). *World fact book: Saudi Arabia economy*. Retrieved Nov 10, 2015, from http://www.theodora.com/wfbcurrent/saudi_arabia/saudi_arabia_economy.html.

Chapman, D. W., Mahlck, L. O., & Smulders, A. E. (1997). *From planning to action: Government initiatives for improving school-level practice.* ERIC.

Chege, L. (2014). *Factors influencing teachers' readiness to use ICT in teaching in public secondary schools in Gatundu North District, Kiambu County, Kenya.* Unpublished M.ED Thesis. University of Nairobi.

Chen, R. J. (2010). Investigating models for preservice teachers' use of technology to support student-centered learning. *Computers, & Education, 55*(1), 32-42.

Chen, W. S., & Yao, A. Y. T. (2016). An empirical evaluation of critical factors influencing learner satisfaction in blended learning: A pilot study. *Universal Journal of Educational Research, 4*(7), 1667-1671.

Chuang, H. H., Weng, C. Y., & Huang, F. C. (2015). A structure equation model among factors of teachers' technology integration practice and their TPCK. *Computers, & Education, 86*, 182-191.

Churchill Jr, G. A. (1979). Paradigm for developing better measures of marketing constructs. *Journal of Marketing Research*, *16*(1), 64-73.

CITC. (2005). Saudi Arabia - towards the Information Society. *Digital Reach Report, ITU.* from file://userab/a/alqa0037/Downloads/ksa_to_information_society.pdf

CITC. (2013). *18th E-Newsletter on ICT indicators in the Kingdom*. Retrieved from http://www.mcit.gov.sa/En/AboutMcit/SectorDevelopment/Pages/SectorIndices.aspx.

CITC. (2015). ICT investments in the Kingdom of Saudi Arabia.

Cleary, M., Horsfall, J., & Hayter, M. (2014). Data collection and sampling in qualitative research: Does size matter? *Journal of Advanced Nursing, 70*(3), 473-475.

Compeau, D.R., Higgins, C.A., & Huff, S. (1999) Social cognitive theory and individual reactions to computing technology: a longitudinal study. *MIS Quarterly*, *23*(2), 145–158.

Condie, R., & Livingston, K. (2007). Blending online learning with traditional approaches: Changing practices. *British Journal of Educational Technology*, *38*(2), 337-348.

Cooke, P., & Leydesdorff, L. (2006). Regional development in the knowledge-based economy: The construction of advantage. *The Journal of Technology Transfer*, *31*(1), 5-15.

Cooper, D. R., Schindler, P. S., & Sun, J. (2003). *Business research methods.* Mcgraw-Hill: New York.

Coupe, J. (2004). Is constructivism universal? In search of meaningful technology in Morocco and Namibia. International Institute for Educational Planning, UNESCO. Available at:www.unesco.org/iiep.

Coupe, J., Goveia, J., El Haichour, H., & Ilukena, A. (2006). *Is constructivism universal? In search of meaningful technology in Morocco and Namibia.* In D. Chapman, & L. Mahick (Eds.), *Adapting technology for school improvement: A global perspective.* International Institute for Educational Planning: Paris.

Cox M., Abbott C., Webb M., Blakeley B., Beauchamp T., & Rhodes V. (2004). *A review of the research literature relating to ICT and attainment*. Department of Education and Professional Studies at King's College, London.

Cox, M., Preston, C., & Cox, K. (1999).*What factors support or prevent teachers from using ICT in their classrooms?* Paper presented at the British Educational Research Association Annual Conference, University of Sussex at Brighton. September2–5. Available online at: www.leeds.ac.uk/educol/documents/00001304.htm.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches.* Sage Publications: California.

Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*. Sage Publications: California.

Cross, M., & Adam, F. (2007). ICT policies and strategies in higher education in South Africa: National and institutional pathways. *Higher Education Policy, 20*(1), 73-95.

Curran, P. J., West, S. G., & Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods, 1*(1), 16.

Davis Jr, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: Theory and results*. Massachusetts Institute of Technology.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. doi: http://www.jstor.org/stable/249008.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science, 35*(8), 982 - 1003. doi: http://dx.doi.org/10.1287/mnsc.35.8.982.

Dawson, S., Heathcote, L., & Poole, G. (2010). Harnessing ICT potential: The adoption and analysis of ICT systems for enhancing the student learning experience. *International Journal of Educational Management, 24*(2), 116-128.

De Grove, F., Bourgonjon, J., & Van Looy, J. (2012). Digital games in the classroom? A contextual approach to teachers' adoption intention of digital games in formal education. *Computers in Human Behavior, 28*(6), 2023-2033.

De Smet, C., Bourgonjon, J., De Wever, B., Schellens, T., & Valcke, M. (2012). Researching instructional use and the technology acceptation of learning management systems by secondary school teachers. *Computers, & Education, 58*(2), 688-696.

De Vaus, D. (2013). Surveys in social research. Routledge: UK.

De Vaus, D. A. (2001). *Research design in social research.* SAGE: London.

Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, *19*(4), 9-30.

Denscombe, M. (2014). *The good research guide: For small-scale social research projects.* McGraw-Hill Education (UK).

Department of Education. (2003). Draft white paper on e-education: Transforming learning and teaching through ICT.

Deutsch, H., Bronold, F. X., & Becker, K. (2014). Calculation of electron-impact ionization cross sections: Bottom-up inductive vs. top-down deductive approaches. *International Journal of Mass Spectrometry, 365*, 128-139.

Devitt, N., Lyons, S., & McCoy, S. (2014). Perceived benefits and barriers to the use of high speed broadband in Ireland's second-level schools. MPRA Paper No. 60185. Available at: http://mpra.ub.uni-muenchen.de/60185/.

Dlodlo, N. (2009). Access to ICT education for girls and women in rural South Africa: A case study. *Technology in Society, 31*(2), 168-175.

Doody, O., & Noonan, M. (2013). Preparing and conducting interviews to collect data. *Nurse Researcher, 20*(5), 28-32.

Dörnyei, Z., & Taguchi, T. (2009). *Questionnaires in second language research: Construction, administration, and processing.* Routledge: UK.

Drucker, P. F. (1994). The age of social transformation. *Atlantic Monthly, (274)*5, 53-80.

du Plessis, A., & Paul, W. (2012). Teachers' perceptions about their own and their schools' readiness for computer implementation: A South African case study. *TOJET: The Turkish Online Journal of Educational Technology, 11*(3).

Duane, B. G., Humphris, G., Richards, D., Okeefe, E. J., Gordon, K., & Freeman, R. (2014). Weighing up the weighted case mix tool (WCMT): A psycho-metric investigation using confirmatory factor analysis. *Community Dental Health, 31*, 200-206.

Dulle, F. W., & Minishi-Majanja, M. (2011). The suitability of the unified theory of acceptance and use of technology (UTAUT) model in open access adoption studies. *Information Development, 27*(1), 32-45.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Harcourt Brace Jovanovich College Publishers.

Edmunds, R., Thorpe, M., & Conole, G. (2012). Student attitudes towards and use of ICT in course study, work and social activity: A technology acceptance model approach. *British Journal of Educational Technology, 43*(1), 71-84.

Eisinga, R., Grotenhuis, M. T., & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health*, *58*(4), 1-6.

Elmore, P. B., & Beggs, D. L. (1975). Salience of concepts and commitment to extreme judgments in the response patterns of teachers. *Education, 95*(4), 325-330.

eMarketer, & AP. (n.d.). Number of mobile phone users worldwide from 2013 to 2019 (in billions). In *Statista – The Statistics Portal*. Retrieved June 10, 2017, from https://www.statista.com/statistics/274774/forecast-of-mobile-phone-users-worldwide/.

Emory, C. W., Cooper, D. R., & Richard, D. (1991). *Business research methods.* Boston Irwin Inc.: Boston.

Erlingsson, C., & Brysiewicz, P. (2013). Orientation among multiple truths: An introduction to qualitative research. *African Journal of Emergency Medicine, 3*(2), 92-99.

Etherington, M. (2008). E-Learning pedagogy in the primary school classroom: The McDonaldization of education. *Australian Journal of Teacher Education, 33*(5). http://dx.doi.org/10.14221/ajte.2008v33n5.3.

Fanni, F., Rega, I., & Cantoni, L. (2013). Using self-efficacy to measure primary school teachers' perception of ICT. *International Journal of Education and Development Using ICT, 9*(1), 100-111.

Fathema, N., & Sutton, K. L. (2013). Factors influencing faculty members' learning management systems adoption behavior: An analysis using the technology acceptance model. *International Journal of Trends in Economics Management, & Technology, 2*(6), 20-28.

Fathema, N., Shannon, D., & Ross, M. (2015). Expanding the technology acceptance model (TAM) to examine faculty use of learning management systems (LMSs) in higher education institutions. *Journal of Online Learning, & Teaching*, *11*(2), 220-232.

Fessakis, G., Gouli, E., & Mavroudi, E. (2013). Problem solving by 5–6 years old kindergarten children in a computer programming environment: A case study. *Computers, & Education*, *63*, 87-97.

Finch, H., & Lewis, J. (2013). Focus groups. In Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (Eds.). Qualitative research practice: A guide for social science students and researchers. Sage: California.

Fishbein, M. (1979). A theory of reasoned action: Some applications and implications. In H. E. Howe Jr., & M. M. Page (eds.), *Nebraska symposium on motivation* (vol. 27, pp. 65-116). Lincoln: University of Nebraska Press.

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: AddisonWesley.

Foddy, W., & Mantle, J. (1994). Constructing questions for interviews and questionnaires: Theory and practice in social research. *Physiotherapy, 80*(6), 382.

Ford, M., & Botha, A. (2010, May). A pragmatic framework for integrating ICT into education in South Africa. In IST-Africa, 2010 (pp. 1-10). IEEE.

Fornell, C., & Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50.

Fosnot, C. T. (2013). *Constructivism: Theory, perspectives, and practice*. Teachers College Press: Columbia University, NYC.

Fu, J. S. (2013). ICT in education: A critical literature review and its implications. *International Journal of Education and Development using Information and Communication Technology, 9*(1), 112.

Gadermann, A. M., Guhn, M., & Zumbo, B. D. (2012). Estimating ordinal reliability for Likert-type and ordinal item response data: A conceptual, empirical, and practical guide. *Practical Assessment, Research, & Evaluation, 17*(3), 1-13.

Gajek, E. (2015). Implications from the use of ICT by language teachers--Participants of international projects. *Universal Journal of Educational Research*, *3*(1), 1-7.

Ghadi, I., Alwi, N. H., Bakar, K. A., & Talib, O. (2012). Construct validity examination of critical thinking dispositions for undergraduate students in university Putra Malaysia. *Higher Education Studies, 2*(2), 138-145.

Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: A guide for non-statisticians. *International Journal of Endocrinology and Metabolism, 10*(2), 486-489.

Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J. J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. *Computers in Human Behavior*, *68*, 441-449.

Gögüs, A., Nistor, N., & Lerche, T. (2012). Educational technology acceptance across cultures: A validation of the unified theory of acceptance and use of technology in the context of Turkish national culture. *TOJET: The Turkish Online Journal of Educational Technology, 11*(4).

Goodhue, D., Lewis, W., & Thompson, R. (2006). PLS, small sample size, and statistical power in MIS research. In *Proceedings of the 39th Annual Hawaii International Conference on System Sciences*. Kauia, HI, USA. 4-7 January 2006. Available online from IEEE *Xplore* at http://ieeexplore.ieee.org/document/1579705/

Goodison, T. A. (2002). Learning with ICT at primary level: Pupils' perceptions. *Journal of Computer Assisted Learning*, *18*(3), 282-295.

Goodwin, A. L., Low, E. L., Ng, P. T., Yeung, A. S., & Cai, L. (2015). Enhancing playful teachers' perception of the importance of ICT use in the classroom: The role of risk taking as a mediator. *Australian Journal of Teacher Education, 40*(4), 8.

Goundar, S. (2011, December). What is the potential impact of using mobile devices in education. In Proceedings of SIG GlobDev Fourth Annual Workshop (Vol. 3, pp. 1-30).

Grandon, E. E., Alshare, K., & Kwun, O. (2005). Factors influencing student intention to adopt online classes: A cross-cultural study. *Journal of Computing Sciences in Colleges, 20*(4), 46-56.

Grbich, C. (2012). *Qualitative data analysis: An introduction.* Sage: UK.

Grossnickle, J., & Raskin, O. (2000). *The handbook of online marketing research: Knowing your customer using the net.* McGraw-Hill: USA.

Gu, X., Zhu, Y., & Guo, X. (2013). Meeting the 'digital natives': Understanding the acceptance of technology in classrooms. *Journal of Educational Technology, & Society, 16*(1), 392-402.

Gudmundsdottir, G. (2010). When does ICT support education in South Africa? The importance of teachers' capabilities and the relevance of language. *Information Technology for Development, 16*(3), 174-190.

Güllü, F., Kuusik, R., Shogenov, K., Laanpere, M., Oysal, Y., Sözcü, Ö. F., & Parlak, Z. (2016). An analysis and comparison of adoption of e-learning systems in higher education by lecturers at largest universities in Estonia and Turkey. *Baltic Journal of Modern Computing*, *4*(3), 428.

Gupte, M. (2015). Does information and communication technology have an important role to play in Indian higher education? *Abhinav-International Monthly Refereed Journal Of Research In Management, & Technology, 4*(1), 41-46.

Haddad, W.D., & Jurich, S. (2002). ICT for education: prerequisites and constraints. In W.D. Haddad, & A. Draxler (eds.), *Technologies for education – potentials, parameters and prospects.* Paris: UNESCO; Washington, DC: Academy for Educational Development, 42-57.

Haddon, L. (2016). *The social dynamics of information and communication technology*. Routledge: London.

Hair Jr, J. F., Sarstedt, M., Hopkins, L., & G. Kuppelwieser, V. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review, 26*(2), 106-121.

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM).* 2nd edition. Sage: Thousand Oaks, CA.

Hair, Jr. J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis.* 7th edition. Prentice Hall: Englewood Cliffs.

Hamari, J., & Nousiainen, T. (2015, January). Why do teachers use game-based learning technologies? The role of individual and institutional ICT readiness. In *System Sciences* (HICSS), 2015 48th Hawaii International Conference on (pp. 682-691). IEEE.

Hammond, M. (2014). Introducing ICT in schools in England: Rationale and consequences. *British Journal of Educational Technology, 45*(2), 191-201.

Haolader, F. A., Foysol, K. M., & Clement, C. K. (2017). Technical and vocational education and training (TVET) in Bangladesh–Systems, curricula, and transition pathways. In *Vocational education and training in times of economic crisis* (201-227). Springer International Publishing.

Hend, S. (2010). E-learning and ICT integration in colleges and universities in Saudi Arabia. *eLearn*, *2010*(3). Retrieved 20 January 2014, from http://doi.acm.org/10.1145/1735103.1735849.

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management, & Data Systems, 116*(1), 2-20.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115-135.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In Rudolf R. Sinkovics, Pervez N. Ghauri (Eds.). *New challenges to international marketing* (*Advances in International Marketing*, Volume 20). Emerald Group Publishing Limited, 277 - 319.

Hermans, R., Tondeur, J., van Braak, J., & Valcke, M. (2008). The impact of primary school teachers' educational beliefs on the classroom use of computers. *Computers, & Education, 51*(4), 1499-1509.

Herselman, M. E. (2003). ICT in rural areas in South Africa: Various case studies. *Informing Science Proceedings*, 945-955.

Hew K.F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55*, 223–252.

Hillmer, U. (2009). Individual Perspective. In *Technology acceptance in mechatronics* (pp. 51-87). Gabler Verlag, Wiesbaden.

Hinkin, T. R. (1995). A review of scale development practices in the study of organizations. *Journal of Management, 21*(5), 967-988.

Hofstede, G. (1984). Cultural dimensions in management and planning. *Asia Pacific Journal of Management, 1*(2), 81-99.

Holland, J., & Holland, J. (2014). Implications of shifting technology in education. *TechTrends, 58*(3), 16-25.

Hollow, D., & Masperi, P. (2009, April). An evaluation of the use of ICT within primary education in Malawi. In the *Proceedings of the International Conference on Information and Communication Technologies and Development (ICTD), 2009* (27-34). IEEE.

Holloway, I., & Wheeler, S. (2013). *Qualitative research in nursing and healthcare.* John Wiley, & Sons: New Jersey.

Hsin, C. T., Li, M. C., & Tsai, C. C. (2014). The influence of young children's use of technology on their learning: A review. *Educational Technology, & Society*, *17*(4), 85-99.

Husain, M. Y., Mustapha, R., Malik, S. A., & Mokhtar, S. B. (2014). Verification of employability skills inventory using confirmatory factor analysis. *Journal of Asian Vocational Education and Training, 6*, 1-9.

Hussein, A. (2015). The use of triangulation in social sciences research: Can qualitative and quantitative methods be combined? *Journal of Comparative Social Work, 4*(1).

Ibanez Martinez, J. (2014, June). Craft, click and play: crafted videogames, a new approach for physicaldigital entertainment. In *Proceedings of the 2014 Conference on Interaction Design and Children* (313-316). ACM.

Ibrahim, S 2010, *ESP Community in transition: A study of ICT use in a tertiary context in Saudi Arabia.* (PhD Education). University of Wollongong, Australia.

Ilieva, J., Baron, S., & Healey, N. M. (2002). Online surveys in marketing research: Pros and cons. *International Journal of Market Research, 44*(3), 361.

Ilomäki, L. (2008). *The effects of ICT on school: Teachers' and students' perspectives.* Annales Universitatis Turkuensis B 314.

Iniesta-Bonillo, M. A., Sánchez-Fernández, R., & Schlesinger, W. (2013). Investigating factors that influence on ICT usage in higher education: A descriptive analysis. *International Review on Public and Nonprofit Marketing, 10*(2), 163-174.

Inspectorate of Education of Ireland. (2008). ICT in schools: A volume of the Inspectorate evaluation studies. Inspectorate's Evaluation Support and Research Unit. Department of Education and Science: Dublin, Ireland.

Isaacs, S. (2007). *ICT in education in South Africa*. Survey of ICT and Education in Africa: South Africa Country Report.

Ismail, R. (2016). *Saudi Clerics and Shi'a Islam*. Oxford University Press: Oxford.

Jaffer, S., Ng'ambi, D., & Czerniewicz, L. (2007). The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges. *International Journal of Education and Development Using ICT, 3*(4).

Jensen, K. B. (Ed.). (2013). *A handbook of media and communication research: Qualitative and quantitative methodologies.* Routledge: UK.

Jimoyiannis, A., & Komis, V. (2007). Examining teachers' beliefs about ICT in education: Implications of a teacher preparation programme. *Teacher Development, 11*(2), 149-173.

Jin, S., & Cho, C. M. (2015). Is ICT a new essential for national economic growth in an information society? *Government Information Quarterly, 32*(3), 253-260.

Jones, T., & Cuthrell, K. (2011). YouTube: Educational potentials and pitfalls. *Computers in the Schools, 28*(1), 75-85.

Kafle, N. P. (2013). Hermeneutic phenomenological research method simplified. *Bodhi: An Interdisciplinary Journal, 5*(1), 181-200.

Kebritchi, M. (2010). Factors affecting teachers' adoption of educational computer games: A case study. *British Journal of Educational Technology, 41*(2), 256-270.

Keengwe, J., Kidd, T., & Kyei-Blankson, L. (2009). Faculty and technology: Implications for faculty training and technology leadership. *Journal of Science Education and Technology, 18*(1), 23-28.

Kelly, S., & Breslin, J. (2010). *Women's rights in the Middle East and North Africa: Progress amid resistance*. Rowman, & Littlefield Publishers.

Khalid, M. S., & Nyvang, T. (2014). A change agent's facilitation process for overcoming the barriers of ICT adoption for educational administration –The case of a rural-Bangladesh vocational institution. *Australasian Journal of Educational Technology, 30*(5).

Khan, M., Hossain, S., Hasan, M., & Clement, C. K. (2012). Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. *Online Submission*, *5*(2), 61-80.

Kidombo, H.J., Gakuu, C.M., & Ndiritu, A. (2009). Institutional management and integration of information and communication technology in teaching and learning in selected Kenyan schools. *Journal of Continuing, Open and Distance Education*, 151.

Kigozi, E., Ekenberg, L., Hansson, H., Tusubira, F., & Danielson, M. (2008). Exploring the e-learning state of art. *Electronic Journal of e-Learning, 6*(2), 77-88.

Kim, H. Y. (2013). Statistical notes for clinical researchers: ASSESSING normal distribution (2) using skewness and kurtosis. *Restorative Dentistry, & Endodontics, 38*(1), 52-54.

King Abdulaziz City for Science and Technology. (2002). *Strategic Technology Program Summary Document*. Riyadh: Ministry of Economy and Planning. Retrieved from http://www.kacst.edu.sa/en/research/it/Documents/ghq.pdf.

Kocaleva, M., Stojanovic, I., & Zdravev, Z. (2014). UTAUT and its application in an educational environment: State-of-the-art. *Yearbook 2013-Faculty of Computer Science, 2*(2), 95-102.

Kock, N. (n.d., online). Data validation for use in SEM. PowerPoint presentation. Slide 9. Available at http://slideplayer.com/slide/6240162/.

Kong, S. C. (2014). Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy. *Computers, & Education*, *78*, 160-173.

Kozma, R. B. (2008). Comparative analysis of policies for ICT in education. In *International handbook of information technology in primary and secondary education* (pp. 1083-1096). Springer US.

Kreijns, K., Van Acker, F., Vermeulen, M., & Van Buuren, H. (2013). What stimulates teachers to integrate ICT in their pedagogical practices? The use of digital learning materials in education. *Computers in Human Behavior, 29*(1), 217-225.

Kreijns, K., Vermeulen, M., Kirschner, P. A., Buuren, H. V., & Acker, F. V. (2013). Adopting the integrative model of behaviour prediction to explain teachers' willingness to use ICT: A perspective for research on teachers' ICT usage in pedagogical practices. *Technology, Pedagogy and Education, 22*(1), 55-71.

Law, N., & Chow, A. (2008). Teacher characteristics, contextual factors, and how these affect the pedagogical use of ICT. In *Pedagogy and ICT Use* (pp. 181-219). Springer Netherlands.

Lee, M. K., Cheung, C. M., & Chen, Z. (2005). Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation. Information, & management, *42*(8), 1095-1104.

Lee, S.G., Trimi, S., & Kim, C. (2013). The impact of cultural differences on technology adoption. *Journal of World Business, 48*(1), 20-29.

Lee, Y., Kozar, K. A., & Larsen, K. R. (2003). The technology acceptance model: Past, present, and future. *Communications of the Association for Information Systems, 12*(1), 50.

Legard, R., Keegan, J., & Ward, K. (2013). In-depth interviews. In Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (Eds.), *Qualitative research practice: A guide for social science students and researchers*. Sage: UK.

Lehmann, E. L., & Romano, J. P. (2006). Testing statistical hypotheses. Springer Science & Business Media.

Li, Y., Chen, H., Liu, Y., & Peng, M. W. (2014). Managerial ties, organizational learning, and opportunity capture: A social capital perspective. *Asia Pacific Journal of Management, 31*(1), 271-291.

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology, 22*(140).

Likert, R. (1974). A method of constructing an attitude scale. In G.M. Maranell (Ed.), *Scaling: A sourcebook for behavioural scientists*. Aldine: Chicago, 233-243.

Lin, P. C., Lu, H. K., & Liu, C. H. I. A. (2013). Towards an education behavioral intention model for e-learning systems: An extension of UTAUT. *Journal of Theoretical and Applied Information Technology*, *47*(3), 1120-1127.

Lindberg, O. J., Lindberg, O. J., Olofsson, A. D., Olofsson, A. D., Fransson, G., & Fransson, G. (2017). Same but different? An examination of Swedish upper secondary school teachers' and students' views and use of ICT in education. *The International Journal of Information and learning Technology*, *34*(2), 122-132.

Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. *Oxford review of education*, *38*(1), 9-24.

López-Nicolás, C., Molina-Castillo, F. J., & Bouwman, H. (2008). An assessment of advanced mobile services acceptance: Contributions from TAM and diffusion theory models. *Information, & Management, 45*(6), 359-364.

Losada Iglesias, D., Correa Gorospe, J. M., & Fernandez Olaskoaga, L. (2017). The impact of the 'one laptop per child' model in primary education: A case study. *Educacion XX1, 20*(1), 339-361.

Luck, D., & Rubin, R. (1987). *Marking research*. Prentice Hall: Englewood Cliffs, NJ.

Luo, M. M., & Remus, W. (2014). Uses and gratifications and acceptance of Web-based information services: An integrated model. *Computers in Human Behavior*, *38*, 281-295.

Mac Callum, K., & Jeffrey, L. (2013). The influence of students' ICT skills and their adoption of mobile learning. *Australasian Journal of Educational Technology, 29*(3).

Macharia, J. K., & Pelser, T. G. (2014). Key factors that influence the diffusion and infusion of information and communication technologies in Kenyan higher education. *Studies in Higher Education, 39*(4), 695-709.

MacLeod, C., & Fraser, B. J. (2010). Development, validation and application of a modified Arabic translation of the What Is Happening In this Class?(WIHIC) questionnaire. *Learning Environments Research, 13*(2), 105-125.

Majlis Al-Shura. (2014). *Committees*. Retrieved August 2014, from http://www.shura.gov.sa/wps/wcm/connect/shuraen/internet/committees.

Malhotra, N. K., Agarwal, J., & Peterson, M. (1996). Methodological issues in cross-cultural marketing research: A state-of-the-art review. *International Marketing Review, 13*(5), 7-43.

Maroun, N., Samman, H., Moujaes, C. N., & Abouchakra, R. (2008). How to succeed at education reform: *The case for Saudi Arabia and the broader GCC region*. Booz and Company: Abu Dhabi.

Masrom, M. (2007, May). Technology acceptance model and e-learning. In *Proceedings of the 12th International Conference on Education*, May 21-24, Brunei Darussalam: Universiti Brunei Darussalam, 1-10. Available at: http://eprints.utm.my/5482/1/ MaslinMasrom2006_Techn.pdf.

McPeake, J., Bateson, M., & O'Neill, A. (2014). Electronic surveys: How to maximise success. *Nurse Researcher, 21*(3), 24-26.

Ministry of Communications and Information Technology (MCIT). (2003). *Information and telecommunication technology in Saudi Arabia*. Ministry of Communications and Information Technology.

Ministry of Communications and Information Technology (MCIT). (2013). *About NCITP*. Ministry of Communications and Information Technology. Retrieved from http://www.mcit.gov.sa/En/nationalplan/pages/about.aspx.

Ministry of Communications and Information Technology (MCIT). (2014). *Saudi Arabia Wins Middle East eGov and eServices Excellence Awards*. Ministry of Communications and Information Technology.

Monecke, A., & Leisch, F. (2012). semPLS: structural equation modeling using partial least squares. *Journal of Statistical Software, 48*(3), 1-32.

Mooketsi, B. E., & Chigona, W. (2014). Different shades of success: educator perception of government strategy on e-education in South Africa. *The Electronic Journal of Information Systems in Developing Countries*, 64.

Mura, G., & Diamantini, D. (2014). The use and perception of ICT among educators: The Italian Case. *Procedia-Social and Behavioral Sciences, 141*, 1228-1233.

Nassuora, A.B. (2012). Students acceptance of mobile learning for higher education in Saudi Arabia. *American Academic, & Scholarly Research Journal*, *4*(2), 24-30.

Ngai, E.T., Poon, J.L., & Chan, Y.C. (2007). Empirical examination of the adoption of WebCT using TAM. *Computers, & Education*, *48*(2), 250-267. doi:10.1016/j.compedu.2004.11.007

Noor-ul-Amin, S. (2013). *An effective use of ICT for education and learning by drawing on worlwide knowledge, research and experience*. Citeseer.

Nurunnabi, M. (2017). Transformation from an oil-based economy to a knowledge-based economy in Saudi Arabia: The direction of Saudi Vision 2030. *Journal of the Knowledge Economy*, 1-29.

Obeidat, B., Shannak, R., Masa'deh, Ra'ed (Moh'd Taisir), & Al-Jarrah, I. (2012). Toward better understanding for Arabian culture: Implications based on Hofstede's cultural model. *European Journal of Social Sciences, 28*(4), 512-522.

Oliver, R. (2002). The role of ICT in higher education for the 21st century: ICT as a change agent for education. Available from ResearchGate at: https://www.researchgate.net/publication/228920282_The_role_of_ICT_in_higher_education_for_the_21st_century_ICT_as_a_change_agent_for_education

Olson, D. R., & Bruner, J. S. (1996). Folk psychology and folk pedagogy. In Olson, D.R., & Torrance, N. (eds.), *The handbook of education and human development*, 9-27. Wiley-Blackwell Publishing Online. Available at: http://www.blackwellreference.com/public/tocnode?id=g9780631211860_chunk_g97806312118604

Ong, C.S., & Lai, J.Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior, 22*(5), 816-829.

Ong, C.S., Lai, J.Y., & Wang, Y.-S. (2004). Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. *Information, & management, 41*(6), 795-804.

Oyaid, A. A. (2009). *Education policy in Saudi Arabia and its relation to secondary school teachers' ICT use, perceptions, and views of the future of ICT in education* (Doctoral dissertation). University of Exeter).

Oyaid, A.A. (2010). Secondary student's perceptions of information and communication technology and their usage of it inside and outside of school in Riyadh City, Saudi Arabia. *International Journal of Applied Educational Studies, 7*(1), 27.

Oye, N., Iahad, N., & Ab Rahim, N. Z. (2013). An application of the UTAUT model for understanding acceptance and use of ICT by Nigerian university academicians.

Oye, N., Iahad, N., & Rahim, N. A. (2014). The history of UTAUT model and its impact on ICT acceptance and usage by academicians. *Education and Information Technologies, 19*(1), 251-270.

Packer, M. J. (1989). Entering the circle: Hermeneutic investigation in psychology. Suny Press: Albany, NY.

Padilla-MeléNdez, A., Del Aguila-Obra, A. R., & Garrido-Moreno, A. (2013). Perceived playfulness, gender differences and technology acceptance model in a blended learning scenario. *Computers, & Education, 63*, 306-317.

Pajo, K., & Wallace, C. (2001). Barriers to the uptake of web-based technology by university teachers. *International Journal of E-Learning, & Distance Education, 16*(1), 70-84.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2013). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 42*(5), 533-544. https://doi.org/10.1007/s10488-013-0528-y

Panda, S., & Mishra, S. (2007). E-Learning in a Mega Open University: Faculty attitude, barriers and motivators. *Educational Media International, 44*(4), 323-338.

Papaioannou, P., & Charalambous, K. (2011). Principals' attitudes towards ICT and their perceptions about the factors that facilitate or inhibit ICT integration in primary schools of Cyprus. *Journal of Information Technology Education, 10*(1), 349-369.

Park, N., Lee, K. M., & Cheong, P. H. (2007). University instructors' acceptance of electronic courseware: An application of the technology acceptance model. Journal of Computer-Mediated Communication, 13(1), 163-186.

Park, N., Roman, R., Lee, S., & Chung, J. E. (2009). User acceptance of a digital library system in developing countries: An application of the Technology Acceptance Model. *International Journal of Information Management, 29*(3), 196-209.

Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educational Technology, & Society, 12*(3), 150-162.

Park, S. Y., Nam, M. W., & Cha, S. B. (2012). University students' behavioral intention to use mobile learning: Evaluating the technology acceptance model. *British Journal of Educational Technology, 43*(4), 592-605.

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers, & Education, 37*(2), 163-178.

Persico, D., Manca, S., & Pozzi, F. (2014). Adapting the technology acceptance model to evaluate the innovative potential of e-learning systems. *Computers in Human Behavior, 30*, 614-622.

Pietkiewicz, I., & Smith, J. A. (2014). A practical guide to using Interpretative Phenomenological Analysis in qualitative research psychology. *Psychological Journal, 20*(1), 7-14.

Pituch, K. A., & Lee, Y.-k. (2006). The influence of system characteristics on e-learning use. *Computers, & Education, 47*(2), 222-244.

Prasad, C. V., Lalitha, P., & Srikar, P. V. N. (2015). Barriers to the use of information and communication technology (ICT) in secondary schools: Teacher's perspective. *Journal of Management Research, 7*(2), 190-208.

Prieto, J. C. S., Migueláñez, S. O., & García-Peñalvo, F. J. (2014, October). ICTs integration in education: mobile learning and the technology acceptance model (TAM). In Proceedings of the Second International Conference on Technological Ecosystems for Enhancing Multiculturality (pp. 683-687). ACM.

Pulkkinen, J. (2003). *The paradigms of e-education: An analysis of the communication structures in the research on information and communication technology integration in education in the years 2000-2001.* (Vol. 66): ProQuest.

Pynoo, B., Devolder, P., Tondeur, J., Van Braak, J., Duyck, W., & Duyck, P. (2011). Predicting secondary school teachers' acceptance and use of a digital learning environment: A cross-sectional study. *Computers in Human Behavior, 27*(1), 568-575.

Raman, A., Don, Y., Khalid, R., & Rizuan, M. (2014). Usage of learning management system (Moodle) among postgraduate students: UTAUT model. *Asian Social Science, 10*(14), 186.

Raman, A., Don, Y., Khalid, R., Hussin, F., Omar, M. S., & Ghani, M. (2014). Technology acceptance on Smart Board among teachers in Terengganu using UTAUT model. *Asian Social Science, 10*(11), 84.

Rapport, F., & Wainvwight, P. (2006). Phenomenoiogy as a paradigm of movement. *Nursing Inquiry. 13, 3*, 228-236.

Razali, N. M., & Wah, Y. B. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics, 2*(1), 21-33.

Rennie, D. L. (2012). Qualitative research as methodical hermeneutics. *Psychological Methods, 17*(3), 385.

Ringov, D., & Zollo, M. (2007). The impact of national culture on corporate social performance. *Corporate Governance: The International Journal of Business in Society, 7*(4), 476-485.

Ritchie, J., Lewis, J., & El am, G. (2013). Designing and selecting samples. In Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (Eds.). *Qualitative research practice: A guide for social science students and researchers.* Sage: California.

Roca, J. C., Chiu, C.-M., & Martínez, F. J. (2006). Understanding e-learning continuance intention: An extension of the Technology Acceptance Model. *International Journal of Human-Computer Studies, 64*(8), 683-696.

Royston, J. P. (1983). Some techniques for assessing multivarate normality based on the Shapiro-Wilk W. *Journal of the Royal Statistical Society*. Series C (Applied Statistics), 32(2), 121-133.

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003). Examining teacher technology use: Implications for preservice and inservice teacher preparation. *Journal of Teacher Education*, 54(5), 297–310.

Sait, S. M., Al-Tawil, Khalid M. , & Ali , S. (2003). Use and effect of internet in Saudi Arabia. Technical report. Riyadh, Saudi Arabia: King Abdulaziz City for Science and Technology.

Salant, P., Dillman, I., & Don, A. (1994). *How to conduct your own survey*. Wiley: NJ.

Salleh, S. H., & Albion, P. (2004). Using the theory of planned behaviour to predict Bruneian teachers' intentions to use ICT in teaching. In *Proceedings of the 15th International Conference of the Society for Information Technology, & Teacher Education* (SITE 2004) (pp. 1389-1396). Association for the Advancement of Computing in Education (AACE).

Sang, G., Valcke, M., van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers, & Education, 54*(1), 103-112.

Sang, G., Valcke, M., van Braak, J., Tondeur, J., & Zhu, C. (2011). Predicting ICT integration into classroom teaching in Chinese primary schools: Exploring the complex interplay of teacher-related variables. *Journal of Computer Assisted Learning, 27*(2), 160-172.

Santos, J. R. A. (1999). Cronbach's alpha: A tool for assessing the reliability of scales. *Journal of Extension, 37*(2), 1-5.

Saudi Embassy Washington DC. (2006). *About Saudi Arabia: Legal and judicial structure.* Retrieved Jun 15, 2014, from https://www.saudiembassy.net/about/country-information/government/legal_and_judicial_structure.aspx

Schulz-Zander, R. (2004). The school online initiative in German schools: Empirical results and recommendations to improve school development. *International Institute for Educational Planning, UNESCO.* Retrieved from www.unesco.org/iiep.

Schwartz, S. H., & Boehnke, K. (2004). Evaluating the structure of human values with confirmatory factor analysis. *Journal of Research in Personality, 38*(3), 230-255.

Sepulveda, A. R., Parks, M., de Pellegrin, Y., Anastasiadou, D., & Blanco, M. (2016). Validation of the Spanish version of the Drive for Muscularity Scale (DMS) among males: Confirmatory factor analysis. *Eating Behaviors, 21,* 116-122.

Sergis, S., Sholla, I., Zervas, P., & Sampson, D. G. (2014, November). Supporting school ICT uptake: The ASK school ICT competence management system. In the *Proceedings of the 2014 International Conference on Interactive Mobile Communication Technologies and Learning* (IMCL2014) (pp. 359-363). Institute of Electrical and Electronics Engineers (IEEE).

Seri, P., & Zanfei, A. (2013). The co-evolution of ICT, Skills and organization in public administrations: Evidence from new European country-level data. *Structural Change and Economic Dynamics, 27*, 160-176.

Shin, D. H. (2009). An empirical investigation of a modified technology acceptance model of IPTV. *Behaviour, & Information Technology, 28*(4), 361-372.

Shin, W. S. (2014). Teachers' use of technology and its influencing factors in Korean elementary schools. *Technology, Pedagogy and Education*, (ahead-of-print), 1-16.

Simpson, A. (2010). Integrating technology with literacy: Using teacher-guided collaborative online learning to encourage critical thinking. *ALT-J*, *18*(2), 119-131.

Skryabin, M., Zhang, J., Liu, L., & Zhang, D. (2015). How the ICT development level and usage influence student achievement in reading, mathematics, and science. *Computers, & Education, 85*, 49-58.

Soiferman, L. K. (2010). Compare and contrast inductive and deductive research approaches. Online submission. ERIC Number ED542066. Available at: https://eric.ed.gov/?id=ED542066

Somekh, B. (2008). Chapter 5.3: Factors affecting teachers' pedagogical adoption of ICT. In J. Voogt, & G. Knezek (eds.), *International handbook of information technology in primary and secondary education* (pp. 449-460). Springer, US.

Sooryanarayan, D. G., Gupta, D., & Rekha, V. S. (2014, December). Trends in open source software adoption in indian educational institutions. In *Technology for Education* (T4E), 2014 IEEE Sixth International Conference on (pp. 249-252). IEEE.

Strudler, N., & Hearrington, D. (2008). Quality support for ICT in schools. In J. Voogt, & G. Knezek (eds.), International handbook of information technology in primary and secondary education, (579-596). Springer: New York.

Šumak, B., Polancic, G., & Hericko, M. (2010). *An empirical study of virtual learning environment adoption using UTAUT.* Paper presented at the Second International Conference on Mobile, Hybrid, and On-Line Learning, (pp. 17-22), 2010.

Sun, H., & Zhang, P. (2006). The role of moderating factors in user technology acceptance. *International Journal of Human-Computer Studies, 64*(2), 53-78.

Susanto, A., Chang, Y., Zo, H., & Park, M. C. (2012). *The role of trust and security in Smartphone banking continuance.* Paper presented at the 2012 IEEE International Conference on Systems, Man, and Cybernetics (SMC).

Talebian, S., Mohammadi, H. M., & Rezvanfar, A. (2014). Information and communication technology (ICT) in higher education: advantages, disadvantages, conveniences and limitations of applying e-learning to agricultural students in Iran. *Procedia-Social and Behavioral Sciences*, *152*, 300-305.

Tatweer. (2017). King Abdullah bin Abdul-Aziz public educational development project. Retrieved from https://www.tatweer.edu.sa/ at 15/07/2017.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2,* 53.

Taylor, S., and Todd, P. (1995c) Assessing IT usage: The role of prior experience. *MIS Quarterly, 19*(4) 561-570.

Teddlie, C., & Tashakkori, A. (Eds.). (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences.* Sage Publications Inc.: California.

Teo, T. (2009). Modelling technology acceptance in education: A study of pre-service teachers. *Computers, & Education, 52*(2), 302-312.

Teo, T. (2010a). A path analysis of pre-service teachers' attitudes to computer use: applying and extending the technology acceptance model in an educational context. *Interactive Learning Environments, 18*(1), 65-79.

Teo, T. (2010b). Examining the influence of subjective norm and facilitating conditions on the intention to use technology among pre-service teachers: a structural equation modeling of an extended technology acceptance model. *Asia Pacific Education Review, 11*(2), 253-262.

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers, & Education, 57*(4), 2432-2440.

Teo, T., & Lee, C., B. (2010). Explaining the intention to use technology among student teachers: An application of the Theory of Planned Behavior (TPB). *Campus-Wide Information Systems, 27*(2), 60-67.

Teo, T., & Tan, L. (2012). The theory of planned behavior (TPB) and pre-service teachers' technology acceptance: A validation study using structural equation modeling. *Journal of Technology and Teacher Education, 20*(1), 89-104.

Teo, T., Lee, C. B., & Chai, C. S. (2008). Understanding pre-service teachers' computer attitudes: applying and extending the technology acceptance model. *Journal of Computer Assisted Learning, 24*(2), 128-143.

Teo, T., Wong, S. L., & Chai, C. S. (2008). A cross-cultural examination of the intention to use technology between Singaporean and Malaysian pre-service teachers: An application of the technology acceptance model (TAM). *Educational Technology, & Society, 11*(4), 265-280.

Tezci, E. (2011). Factors that influence pre-service teachers' ICT usage in education. *European Journal of Teacher Education, 34*(4), 483-499.

The World Bank. Gross enrolment ratio, primary, both sexes (%). Retrieved 15 August, 2015, from http://data.worldbank.org/indicator/SE.PRM.ENRR

The World Bank. (2012). *Gender equality and development.* World Development Report 2012. The World Bank (The International Bank for Reconstruction and Development): Washington, DC.

The World Bank. (2015). *Annual report 2015.* The World Bank (The International Bank for Reconstruction and Development): Washington, DC. Available at http://www.worldbank.org/en/about/annual-report-2015.

Tinio, V. L. (2002). *Survey of information, & communication technology utilization in Philippine public high schools*. Retrieved on April, 15, 2008.

Tondeur, J., Hermans, R., van Braak, J., & Valcke, M. (2008b). Exploring the link between teachers' educational belief profiles and different types of computer use in the classroom. *Computers in Human Behavior, 24*(6), 2541-2553.

Tondeur, J., Valcke, M., & Van Braak, J. (2008). A multidimensional approach to determinants of computer use in primary education: Teacher and school characteristics. *Journal of Computer Assisted Learning, 24*(6), 494-506.

Tondeur, J., Van Braak, J., & Valcke, M. (2007). Curricula and the use of ICT in education: Two worlds apart? *British Journal of Educational Technology, 38*(6), 962-976.

Tondeur, J., Van Keer, H., van Braak, J., & Valcke, M. (2008a). ICT integration in the classroom: Challenging the potential of a school policy. *Computers, & Education, 51*(1), 212-223.

Trochim, W.K. (2006). Design. In *Research methods knowledge base*. Online at https://www.socialresearchmethods.net/kb/design.php

Tuohy, D., Cooney, A., Dowling, M., Murphy, K., & Sixsmith, J. (2013). An overview of interpretive phenomenology as a research methodology. *Nurse Researcher, 20*(6), 17-20.

Tuparova, D., Kaseva, M., & Tuparov, G. (2014). Development of key competences through ICT in primary school. *Procedia-Social and Behavioral Sciences, 116*, 2952-2956.

UNESCO-IBE, 2011. *World data on education*. 7th edition, 1010/11.

Usluel, Y. K., Aşkar, P., & Baş, T. (2008). A structural equation model for ICT usage in higher education. *Journal of Educational Technology, & Society, 11*(2), 262-273.

Usun, S. (2004). *Factors affecting the application of information and communication technologies (ICT) in distance education.* Online Submission, *5*(1).

van Braak, J. (2001). Factors influencing the use of computer mediated communication by teachers in secondary schools. *Computers, & Education, 36*(1), 41-57.

Vanderlinde, R., & van Braak, J. (2011). A new ICT curriculum for primary education in Flanders: Defining and predicting teachers' perceptions of innovation attributes. *Journal of Educational Technology, & Society, 14*(2), 124-135.

Vandeyar, T. (2013). Practice as policy in ICT for education: Catalysing communities of practice in education in South Africa. *Technology in Society, 35*(4), 248-257.

Vandeyar, T. (2015). Policy intermediaries and the reform of e-education in South Africa. *British Journal of Educational Technology*, *46*(2), 344-359.

Venkatesh, V., & Davis, F. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science.* INFORMS PubsOnLine, pp. 186-204. Available at: https://pubsonline.informs.org/doi/abs/10.1287/mnsc.46.2.186.11926%20

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Journal of Information Technology, 39*(2), 273-315.

Venkatesh, V., & Bala, H. (2013). TAM 3: Advancing the technology acceptance model with a focus on interventions. Manuscript in preparation.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186-204.

Venkatesh, V., Croteau, A. M., & Rabah, J. (2014). Perceptions of effectiveness of instructional uses of technology in higher education in an era of Web 2.0. In *System Sciences (HICSS), 2014 47th Hawaii International Conference on* (pp. 110-119). IEEE.

Venkatesh, V., Morris, M. G., Davis , G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478. doi: http://www.jstor.org/stable/30036540.

Vincent, J. (2015). Mobile opportunities: Exploring positive mobile opportunities for European children. *Polis.* The London School of Economics and Political Science. Available online at http://eprints.lse.ac.uk/61015/1/__lse.ac.uk_storage_LIBRARY_Secondary_libfile_shared_repository_Content_POLIS_Vincent_Mobile-Opportunities_2015.pdf

Vision 2030 (2017a). Vision 2030: Kingdom of Saudi Arabia. Available at: http://vision2030.gov.sa/en (accessed: 12 January 2017).

Vision 2030 (2017b). National Transformation Program 2020: Kingdom of Saudi Arabia. Available at: http://vision2030.gov.sa/sites/default/files/NTP_En.pdf (accessed: 15 May 2017).

Vitanova, V., Atanasova-Pachemska, T., Iliev, D., & Pachemska, S. (2015). Factors affecting the development of ICT competencies of teachers in primary schools. *Procedia-Social and Behavioral Sciences, 191*(2015), 1087-1094.

Vrasidas, C. (2015). The rhetoric of reform and teachers' use of ICT. *British Journal of Educational Technology*, *46*(2), 370-380.

Wall, K., Higgins, S., & Smith, H. (2005). ‘The visual helps me understand the complicated things’: Pupil views of teaching and learning with interactive whiteboards. *British Journal of Educational Technology, 36*(5), 851-867.

Wang, E. H. H. (1999). ICT and economic development in Taiwan: Analysis of the evidence. *Telecommunications Policy, 23*(3), 235-243.

Wang, S. K., Hsu, H. Y., Campbell, T., Coster, D. C., & Longhurst, M. (2014). An investigation of middle school science teachers and students use of technology inside and outside of classrooms: considering whether digital natives are more technology savvy than their teachers. *Educational Technology Research and Development, 62*(6), 637-662.

Watson, D.M., 2001. Pedagogy before technology: Re-thinking the relationship between ICT and teaching. *Education and Information Technologies, 6*(4), 251-266.

Webb, C., & Way, J. (2007). A framework for analysing ICT adoption in Australian primary schools. *Australasian Journal of Educational Technology, 23*(4), 559.

William. L. Ochsenwald. (2015). Saudi Arabia. *Britannica Online Encyclopedia*. Retrieved from http://www.britannica.com/place/Saudi-Arabia?anchor=ref484613

Wong, K. K. K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using *SmartPLS*. *Marketing Bulletin, 24*(1), 1-32.

Wong, K.T., Teo, T., & Russo, S. (2013). Interactive whiteboard acceptance: Applicability of the UTAUT model to student teachers. *The Asia-Pacific Education Researcher, 22*(1), 1-10.

Wook, M., Yusof, Z. M., & Nazri, M. Z. A. (2017). Educational data mining acceptance among undergraduate students. *Education and Information Technologies*, *22*(3), 1195-1216.

Wrycza, S., Marcinkowski, B., & Gajda, D. (2017). The enriched UTAUT model for the acceptance of software engineering tools in academic education. *Information Systems Management*, *34*(1), 38-49.

Yadav, P., & Mehta, P. (2014). Importance of ICT in education. *International Journal of Research in Social Sciences and Humanities, 2*(V), online.

Yuan, L., Powell, S., & Cetis, J. (2013). MOOCs and open education: Implications for higher education.

Yuen, A. H., & Ma, W. W. (2008). Exploring teacher acceptance of e-learning technology. *Asia-Pacific Journal of Teacher Education, 36*(3), 229-243.

Yuen, A. H., Law, N., & Wong, K. (2003). ICT implementation and school leadership: Case studies of ICT integration in teaching and learning. *Journal of Educational Administration, 41*(2), 158-170.

Zikmund, W. G., & Babin, B. (1997). *Exploring market research*. The Dryden Press: Fort Worth, Texas.