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A study of students' perceptions and attitudes toward the use of SMS to support learning and teaching at the Kuwait University

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A Study of Students' Perceptions and Attitudes toward the Use of SMS to
Support Learning and Teaching at the Kuwait University

A thesis submitted in (partial) fulfilment of the requirements for the award of the degree

(Doctor of Education)

From

UNIVERSITY OF WOLLONGONG

by

Budour Almisad

Supervisors: Dr Sarah Howard & A/Prof Ian Brown

Faculty of Education

2015

Thesis Certification

Budour Almisad declares that this thesis, submitted in partial fulfilment of the requirements for the award of Doctor of Education, in the Faculty of Education , University of Wollongong, is wholly her own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Budour Almisad

9 September 2015

Abstract

The aim of this study was to examine relations between Kuwaiti students' perceptions of ease of use, usefulness and attitudes towards the use of Short Message Service (SMS) to support learning and teaching. In developing countries, students may not have access to information and communication technologies such as computers and high-speed internet connections, and the use of digital technologies in learning may be limited. However, mobile phones are a popular and inexpensive technology that most university students can access. Research has suggested that SMS is a mobile phone service that has advantages as an educational tool. Kuwait, as a developing country, has a high mobile subscription rate among university students. This study examined Kuwaiti university students' acceptance of the use SMS technology to support their learning, their preferences regarding how SMS is used and their views on the educational value of SMS to understand how SMS may support learning in higher education.

To do this, students' perceptions of and attitudes about SMS were investigated through the Technology Acceptance Model (TAM) and a mixed methods survey and pre-post quasi-experimental study design. The study examined students' perceptions of and attitudes toward SMS as an educational tool before and after one semester of use, in two university subjects. The participants were 171 students enrolled in English and engineering programming subjects in the Autumn semester, 2013–2014 at Kuwait University. Data were collected over two rounds, each of which included a questionnaire and interviews. Students' perceptions of the use and usefulness of SMS as an educational tool and their attitudes towards the use of SMS in education were strongly and positively related. Students believed that SMS was easy-to-use and was a useful communication tool. Students reported that they would like to use SMS in their learning. Participants said they liked educational SMS because in general they had a positive attitude toward the use of technology in education and because they found SMS to be a useful and easy-to-use communication tool.

Students found SMS convenient and motivating in their learning. They felt it helped them regulate their study and improved their connections with the lecturer. They preferred SMS to be used to send discrete pieces of educational content, at appropriate times and frequencies.

Positive beliefs about the use of SMS suggest a number of possible uses in higher education. The key message from the interview findings was that the selection of SMS content should be clearly linked to educational content such as lectures and homework, and should not be complex. Educational SMS should contain stand-alone material that supplements face-to-face instruction. SMS could also be used to send administrative information and quizzes. SMS would have some advantages as an educational tool in Kuwaiti higher education. Students would accept its use. The selection of the content of SMS, ways of using SMS, and the implications of SMS for learning should be considered in light of students' expectations and concerns. The findings from this study contribute to the body knowledge in relation to the use of TAM to examine the adoption of technology in different settings. The original TAM was effective for explaining students' acceptance of SMS as an educational tool in Kuwaiti institutions of higher education.

The empirical findings can be used to guide higher education practitioners' efforts to enhance the adoption of technology in education, particularly the popular and widely-available SMS technology. The findings of the current study have practical value for faculty members who wish to use SMS to support face-to-face teaching.

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Chapter 1: Introduction

This study aims to investigate Kuwaiti students' perceptions and attitudes towards the integration of SMS technology in undergraduate teaching and learning. Over the last quarter of a century, the increasing availability of information and communication technologies (ICTs) has resulted in changes to teaching and learning systems across educational sectors (Sarkar, 2012). In higher education, these changes are visible through the increasing range of educational designs supported by new technologies, such as flexible and blended learning, as well as online learning platforms presented through online learning management systems. The increasing range of modes of delivery in education through technology has appeared in parallel with increasing access to information, changes in pedagogical approaches to learning and teaching, and increasing communication between students and faculty members (Livingstone, 2012; Beetham & Sharpe, 2013; Allen & Seaman, 2013).

However, there has been limited access and integration of technology in developing countries to support higher education, often due to economic and infrastructure constraints (Al-Fahad, 2009; Lwoga, 2012). One type of ICT that is commonly available and inexpensive, and which affords flexible learning and increased communication is the mobile phone. In the last decade, the most popular and widely owned hand-held device has been the mobile phone (Trinder, 2005). Mobile phones are commonly used for communication, exchanging information and entertainment.

Mobile phones include standard phones and smartphones. They can make calls and send short messages, and may have the power of a small computer and the capacity to take advantage of a wide range of applications (Grace, Zhou, Wang & Jiang, 2012). Keegan (2005) described mobile phone as a personal technology, since people carry their mobile phones everywhere with them. Keegan's research shows that people use their mobile phones frequently because they are easy-to-use, cheap, reliable and fashionable.

Mobile phones have been very popular among university students (Dahlstrom & Bichsel, 2014). Given this popularity, they would be an appropriate and useful tool for use in teaching and learning (Kim, Mims & Holmes, 2006; Wong, Wang, Ng & Kwan, 2015). Mobile phones provide flexible access to educational knowledge that is independent of time or place. They can also support and guide learners and provide more efficient course

(2005, Traxler & Hulme-Kukulska) administration. One mobile service that has been shown to have some application in higher education to support teaching and learning is SMS communication technology, also known as "texting". Prensky's (2005) study highlighted several potential uses of mobile phone services for educational purposes, including: voice only, SMS, graphic displays, downloadable programs, internet browsers, cameras and video clips, and Global Positioning Systems (GPS). Prensky (2005) argued that students can learn anything with a mobile phone if the educational practitioners design their communication in the right way. He reported that in schools SMS have been used to send quizzes and spelling or maths tests, to distribute surveys, to tell students about current events for class discussion, and to tutor students. Other research has also identified some advantages of using SMS as an educational tool, for example, for improving the learning of a foreign vocabulary (Levy & Kennedy, 2005), allowing students to study short and manageable amounts of educational content (Lu, 2008), improving students' learning (Kert, 2011), enabling students to take advantage of fragments of time to learn educational content (Zhang, Song & Burston, 2011), motivating students to study (Cavus & Ibrahim, 2009), providing convenient access to educational content (Zhang et al., 2011), and regulating students' study through sending them educational content regularly at scheduled times (Lu, 2008).

Investigations into the use of SMS in higher education have primarily been conducted in developed countries including England (Naismith, 2007), Taiwan (Lu, 2008) and New Zealand (Goh, Seet & Chen, 2012). However, studies have shown that the use of mobile phones has a much higher potential in developing countries, such as countries in Africa and the Middle East, where access to more expensive ICTs (e.g. laptops and fast internet connections) has been more limited (Al-Fahad, 2009; Lwoga, 2012). For instance Keegan (2005) examined the use of mobile phones and SMS for supporting learning activities across the African continent. These uses took two forms, administrative and academic. Examples of administrative support include the provision of administrative information, and access via mobile service numbers or mobile portals to examination and test marks, financial statements and registration data. Examples of academic support include communication and interaction (bulk SMS), assessment (quizzes), feedback on assignments and tasks, and motivational and instructional messages.

Kuwait is a developing country with a high mobile phone subscription rate. This study presents an investigation of students' perceptions and attitudes towards the integration of SMS technology in undergraduate classes at Kuwait University. Arab countries have exhibited very high mobile phone ownership and usage. While studies have suggested that SMS can have useful applications in higher education, it has not been widely examined in Arab countries (Santos & Bocheco, 2010; Nassuora, 2012). Access to mobile phones and familiarity with the technology are essential for the use of SMS in teaching and learning. In addition, students' perceptions and beliefs about the use of SMS in education are important success factors.

1.1 Use of SMS

SMS is a popular service all over the world (Albuja & Carrera, 2009). As a communication tool, SMS technology provides users with an “anywhere and anytime” method of communication (Kennedy & Levy, 2008). It is a fast, convenient and personal mode of communication, and it is widely used by students worldwide (Smith & Caruso, 2010; Balakrishnan & Loo, 2012). It has been found that the use of SMS to support learning and teaching provides a number of benefits for students (Lu, 2008; Kert, 2011; Zhang et al., 2011). SMS has some applications in different fields, such as advertising (Barwise & Strong, 2002; Zabadi, Shura & Elsayed, 2012; Drossos, Giaglis, Vlachos, Zamani & Lekakos, 2013), governmental services (Susanto & Goodwin, 2013), banking services (Elbadrawy, Aziz & Hamza, 2012; Malik & Gulati, 2013) and health services (Déglise, Suggs & Odermatt, 2012).

The subscription rate for mobile phones (expressed as mobile lines per 100 inhabitants) in Kuwait in 2010 was 160.8 %, compared to a world average of 76% (Communications and Information Technology Commission (CITC), 2010; International Telecommunications Union (ITU), 2012), since many subscribers have multiple connections. Studies have shown that the use of SMS is popular among Arab university students (Tahat, Al-Dabesi & Al-Qta, 2014). Given this popularity, it would be beneficial to utilise this everyday technology in higher education (Kim et al., 2006). In developing nations, where there is often limited access to computers and the internet, this is an important technological resource that could be used in teaching. However, if they are to be

used effectively in teaching and learning, it is important that educators and students understand the potential of these tools.

1.2 SMS in Higher Education

In Kuwait, as in many developing countries, the use of mobile phones for inexpensive communication is critical. Mobile phones are popular, readily available and have the potential to support learning and teaching in higher education (Zhang et al., 2011; Kert, 2011). There has not been a significant adoption of the technology in higher education in developing Arab countries (Al-Fahad, 2009), but studies have shown some educational use and benefits of SMS integration in higher education. They have suggested that SMS technology can be used to enhance and facilitate collaboration, interaction and discussion among students and between students and teachers (Markett, Sánchez, Weber & Tangney, 2006). It can also help students review lecture content (Richardson, Littrell, Challman & Stein, 2011); enhance the evaluation process (Petrova, 2010); communicate administrative information (Mikleia, 2006); support the learning of languages (Kennedy & Levy, 2008); and improve students' self-regulated learning (Goh et al., 2012). SMS integration in higher education therefore has the potential to improve and support students' learning experiences. Supporting students' learning can help put them on the path to lifelong learning and help them acquire the skills they will require in the workplaces of the future (Windisch, 2015).

While research has identified a number of different uses and advantages of SMS technology in higher education, the integration of SMS technology to support learning and teaching has not been popular in higher education institutions in the Arab world (Santos & Bochecho, 2010; Nassuora, 2012). The use of SMS in education does not require special expensive infrastructure, as the students have the required software and hardware in their hands all the time. Exchanging text messages takes place via existing mobile systems, which are maintained by mobile service providers (Nwagwu, 2013). Recently, a small-scale study showed the effectiveness of using SMS for teaching English words to Arab teenagers. The research was motivated by the relatively low cost, quiet use, asynchronous interaction and privacy of texting (Abdou, 2014). One indication of the low popularity and limited use of SMS technology in Arab higher education systems is the small number of studies that discuss its use (Altameem, 2011). Similar to higher education systems in other Arab

countries, Kuwait's higher education institutions have not taken full advantage of SMS technology in administrative and educational processes. If Kuwaiti and other Arabic universities are to begin taking advantage of SMS, and mobile phones more broadly, research is needed to examine students' perceptions and beliefs about the potential of SMS technology in learning and teaching.

1.3 Students' Attitudes and Perceptions

Students' attitudes and perceptions toward introducing new technology to support learning and teaching represent an important factor in predicting their adoption of this technology in the educational environment (Davis, 1986; Rogers, 2003). Students' perceptions and attitudes have been identified as key factors in the successful integration of new technology in education (Rogers, 2000). For SMS to be effectively used in higher education, its introduction into learning and teaching needs to be accompanied with assessments of students' perceptions and attitudes in order to provide information on how it can be implemented. Margaryan, Littlejohn and Vojt, (2011) recommend that to inform policy and practice regarding technology integration, higher education practitioners should examine what technologies students have access to and what their preferences are, as well as the educational value of these technologies. Therefore, this study investigated students' perceptions and attitudes towards the introduction of SMS technology into university undergraduate classrooms at Kuwait University.

Students' perceptions of and attitudes towards the use of SMS as an educational tool were explored through the original Technology Acceptance Model (TAM; Davis, 1986). The TAM and the extended TAM have been used extensively to explain and predict users' attitudes towards and use of technology (e.g., Huang, Huang, Huang & Lin, 2012; Edmunds, Thorpe & Conole, 2012). The original TAM is still appealing due to its simplicity, its wide use in a number of domains and its proven validity (Edmunds et al., 2012). The TAM assumes that a user's attitude towards a technology is a major factor predicting whether that user will accept or reject it (Lee, Kozar & Larsen, 2003). It is based on three main concepts: perceived usefulness (PU), perceived ease of use (PEOU) and a user's attitude towards using a technology (Davis, 1986). In Kuwait, different versions of TAM have been used to assess users' adoption of mobile phone camera technology

(Rouibah & Abbas 2006; Rouibah, 2009), instant messaging (Rouibah, 2008), and information systems in Kuwaiti ministries (Almutairi, 2007). In addition, TAM has been used to study users' perceptions and uses of SMS services, such as SMS banking (Amin, 2007), SMS advertising (Zhang & Mao, 2008) and an SMS library catalogue search service (Goh, 2011). There has not been specific work employing the TAM to study Kuwaiti university students' perceptions of and attitudes towards the use of SMS technology to support learning and teaching.

1.4 Purpose of the Study

The aim of this study is to examine relations between students' perceptions of ease of use, usefulness and attitudes towards the use of SMS to support learning and teaching. To investigate this, the study examined students' perceptions of and attitudes about SMS before and after one semester of use in two university subjects.

1.5 The Research Questions

The research questions guiding this study were:

1. What are the perceptions of students at Kuwait University of the ease of use and usefulness of SMS?
2. What are the attitudes of students towards the use of SMS to support learning and teaching at Kuwait University?
3. What is the relationship between students' attitudes towards using SMS and their perceptions of the usefulness and ease of use of SMS technology?

The study involved 171 university students enrolled in the first semester of the 2013/2014 academic year at Kuwait University. Students were enrolled in two classes: "Computer Programming for Engineers" and "Advanced English". The instructors of these courses were willing to have their classes participate in the current study. The nature of the educational content in these courses suited SMS communication, as many aspects could be reduced to small messages (e.g. one programming statement) that could stand alone and retain meaning. The study investigated students' perceptions and attitudes towards using SMS as an educational tool to support learning in these two classes. Data were collected over two rounds with each round including questionnaires and semi-structured interviews.

The first round took place prior to the use of SMS as an educational tool and the second took place after the use of SMS as an education tool for one semester.

1.6 The Significance of the Study

This study is important research in the field of technology integration in higher education in a developing country. It is necessary to explore the use of mobile phones and SMS in developing countries where more expensive ICTs are less available. Specifically, the research focuses on the use of SMS in a Kuwaiti university. Reports have shown that mobile subscription is high in Kuwait and SMS technology is popular among university students in Kuwait (Rouibah, 2009). Given that research has already demonstrated that SMS can be used to support learning and teaching, the current study investigated students' acceptance and use of SMS as an educational tool.

The present study contributes to the growing body of literature exploring the use of SMS in higher education to support teaching and learning. The results lead to recommendations in regard to practical procedures regarding the use of SMS to support teaching and learning. The study was unique in the culture and educational background of students, and in its design. The study took place in an Arab higher education environment in which the language of instruction is English; most of the participants were engineering students, and students' perceptions and attitudes were measured using a questionnaire and interviews before and after the use of SMS as an educational tool for one semester. In addition, the study is significant due to the limited amount of research on integrating SMS technology in higher education in the Arab world.

The study examined students' attitudes towards integrating SMS technology in their education, as well as the relationship between these attitudes and their views on the ease of use and usefulness of SMS technology. The findings contribute to the growing body of literature examining the validity of TAM in different cultures. The study also provides recommendations for future research into the application of SMS or similar technologies in higher education.

1.7 Limitations of the Study

As with any other research study, this one has limitations. Some of these limitations were related to the questionnaire instrument used. In the first questionnaire, the items that

were designed to examine the types of ICT used for personal and educational purposes listed a limited number of ICTs, and therefore the ICTs that might have been popular among the participants might have been misreported. In addition, in the same version of questionnaire, the item that was designed to examine participants' reasons for using SMS listed a limited number of uses of SMS. Therefore, the uses of SMS that might be popular among the participants might have been misreported.

In addition to the limitations related to the study's questionnaire instrument, the period of use of SMS was only one semester, and so the study could not have identified possible significant changes in participants' perceptions and attitudes towards the use of SMS as an educational tool that may have occurred over an extended time period.

Furthermore, the number of educational messages that were sent was limited. According to the instructors, only one or two messages were sent each week. Another possible limitation is that all the collected data were self-reported data, and self-reported data might be subject to different types of bias.

The majority of the participants who completed the questionnaire and all the interviewees were engineering students. This homogeneity in participants' majors might limit the generalisability of the findings. Including participants from different majors might have provided a wider range of attitudes and perceptions in relation the use of SMS as an educational tool. Varied attitudes and perceptions on the use of SMS as an educational tool would have been useful for providing more and more various recommendations regarding the use of SMS to support teaching and learning in higher education.

1.8 Structure of the Thesis

This thesis has seven chapters. After the introductory chapter that presents the background and the goals of the study, the literature review chapter reviews related research into the use of ICTs, including SMS, in higher education. The third chapter discusses TAM as the theoretical framework of the study; the chapter discusses the evolution of TAM and the research studies that have used TAM to explore the use of different types of technology. After the theoretical framework chapter, the fourth chapter presents the methodology and research design. The fifth chapter presents the results from the questionnaires and the interviews. The sixth chapter presents a discussion of the

findings of the study. Finally, based on the findings, the seventh chapter presents the conclusions and recommendations of the study.

1.9 Definition of Terms

- **Information and Communication technology (ICT):** an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer, and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning (Ossai-Ugbah, 2011; p.49).
- **Short Message Service (SMS):** a text messaging service component of phone, web or mobile communication system, using communications protocols that allow the exchange of short text messages between fixed line or mobile phone devices (Singhal & Gujral, 2012; p.39).
- **Smartphone:** a mobile phone with computer functionality such as internet access, media player and video games. It usually has a large touch screen and it allows users to download and run software applications.
- **Perceived usefulness (PU):** the degree to which a user believes that using the system will enhance his or her job performance (Davis, 1989, p. 320).
- **Perceived ease of use (PEOU):** the degree to which a person believes that using a particular system would be free of effort (Davis, 1989, p. 320).
- **Attitude:** a person's general favourable or unfavourable attitude toward some stimulus or object (Fishbein & Ajzen, 1975, p. 216).
- **The Technology Acceptance Model (TAM):** a model that explains why users accept or reject information technology. It argues that perceived usefulness (PU) and perceived ease of use (PEOU) factors can predict a user's attitude toward using a technology (Davis, 1986).

Chapter 2: Review of Literature

The aim of this study is to examine relations between students' perceptions of ease of use, usefulness and attitudes toward the use of SMS to support learning and teaching. To investigate this, the study examined students' perceptions of and attitudes about SMS before and after one semester of use in two university subjects.

This chapter provides an overview of previous research on the use of ICT and SMS in education. The first section discusses the integration of ICTs in higher education. The second section reviews studies that discuss SMS technology in terms of its popularity among higher education students, and its advantages and disadvantages as a communication tool. The third section examines SMS technology applications in higher education as well as university students' perceptions of the use of SMS as an educational tool. These first three sections primarily draw on research from developed countries. The fourth section discusses ICT integration in higher education in developing countries, firstly in the broader collection of Gulf Cooperation Council (GCC) countries, and then in Kuwait. The fifth section examines the status of ICT in Kuwait and in Kuwaiti higher education.

2.1 The Integration of ICTs into Higher Education

Developing countries have shown increasing interest in the integration of ICT in their higher education institutions (Bhuasiri, Xaymoungkhoun, Zo, Rho & Ciganek, 2012). According to Balasubramanian et al. (2009), "In many countries, demand for higher education far outstrips supply and governments and institutions are turning more and more to the use of ICTs to bridge the access gap" (p. 20). The integration of ICTs in higher education has the potential for educational reformation (Sarkar, 2012). However, the use ICTs in universities in many of developing countries faces a range of barriers, such as the lack of the required infrastructure and issues related to the awareness of, and attitude toward, ICTs (Sife, Lwoga & Sanga, 2007; Alturise & Alojaiman, 2013).

The term ICT refers to a range of applications including television and radio; compact discs (CDs); digital versatile discs (DVDs); video conferencing; mobile technologies; web-based technologies; and electronic learning platforms (Yoloye, 2015).

In the higher education context in developed countries, ICTs are used to support learning and teaching in different contexts, starting from traditional learning environments,

such as using computers in class, to non-traditional learning environments such as using the internet in online learning (Binghimlas, 2009; Sarkar, 2012; Allen & Seaman, 2013). Faculty members have perceived the advantages of ICTs in their educational practice in terms of improving learning and enhancing instruction (Kyei-Blankson, Keengwe & Blankson, 2009; Waycott, Bennett, Kennedy, Dalgarno & Gray, 2010).

Research has identified the general benefits of integrating ICTs (such as computers and internet technologies) for providing students with the ICT skills and knowledge needed for coping with the current era of technology (Poelmans, Truyen & Stockman, 2012); coping with the increasing competition in the higher education market (Urbanovič & Wilkins, 2013); increasing access to education and recruiting more non-traditional students, such as distance education students (Andrew, 2012; Muianga et al., 2013); and contributing to the development of the life-long learning process (Ranieri, Manca & Fini, 2012).

In the educational field, the integration of ICTs to enhance and support teaching and learning processes is referred to as e-learning (Yoloye, 2015). Oye, Salleh and Iahad (2011) explain that “e-learning ranges from the way students use e-mail and accessing course work online while following a course on campus to programmes offered entirely online” (p. 40). Garrison (2011) defined e-learning as “electronically mediated asynchronous and synchronous communication for the purpose of constructing and confirming knowledge” (p. 2).

Students have pointed to the benefits of e-learning in higher education in terms of enhancing their learning, and improving instruction (Löfström & Nevgi, 2007). More research has been conducted looking at school teachers' beliefs about technology integration. A key study in this area is Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur and Sendurur's (2012) work examining the alignment between school teachers' beliefs regarding technology and their actual use of technology. In this research, twelve teachers who were leaders in the application of technology to education were interviewed. The results showed the interviewees believed in the importance of using technology to deliver educational content, motivate students, enrich the curriculum, and transform and support teaching and learning. The interviewees believed that there were some barriers to technology integration such as teachers' knowledge and skills in using technology, technology support, money, technology access, technology problems, and students'

knowledge and skills. The authors found that SMS could be used to overcome some of the barriers of ICT integration in education, because mobile technologies are inexpensive and easy to access. However, more importantly, students and their instructors are familiar with the use of SMS technology (Ertmer, et al., 2012). These findings can be applied to higher education. Institutions of higher education can make use of the reported advantages of using technology in general and of advantages of SMS in particular. Like school students, university students are familiar with the use of SMS technology. Mobile technologies can be used in schools and universities to overcome the common barriers to ICT integration in education.

Some studies suggest that university students have positive perceptions, attitudes and experiences of the integration of ICTs in learning. Ituma (2011) investigated students' perceptions and patterns of use of e-learning systems. The researcher used a cross-sectional study design in which 80 university students completed a questionnaire regarding their perceptions of an e-learning system. The results showed that the majority of participants used the e-learning system. In addition, a large percentage of the students had very positive perceptions, and found some components (e.g. online course content) of the system very valuable.

In another large-scale study, Dahlstrom and Bichsel (2014) examined college students' technology experiences and expectations. The researchers used a cross-sectional study design in which 75,306 undergraduate students from 213 higher education institutions across 45 US states and 15 countries completed an online questionnaire. The results showed that the majority of participants believed technology was embedded into their lives and they had positive attitudes toward the use of technology. The majority had used technology for academic purposes and they reported that they learnt best with a blend of online and face-to-face work. The findings suggest that university students have positive perceptions and attitudes toward the use of ICTs in their education, and they expect to have ICTs available to support teaching and learning at the university level.

One ICT that is popular and ubiquitous among university students is the mobile phone. University students are familiar with using mobile phones and they have the potential to be used to support students' education. The use of mobile phones in education requires the lowest amount of technological and financial support to students (Park, Nam &

Cha, 2012). The use of mobile phones in education does not require special infrastructure, as the students have the required software and hardware in their hands all the time. Communication using mobile phones takes place via existing mobile systems, which are maintained by mobile service providers (Nwagwu, 2013). Smartphones which are similar to miniature computers that can also be used to make phone calls (Davis, Hovanesian, Katz, Kraff & Trattler, 2010), are popular among university students. Smartphones are becoming the main tool to access the internet among college students (Stollak, Vandenberg, Burklund & Weiss, 2011). Smartphones offer communication and computing services that regular phones do not offer (Boulos, Wheeler, Tavares & Jones, 2011). Current versions of smartphones offer more than texting and voice communication services, and they are comparable to computers in terms of the provided services (Grace et al., 2012). There is a huge industry that aims to design and develop applications that can be installed on smartphones. Therefore, depending on the installed applications, smartphones can be used to access the internet; play games; create, edit and upload videos; handle one's finances; observe one's health and much more. Dahlstrom and Bichsel's (2014) study showed that more students now own mobile devices than ever before, and 86% of respondents in their international study reported owning a smartphone.

Kukulska-Hulme (2010) analysed learner-centred education in relation to mobile learning. The analysis of students' use of mobile technologies demonstrated the potential power of these technologies to support learner-centred education. For instance, the students used their personal mobile devices "to create, collect and access useful resources, to communicate inventively in a variety of ways with other individuals and communities, and to make best use of time wherever they happen to be" (p.8). Examples of students' relatively new uses of mobile devices included social/community interaction, mobile internet access, multimedia use, location-based activity, and user-created content. The researcher stated that "personal devices may be helpful tools in developing initiative, digital competence, and skills in knowledge production and communication.... The pervasiveness of mobile technology is certainly changing how we teach and learn. Mobility is a great instigator of change" (p.10). Mobile devices can help students at anytime and anywhere, to maintain social interactions, access information, and create content for personal and educational purposes. SMS is a mobile application that can support flexible learning.

Learners can study SMS content at any time and in any place. Like other mobile applications, SMS can facilitate learner-centred education.

Margaryan et al. (2011) conducted a study that examined the extent and nature of university students' use of digital technologies for learning and socialising. The researchers used a mixed methods research approach in which 160 university students completed a paper-based questionnaire and interviews were carried out with eight students. The results showed that the most popular devices among different ICTs were mobile phones, and 99.4%, ($n=159$) reported owning mobile phone. The participants reported that the most popular function on their phones for both formal and informal learning was SMS. More than half of the participants reported using SMS for formal and informal learning on either a daily or weekly basis. The interview participants reported using their mobile phones and SMS to contact peers to coordinate project meetings, to work together on group assignments, to practice for exams or to record lectures. The interviewees indicated a preference for SMS rather than voice calls, because texting was considered quicker and cheaper. In addition, Margaryan et al. (2011) found that engineering students used more technology tools when compared to non-engineering students. They suggested that this was because engineering courses required more concentrated and broad access to technology than non-engineering courses such as social work.

Margaryan et al. (2011) found that despite the popularity of some technologies among students, students had limited skills and knowledge about how to use these technologies to support their learning. In addition, students' use of technology was influenced by the use of technology by faculty members. They recommended that, in order to inform policy and practice regarding technology integration, higher education practitioners should examine what technologies students have access to, and what their preferences are as well as the educational values of these technologies.

SMS is a popular function on mobile devices in different parts of the world (Hall, Cole-Lewis & Bernhardt, 2015). As a communication tool, SMS provides users with an "anywhere and anytime" method of communication (Islam & Abdullah, 2013). It is a fast, convenient, and personal mode of communication, and it is widely used by students (Balakrishnan, 2013).

2.2 SMS Technology

SMS has been called the “killer” application of mobile phones, as its usage has exceeded all expectations (Markett et al., 2006, p 282). SMS is a very popular technology. There are several factors that have contributed to the popularity of SMS; some of these factors include low price, ease of use (Clarke, Keing, Lam & McNaught, 2008), and the fact that it is free of charge for receivers. According to Bouhlel, Mzoughi, Hadiji and Slimane SMS “is a massive and a powerful support of communication with strong relational power. It is an immediate, automated, reliable, personal, discreet and customized channel” (Bouhlel, Mzoughi, Hadiji & Slimane, 2011; p. 216).

2.2.1 SMS popularity among university students. In 2008, 2.3 trillion SMS text messages were exchanged worldwide (Albuja & Carrera, 2009) and the number reached eight trillion in 2013 (Hall, Cole-Lewis & Bernhardt, 2015). Research studies report SMS is common among university students. In a study that involved 455 Hong Kong college students, Lin (2005) found that 76 % of them identified themselves as SMS users. In Australia, Kennedy, Judd, Churchward, Gray and Krause (2008) investigated ICT use among university students. Almost 2,000 University of Melbourne students participated in their study. The researchers reported that 80% of students sent SMS messages every day. There has been a demonstrated rapid growth in the use of SMS as a communication tool all over the world over time. Smith and Caruso (2010) conducted a study of university students' ownership and use of technology. The study involved 36,950 respondents from universities in the United States and Canada. The results showed that 92.3% of respondents sent text messages regularly, and 72.9% of them sent text messages daily. In Malaysia, a recent study conducted by Balakrishnan and Loo (2012) investigated the usage of mobile phone and SMS among Malaysian youth. Four hundred and seventeen people participated in the study with an average age of 20.5. Regarding SMS usage, the results showed that 89.7% of the respondents sent more than five messages daily, and 92.3% received between six and ten messages daily. In Jordan, Tahat et al. (2014) conducted a study that aimed to identify the extent of SMS usage at a private university. The researchers used a field survey research design. The participants were 500 university students of different genders, ages, majors and academic years. The results showed that 99.4% of the participants owned

mobile phones, 97.85% used SMS and 46.59% exchanged four to six messages a day. The researchers found that the most popular use of SMS was to contact friends – 75% of the participants reported using SMS to contact friends. They reported using SMS to exchange movies, pictures, information, congratulations and jokes. They also reported using SMS for reminders, to receive news and religious quotes and for banking.

The studies discussed above demonstrated that SMS is very popular among university students in different countries around the world and students use it on a daily basis. The popularity of SMS among university students suggests that SMS might be used to support teaching and learning. Therefore, before discussing the uses of SMS in higher education, the following sub-section explains the positive and negative aspects of the use of SMS as a communication tool.

2.2.2 SMS as a communication tool. According to Mante and Piris, “SMS means cheap, quick, impersonal, discrete and cryptic communication and that is more than any other means of communication can offer nowadays” (Mante & Piris, 2002; p. 55). Lominé and Buckingham’s (2009) theoretical study examined the positive aspects of the use of SMS as a communication tool. The reported pros of SMS included being quick, discreet, to the point and inexpensive. The high speed of sending information through SMS has been documented in other research studies (Day & Kumar, 2010; Rajasingham, 2011). People perceived SMS as a more private communication tool than normal phone calls (Goel, Shah & Qadeer, 2011). Due to the brevity of SMS messages, many people perceived it as going straight to the point (Oluga & Babalola, 2013). SMS is usually a cheap way of communicating in different parts of the world (Mante & Piris, 2002; Goggin, 2004; Kazi & Dharmadhikari, 2014).

SMS is cheap because users can control precisely the number of text characters that they send, avoiding long voice conversations. SMS users usually use abbreviations that save money and increase message speed. SMS is a private and convenient communication tool. Unlike phone calls, SMS messages can communicate information that users do not want other people to listen to, and they can be used to exchange information at times and places that would be inappropriate for phone calls, such as in the early morning or late at

night, as well as in meetings or in class. One SMS can be sent to many of the user's contacts at once, so SMS is often used to invite people to events.

The research studies that have examined university students' perceptions of the usefulness of SMS as a communication tool have shown that they hold positive perceptions of SMS. Balakrishnan and Loo (2012) report that among Malaysian youths, the top motivations for using SMS were: it offered privacy, it was cheap, it was easy-to-use, it was quick, it was convenient and it was fun. In Hong Kong, Leung (2007) conducted a study that examined college students' reasons for using SMS technology. The researcher used a cross-sectional study design, in which 532 college students completed a questionnaire regarding their use of SMS. The researcher found that the main motivations for the use of SMS were its convenience, its low cost, its speed and its value for organising events.

SMS is a common communication tool among institution of higher education students. Students perceive SMS as being easy to access, cheap, convenient, quick, easy-to-use, private, fun and useful for coordinating events (Leung, 2007; Balakrishnan & Loo, 2012). The positive perceptions of SMS as a communication tool might suggest that SMS would have prior acceptance as an education tool among university students.

However, due to the limited number of characters (i.e. 160) that can be sent in one SMS message, university students believed that SMS have a number of shortcomings. One of the main disadvantages of SMS is associated with the use of text message abbreviations referred to as "textisms" (such as "B4" for *Before*, "C U" for *See you* ; Grace, Kemp, Martin & Parrila, 2013). In Leung's (2007) study, participants reported that one of the limitations of SMS was the confusing acronyms that were used in writing messages and difficulties in understanding them. The researcher said the respondents reported that one of the difficulties in understanding the intentions of SMS relate to it being hard to figure out whether the sender was joking or not. In a more recent study, Nwagwu (2013) examined university students' use of SMS. Nwagu used a cross-sectional study design in which 1,676 Nigerian students completed a questionnaire regarding their use of SMS. The findings showed that main constraint of using SMS was related to the associated difficulties of using ambiguous acronyms and shortened phrases. The second constraint related to the difficulty of interpreting the intentions of SMS senders.

In the Arab world, it is popular for SMS users to write messages using what it is called “Arabizi”, a term that refers to “writing Arabic in Latin characters and Arabic numerals” (Farrag, 2012; p. 2). For example “kaif al7al?” means *How are you?*). Farrag (2012) conducted a study that examined Arabic language learners’ views of Arabizi. The researcher used a cross-sectional study design in which 42 Arabic language students completed a web-based and paper-based questionnaire regarding their perceptions of the use of Arabizi. The results showed that the participants believed that Arabizi obstructed effective communication in Arabic. They believed that they could not easily read or write in Arabizi. The use of SMS in education should communicate information in an effective way, allowing the students to easily comprehend the educational content. The results suggest that the use of SMS as an educational tool in the Arab world should avoid using Arabizi.

The results of the above studies suggest that university students perceive SMS to have more positive aspects than negative ones. The perceived advantages and publicity of SMS technology among higher education students suggest that the use of such technology in higher education would be useful and would be accepted by students. However, there is a need for more investigation of higher education students’ perceptions of and attitudes toward the uses of such technology, to understand how it can be used to support their education.

2.3 SMS Technology Applications in Higher Education

SMS has been increasingly used in higher education in developed countries to serve a variety of purposes. Several research studies (e.g., Markett et al., 2006; Mikleia, 2006; Zhang et al., 2011; Goh et al., 2012) have examined the different uses of SMS in higher education.

Peters (2007) argued that mobile technologies have the potential to provide “learning that is just in time, just enough, and just for me” (p. 130). Peters (2007) investigated the potential application of mobile technologies in education. As part of the study, Peters interviewed 19 educators and trainers from Australian universities, schools and private training institutions. The findings showed that interviewees believed that it would be good idea to use mobile phones in students' learning since students already owned

them. Some participants believed that SMS would act as a strong motivational tool for young students since they were already using them in their social lives. One of the participants pointed to the need to consider the application of SMS in learning: "SMS is already in place but the opportunities to use it for learning have not been considered in great depth – implementation will largely depend on practicalities and cost" (p.126). Such nine years old study (Peters, 2007) showed that for the last decade educators have held positive beliefs toward the educational potential of mobile technologies, including SMS. In addition to investigating educators' views on the use of mobile technologies, it is important to consider students' views to ensure the successful integration of these technologies into their education.

In Lominé and Buckingham's (2009) theoretical study, the researchers proposed three categories of ways in which SMS might be used to support teaching and learning. These categories are: "direct teaching" messages such as short educational texts or quiz questions, "teaching-related" messages, such as motivational messages or alerts asking them to check their emails and "contact and communication" messages such as reminders of key dates and information about cancelled/ rescheduled classes. However, these do not include all the ways of using SMS in higher education, as all three categories are related to sending SMS to students. SMS can also be used as a two-way in-class discussion tool.

Markett et al. (2006) conducted a study that examined the use of SMS as an in-class discussion tool which encourages interactivity. For the purposes of the study, the researchers developed "*PLS TXT UR Thoughts*" software that allowed the students to send SMS and to show the received SMS on an in-class interface and a database-driven website. The software was tested with 30 university students from two different classes. The analysis of SMS content showed that the content of most messages was either to clarify questions or to comment on educational material. Students' reactions to the system showed that they were interested in it and they believed that the software improved interaction with the instructor. The limitations of the project were related to the price of sending SMS, the possible distraction of using SMS during classes and using SMS for non-educational purposes in classes. The reported limitations can be eliminated by using SMS to send information to students. Other empirical studies have examined the use of SMS in

institutions of higher education in ways that fit in Lominé and Buckingham's (2009) three categories: direct teaching, teaching-related; and contact and communication.

Studies have examined the use of SMS to send teaching-related and contact and communication material in institutions of higher education, including sending administrative information to students. Naismith (2007) carried out a study that examined the use of SMS for the purpose of administrative communication in higher education. The researcher used SMS to send different types of administrative information to students. The types of information sent included: notices of room changes and cancellations, notices of relevant lectures or other on-campus activities, details of assignment submission procedures and attendance matters. The researcher designed an SMS-based service called "*StudyLink*". Eight university students participated in the trial of the "*StudyLink*" service. The study lasted for two educational terms and the researcher collected students' feedback regarding their use of the service. Most participants reported that the content of the SMS messages was useful. In addition, the majority reported that they would participate in an SMS service in the future. However, the students believed that SMS should be a supplementary communication tool rather than the main communication tool. The study involved a small sample, which limited the generalisability of the findings. However, the study gave an indication regarding university students' acceptance of the use of SMS to communicate administrative material.

The other type of content that can be sent to higher education students is persuasive SMS messages. The content of persuasive SMS can be classified as teaching-related information (Lominé & Buckingham, 2009). Goh et al. (2012) conducted a study that examined the effects of using persuasive SMS on students' self-regulated learning strategies. The researchers used an experimental design in which the participants in experimental and control groups completed Motivated Strategies for Learning Questionnaires (MSLQ) before and after the use of persuasive SMS. In addition, students' performances were measured before and after the use of persuasive SMS. The experiment lasted for nine weeks during which the participants in the experimental group received SMS reminders that encouraged them to attend lectures, tutorials and workshops, as well as to complete assignments. There were 57 participants; twenty five of them were in the control group and thirty two were in the experimental group. The results showed that the

students in the experimental group, who received persuasive SMS, performed better than students who were in the control group. In addition, the study showed that there was a positive effect of persuasive SMS on students' self-regulation. The findings suggest that SMS was useful in improving students' learning and self-regulation in terms of attending classes and educational activities as well as submitting assignments on time.

Besides the use of SMS to send information related to the management and persuasive content to students, some researchers have examined the use of SMS to send different types of teaching-related information such as the use of SMS for assessment purposes. Abu Ziden and Abdul Rahman (2013) carried out a study in relation the use of SMS to send quizzes to students.

The above research studies involved using SMS on a small scale to support teaching and learning. These studies have shown that SMS has the capability to support teaching and learning in different ways. However, none of the uses of SMS mentioned in these studies involved the direct teaching of educational content that was discussed in Lominé and Buckingham's (2009) study.

The direct teaching use of SMS involves sending short educational content such as a foreign word and its meaning, or a programming code and its meaning. Examples of such uses were examined in a study by Kert (2011) that involved the use of SMS to support programming education. The study investigated the effect on students' learning levels of SMS support in computer programming languages education. The sample for the study consisted of 40 students who were randomly assigned into two groups, the experimental group ($n=20$) and control group ($n=20$). The analysis of the pre-test scores of the two groups showed that there was no significant difference between the pre-test achievement scores of the experimental and control groups. During the application period of seven weeks, information messages through SMS were sent to the experimental group in parallel with the course content of Programming Languages II in a university in Turkey. In this process, a total of 27 SMS messages were sent over a seven-week period. All the information in the messages sent to the experimental group via SMS were given to the students in the control group as written documents in the final week of the application process.

The analysis of the post-test scores of the two groups showed that there was a significant difference ($t=3,067$, $p<.05$) between the post-test academic achievement mean scores of the experimental and control groups. The use of SMS support provided to the students in the experimental group improved their learning performances; they scored higher than the students who did not use SMS as an educational tool. Kert's (2011) study is similar to the present study in terms of the discipline in which the SMS intervention was introduced – a programming language course. In the current study most participants were from a programming language course. In Kert's (2011) study, students' reactions were not measured through a questionnaire or interviews. In the current study, students' acceptance of the use of SMS as an educational tool was measured. The findings of Kert's (2011) study suggest that the use of SMS as an educational tool improved students learning in programming classes.

The use of SMS as an educational tool has several advantages. For instance, Lominé and Buckingham (2009) identified some possible advantages of using SMS to support teaching and learning. One of the listed educational advantages of SMS was improving students' motivation and retention. Experimental research studies have shown that sending university students SMS with educational content can improve their learning and motivation (Goh et al., 2012; Guo, 2014). In addition, Lominé and Buckingham (2009) pointed to another possible advantage of educational SMS: there is no need for familiarisation or training in its use. Other research studies have also shown that people perceive SMS as an easy-to-use communication tool (Clarke, Keing, Lam & McNaught, 2008). Furthermore, Lominé and Buckingham, (2009) report that educational SMS could involve students more actively/interactively and it could be used to contact any group or individual instantly. Considering the benefits of the use of SMS in education and the importance of understanding higher education students' acceptance of this technology and its use, the next section examines students' perceptions of the use of SMS as an educational tool.

2.3.1 Students' Perceptions of SMS as an Educational Tool. Understanding students' reactions to the use of SMS as an educational tool is an important factor for the success of SMS integration in higher education. Students' reactions to the use of SMS as an

educational tool could inform the way it is used in higher education. Margaryan et al. (2011) recommend that, in order to inform policy and practice regarding technology integration, higher education practitioners should examine what technologies students have access to and what their preferences are, as well as the educational values of these technologies.

Some studies have examined the effect of the use of SMS as an educational tool on students' learning as well as students' perceptions and attitudes toward the use of SMS technology in their education. For instance, Levy and Kennedy (2005) described a project in which SMS was used to teach Italian words in an Australian university. The project involved sending SMS messages that contained new Italian words, with definitions and examples of the words used in sentences, to 18 students. The SMS messages were sent throughout the course at suitable intervals. At the end of the project, students' reactions were canvassed using a questionnaire and a focus group interview. Seventeen out of the 18 students reported that they enjoyed receiving the SMS messages. The interview showed that the students liked the SMS messages since they kept them connected with the classes and reminded them to study. The students reported that they liked to receive SMS messages in the morning at 9 am or 10 am. Most of the students believed that two to three messages a day would be acceptable. The findings show that SMS has been accepted as an educational tool for learning foreign languages in the last decade. They also show that students have very specific beliefs about how, when and how frequently SMS should be used to support their learning. This has implications for integration in other contexts, such as Kuwaiti higher education. However, this study (Levy & Kennedy, 2005) is eleven years old and its findings might or might not apply to the students in the current time.

A second study demonstrating students' beliefs about SMS use was Cavus and Ibrahim (2009) study, which involved using the mobile learning tool (MOLT) to send educational SMS that contained new technical English language words. Using a quasi-experimental design and survey questionnaire, the effect of using educational SMS on students' success was examined. In addition, the questionnaires were used to assess students' opinions about the use of SMS as an educational tool. The study was carried out with 45 first-year volunteer students. The students' levels of word knowledge were measured at the beginning and the end of the study. Sixteen messages were sent daily

during the eight-hour operating time. The same 16 message were sent over three separate days. In total 48 messages were received by each participant. The results showed higher levels of knowledge at the end of the experiment ($t = 32.29, p < 0.05$). The study indicated that educational SMS contributed to students' success in learning new English words. However, the validity of the results was affected by the lack of a comparison group using a different tool for teaching the English words such as a paper-based tool.

The results of the questionnaire survey showed that the students agreed that the SMS experiment was enjoyable and useful for learning and memorising new English words. In addition, the students believed that SMS played a role in motivating them to study and learn new words in their leisure time. The participants reported positive intentions to use educational SMS in the future. The majority of participants (88.9%) reported that they would like to receive summaries of lecture notes through SMS. Regarding the timing of SMS, the majority (42.2%) preferred to receive SMS between nine in the morning and five in the afternoon. The study concluded that educational SMS had positive effects on students' performance in learning new English words; the participants had positive reactions to the use of SMS as an educational tool and felt that other lecturers should also use mobile phone-based teaching to support the main teaching activities in the classroom. However, the participants agreed that SMS would be more effective when used for two-way communication. About two-thirds of the participants (75.4%) preferred to receive administrative and non-educational material such as advertisements and exam results through their mobile phones. The study took place over short period of time (only three days); students' opinions about the use of SMS as an educational tool might be more informative after the use of SMS for longer period of time.

In another study that showed the effectiveness of using SMS as an educational tool Zhang et al. (2011) used an experimental design in which students from two classes at a Chinese university were assigned to two groups, the SMS group ($n=32$) and the paper group ($n=30$). The results of the analysis of the students' pre-test scores showed that there was no significant difference between the SMS group and the paper group. The SMS group studied a selected list of vocabulary words via mobile phone SMS technology, while the paper group worked on the same list through paper material in a self-regulated manner. Post-tests were administered at the end of the experiment that lasted for three weeks. The

results of the post-tests showed that there was a significant difference ($t=2.45$, $p<.05$) in the two groups' scores. Experimental designs are more valid than quasi-experimental designs for assessing the effects of the use of SMS as an educational tool. The researchers concluded that a blended approach to vocabulary learning may be best for increasing the effectiveness of students' acquisition of knowledge from the viewpoint of sustained retention rates. The SMS group submitted written reports regarding their experiences of vocabulary learning with mobile phones.

The results showed that the students reported advantages and disadvantages of vocabulary learning via mobile phones. The reported advantages included taking advantage of fragments of time such as while they are riding in the subway or standing in queues. Convenience was the second advantage of vocabulary learning via mobile phones. The students valued the opportunity to learn vocabulary anytime and anywhere via SMS. The third reported advantage was motivation. The participants believed that educational SMS had a stimulating effect on them as the SMS reminded and motivated them. The last reported advantage was efficiency. The participants reported that using educational SMS made them able to memorise target words within a given period of time. Regarding the efficiency of using SMS for teaching vocabulary, the authors stated that "a huge learning task has been divided into multiple mini-tasks, which makes it psychologically less overwhelming to deal with learning tasks" (p. 209).

One of the reported negative aspects of the use of SMS for vocabulary learning was related to the restricted capability of mobile devices. For instance, some participants complained about limited storage and the limited number of characters that could be sent in one SMS message. The authors stated that "unlike computer RAM, mobile phone memory is normally not large enough to store all the words received. Information storage for a learner becomes problematic, especially when vocabulary items are received beyond what can be stored in a phone's memory" (p. 209). Another reported limitation of the use of SMS as an educational tool was the time consumed in locating previous messages. The authors recommended that SMS should be used only to support traditional vocabulary learning, and that students should be involved in determining the delivery schedule of the SMS.

The findings suggest that the use of SMS as an educational tool would be useful for students' learning and students had positive attitudes toward the use of SMS as an

educational tool. The findings suggest that SMS should be used support traditional learning rather than as the main tool for the delivery of the educational content. The mixed results regarding the positive and negative aspects of the use of SMS as an educational tool indicate that there was no consensus among students regarding the usefulness of SMS in education.

Similar research studies have been conducted in language teaching at the high school level. Lu (2008) carried out a study that examined the effectiveness of SMS vocabulary lessons using mobile phones. The study lasted for two weeks. The researcher used an experimental design in which Taiwanese students ($n=30$) from one class were equally distributed into two groups, an SMS group and a print material group. In the first week, the SMS group learned 14 words via SMS, while the print material group learned the same 14 words via paper-based materials. In the second week, the two groups switched their media and they learned another 14 words. The researcher used a pre-test, an immediate post-test, and a delayed post-test to assess students' learning of English words. The results showed that the mobile phone groups had significantly greater vocabulary gains than their paper-group counterparts in the immediate post-tests ($t= 2.62$, $p < 0.05$). Furthermore, the researcher used a questionnaire to examine students' perspectives on the use of SMS to learn English words. The students reported that the use of SMS as an educational tool was useful because it was convenient and interesting, and it was easy to memorise words using SMS. The participants reported other advantages of SMS that included: SMS allowed for effective time management, SMS involved receiving manageable amounts of content, and SMS was helpful for study. The brevity of SMS messages made the students believe that SMS would allow them to take advantage of short intervals of time to easily study small amount of educational content. In addition, receiving educational SMS regularly and at scheduled times made the students believe that SMS helped them to learn better. However, the students pointed to some drawbacks of the use of SMS as an educational tool. The reported disadvantages of the use of SMS as an education tool were grouped into four categories that included: troublesome in use, insufficient content, technical problems, and difficult for study. The difficulties in using SMS were related to clicking on their mobile phones and opening SMS one by one. The brevity of SMS made the students point to the lack of detail and examples in the SMS. The technical

disadvantages of receiving educational SMS were related to the small memory of students' mobile phones and consequent difficulties in saving the received messages. The students complained about using SMS to study in terms of locating old messages on their mobile phones and the difficulty of concentrating when learning on the move.

The above studies show that students perceived SMS to have advantages and that SMS helped them to improve their learning. The participants reported that the advantages of educational SMS included: taking advantage of fragments of time to learn educational content, the convenience of learning via SMS through an easy to access medium, increased motivation to study, the ability to study short and manageable amounts of educational content, and regulating study through receiving educational content regularly and at scheduled times. The studies showed that students perceived SMS to have more positive aspects than negative ones as a tool to support teaching and learning. The reported disadvantages included: limited mobile storage, the time required to locate previous messages, difficulties in clicking on mobile phones, difficulties in opening SMS one by one, lack of examples and details in the received SMS, lack of two-way communication, and the difficulty of concentrating when learning on the move. The results of the studies indicated that the participants had overall optimistic perceptions of the use of SMS as an educational tool.

The integration of ICT in higher education has several advantages that include: enhancing students' learning, improving instruction (Dahlstrom & Bichsel, 2014), providing students with the ICT skills that are necessary to cope with the current era of technology (Poelmans et al., 2012), coping with increasing competition in the higher education market (Urbanovič & Wilkins, 2013), increased access to education and recruiting more non-traditional students, such as distance education students (Andrew, 2012; Muianga et al., 2013) and contributing to the development of the life-long learning process (Ranieri, Manca & Fini, 2012).

SMS technology is a type of ICT that is easy-to-use, cheap and popular among university students. It uses a readily available technology, and is an effective learning tool. Research has found that the use of SMS as an educational tool had some advantages that included: improving students' learning, taking advantage of fragments of time to learn educational content, convenience in learning through an easy-to-access medium, motivating

students to study, enabling students to study short and manageable amounts of educational content, and regulating students' study by sending them educational content regularly and at scheduled times (Lu, 2008; Cavus & Ibrahim, 2009; Kert, 2011).

However, not all countries are able to fully use new ICT in higher education. Many developing countries still have several barriers to the use of ICT in their educational systems (Khan, Hasan & Clement, 2012). Examples of these barriers include the lack of the required infrastructure and issues related to the awareness of, and attitude toward, ICTs (Sife et al., 2007; Alturise & Alojaiman, 2013). Developing countries may not have the resources for other forms of ICT but they do have mobiles phones.

Institutions of higher education in developing countries can take advantage of the use of SMS technology to support teaching and learning. SMS has been found to support educational purposes in developing countries, including African countries (Traxler & Dearden, 2005; Kaleebu et al, 2013). The following section discusses ICT integration in higher education, focusing on developing countries and the status of Gulf Cooperation Council (GCC) countries.

2.4 ICT Integration in Higher Education: The Case of Developing Countries

Many developing countries are looking to create a knowledge-based economy through the development and reform of their higher education systems to improve the quantity and quality of education (Shin, 2012; Sum & Jessop, 2013). For instance, Mikre (2011) stated that:

ICTs greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for business and the poor (p. 1).

Unfortunately, many developing countries are unable to take advantage of ICT (e.g., computer and internet applications) in learning and teaching. The "high cost of acquiring, installing, operating, maintaining and replacing ICTs" (Balasubramanian et al., 2009, p. 21) limits access to many standard learning and teaching technologies used in the developed world. In addition, the limited integration of ICT in higher education can be ascribed to limited knowledge, skills and experience in relation to ICT integration by the individual

(e.g., faculty members and institutions and higher education administrators) (Buabeng-Andoh, 2012) a lack of clear institutional strategy and policy in relation to ICT integration in higher education (Lwoga, 2012), and limited research in the area of emerging technology integration in education in developing countries (e.g. in Arab countries) (Al-Omari, 2014).

Furthermore, Touray, Salminen and Mursu (2013) conducted a study that examined the barriers to ICT use in developing countries through the review of several research studies. The findings showed that among the main barriers ICT in developing countries were technical barriers such as low rates of internet connection, socio-cultural barriers such as fear of technology, infrastructural barriers such as a lack of software and hardware, and educational and skills-related barriers such as lack of ICT skills.

In a recent study, Tarus, Gichoya and Muumbo (2015) examined the barriers to e-learning use in Kenyan universities. The researchers collected data through a questionnaire involving 148 faculty members and administrators regarding the barriers to e-learning use in Kenyan universities. The findings showed that most participants reported that the main challenges of e-learning use in Kenyan higher education were inadequate ICT and e-learning infrastructure, a shortage of inexpensive and adequate internet bandwidth, lack of technical skills on e-learning and financial constraints.

The above studies suggest that developing countries have increasing interest in ICT integration in higher education. However, several constraints are hindering the implementation of ICT. The use of mobile phone services such as SMS in education does not require special infrastructure. Students already have the required software and hardware in their hands all the time. Communication using mobile phones takes place via existing mobile systems, which are maintained by mobile service providers (Nwagwu, 2013). The current study took place in Kuwait. Kuwait is part of the Arab Gulf Cooperation Council (GCC). The following section discusses the situation in the Arab (GCC) countries in relation to ICT integration in higher education.

2.4.1 ICT integration in higher education: The case of (GCC) countries. Gulf Cooperation Council (GCC) countries (Saudi Arabia, UAE, Kuwait, Bahrain, Qatar and Oman) are characterised by high technology access (ITU, 2012); however, this high access has not translated to high technology integration in higher education (Bounabat, 2009).

Statistics have shown that the people of these countries have higher rates of technology adoption than other developing countries. The mobile penetration in gulf countries stood at 173%, which is higher than the developed world average of 114% (ITU, 2012). The percentage of internet users in the gulf countries stood at 50.6%. This is significantly higher than the world average of 28.7%, the Arab states' average of 24.9%, and developing countries' average of 21%, but it is lower than the developed countries' average of 71% (ITU, 2012). These statics suggest high rates of adoption of different technologies by the people in gulf countries. Such high adoption of these technologies can be taken advantage of in higher education institutions.

The integration of ICTs in the educational system has received attention from the governments of GCC countries as a means of advancing their socio-political and economic agendas (Wiseman & Anderson, 2012). This is reflected in the creation of policies and national projects establishing ICT in higher education. For example, in Saudi Arabia, the Ministry of Higher Education has launched the National Centre for E-Learning and Distance Education (NCEL) with the vision of "establishing a complementary educational system in a form of a national centre that utilizes the most recent advanced technologies in e-learning and distance learning" (NCEL, 2009, p. 1). Bahrain University has established the Zain e-Learning Centre with a mission of allowing faculty members to implement different technologies to achieve excellence and high quality education (Zain e-Learning Centre, 2009).

The availability of technologies, as well as the increasing institutional interest in ICT integration in higher education, has led academics in GCC countries to adopt different types of ICT in their educational practice. However, the GCC institutions of higher education are still faced with some barriers to using ICTs. Alturise and Alojaiman (2013) found that the main barriers of the use of ICTs in universities in Saudi Arabia are the lack of infrastructure, the resistance from faculty members, and students' limited access to ICTs. They explained that "University barriers often result from not having the correct ICT infrastructure such as smart buildings, proper equipment, servers, networks, etc." (p. 46). In addition, they stated that "Many faculty members lack confidence when using ICT for many reasons such as feelings of inadequacy, insecurity and fear of failure" (p. 46). In relation to reading students' access to ICT, Alturise and Alojaiman, (2013) explained that:

Students usually do not have enough income to purchase or hire rapidly changing hardware and software technology and therefore how much money is spent on a university ICT system is a critical issue. Many students who do not have much technical knowledge about ICT may experience ICT-related problems (p. 46).

Research has examined the uses of different ICTs in higher education in these countries. However, a great majority of these studies have focused on computer and internet technologies (Al-Khalifa, 2010; Hussein, 2011; Alkhalaf, Drew, AlGhamdi & Alfarraj, 2012; Sultan, van de Bunt-Kokhuis, Davidson, Sentini & Weir, 2012). The investigation of the integration of mobile phone technologies in general and SMS technology in particular in the higher education institutions in GCC countries is still limited (Nassuora, 2012; Khan, Al-Shihi, Al-khanjari & Sarrah, 2015).

Tamim (2013) presented a discussion involving five mobile learning stakeholders about the status of mobile learning in GCC higher education. The stakeholders included a university administrator, a faculty member, an educational researcher, an information technology employee and an undergraduate student. In regard to the issues and gaps in mobile learning in GCC, some of the interviewees believed that there is a need for a training program for instructors in relation to the integration of mobile technologies in education as well as a need for a training program for students in relation to the ethical use of technology. Some participants felt it was necessary to evaluate the impact of mobile devices on students' performance when they are integrated into teaching and learning. The stakeholders said that assessing students' reactions to the use of SMS as an educational tool should inform the future use of mobile phones in education.

Kuwait, a GCC country, is looking to increase the integration of ICTs in different government sectors. However, such integration is faced with some barriers related to human skills, infrastructure and resources, and policy and support (Alwani & Soomro, 2010; Wiseman & Anderson, 2012). The current study took place in Kuwaiti higher education; the following section discusses the status of ICT integration in Kuwait, specifically focusing on higher education.

2.5 ICTs in Kuwait

Kuwait is a high-income GCC country with a zero poverty rate. The gross domestic product (GDP) per capita is \$47,926, which is the 18th-highest GDP in the world (United Nations Development Programme (UNDP), 2012). However, Kuwait is still considered a developing country (United Nation, 2011). The wealth of the country was reflected in the diffusion of different ICTs among the Kuwaiti people. In 2010, the subscription rate for mobile services was 160.8 % (ITU, 2012). Internet user penetration in Kuwait was 38.3%, which is higher than the world average of 28.7%, but lower than the developed countries' average of 71% and the GCC average of 50.6% (ITU, 2012). The statics showed that Kuwaiti people had higher access to mobile phones compared to their access to the internet. This would suggest that mobile phones and mobile phone services including SMS might be used for educational purposes since it is very available.

The Kuwaiti government has made efforts to integrate ICTs in all governmental sectors in order to provide electronic services to their citizens (Zaied, Al-Khairalla & Al-Rashed, 2007). According the *Times of Oman* newspaper (2013), Kuwait is the third-largest spender on information and communication technology (ICT) infrastructure in the Gulf Cooperation Council (GCC), and its total ICT spending will reach \$28 billion between 2011 and 2015. The Kuwaiti government's interest in ICTs is evidenced by several projects, such as the Kuwait Government Online (KGO) portal. Developed with the assistance of Singapore, the government online portal is a website that has provided Kuwaiti society with non-stop (in both Arabic and English) information, data and government services through multiple access channels, such as the web and different means of communications technology (KGO, 2012). The government has also launched award programs that offer financial support for projects related to the field of information technology. These awards were the "Sheikh Salem Al-Ali Al- Subah" and the Kuwait e-Award. The awards were created to encourage development in the field of information technology (Sheikh Salem Al-Ali Al-Subah Award, 2012; Kuwait e-Content Award, 2012). ICT projects and initiatives reflect the high interest of the Kuwaiti government in taking advantage of ICTs in the different governmental sectors, including higher education. The following section discusses ICT integration in Kuwaiti higher education.

2.5.1 ICTs Integration in Kuwaiti Higher Education. As in any other government sector in Kuwait, ICTs have found their way into the field of higher education to support the learning and teaching process (Al-Ansari, 2006; Al-Doub, Goodwin & Al-Hunaiyyan, 2008; AlAjlan, 2011; Alajmi, 2010). There are two public higher education institutions in Kuwait: Kuwait University and the Public Authority for Applied Education and Training (PAAET). In addition, there are seventeen private universities (Ministry of Higher Education, 2015). Both public universities have learning management systems (Kuwait University, 2012a; PAAET, 2012). Kuwait University uses Blackboard and has also established the Distance Learning Centre. The Centre provides students with opportunities for distance education through electronic communication, conferences and multimedia systems, as well as providing students and faculty with the required technical assistance for distance education (Kuwait University, 2012b). PAAET also has an e-learning support systems unit that is responsible for distance-learning technology to support teaching and training, development of plans to use computers for educational purposes, development of educational software and technologies to enhance the quality of education, and providing training courses in relation to technology integration (PAAET, 2012). The websites of the two public higher education institutions in Kuwait show that the universities have computer labs and internet services in their colleges (Kuwait University, 2012a; PAAET, 2012).

Research in this area has begun to address Kuwaiti university students' attitudes toward and perceptions of the integration of these different ICTs into educational practices. The findings of these studies have demonstrated that Kuwaiti students have positive attitudes toward and acceptance of ICTs in their educational experiences.

Alsanaa (2012) investigated students' acceptance of incorporating emerging communication technologies into Kuwait's higher education institutions. The researchers used a cross-sectional study design in which 270 participants completed a questionnaire. The results showed that the majority of the participants had positive attitudes toward using social media for school work. In addition, about half of participants reported an intention to use e-learning tools in the future

The findings of this study reflected students' positive attitudes and acceptance of the use of certain ICTs in their education. Other ICTs such as mobile phones are very popular

among Kuwaiti students. One of the mobile phone services that was used to support teaching and learning was SMS. However, SMS technology has unique characteristics. There is a need to examine Kuwaiti students' attitudes toward and perceptions of this emerging technology.

Similar findings were obtained in a study conducted by AlAjlan (2011). The researcher examined students' attitudes toward communicating with instructors via the internet at Kuwait University. The researcher created a website to serve as an information source, and e-mail was employed to serve as a primary means of communication between the teacher and the students. One hundred students completed a Likert scale questionnaire regarding their attitudes toward the use of internet in their class. A significant majority of students reported positive attitudes toward the use of the internet in their education, and 71.2% agreed or strongly agreed that the website was as informative as the lectures, 69.5% agreed or strongly agreed that using the internet for their class was enjoyable, and 88.2% of the participants agreed or strongly agreed that communication between students and instructors via e-mail was important for them.

The above studies examined the use of common ICTs, including e-learning systems, educational websites and e-mail. Similar to other international research studies (Liaw, Huang & Chen, 2007; Sun, Tsai, Finger, Chen & Yeh, 2008), the results of these two studies show that Kuwaiti university students reported positive experiences and attitudes toward these different ICTs. Such findings will motivate academics and practitioners to introduce ICTs to support teaching and learning in Kuwaiti higher education institutions.

SMS is popular among Kuwaiti people. For instance, Al-Failakawi (2006) conducted a study that examined Kuwaiti people's use of SMS. The researcher used a cross-sectional study design in which 1,591 Kuwaitis completed a questionnaire regarding their use of SMS. All the participants were older than 18. This study found that 91% of participants used SMS and more than 90% of those had used SMS for more than a year. The results showed that about half of the participants (48%) sent less than six messages a day while rest sent six or more messages a day. In addition, the study found that 42% of the participants received less than six a day, while the rest received six or more messages a day. The results showed that their main reasons for using SMS included: it is easier to write

about things than say them verbally, it is fun and it is cheap. The researcher found that Kuwaiti people use SMS for chatting and to exchange jokes, love messages, information, poems, international messages, information related to work and study, appointment times and religious quotes. The findings suggest that Kuwaiti people are familiar with SMS and they use it for different reasons. The use of SMS as an educational tool does not require training or special equipment.

Research examining students' attitudes toward the integration of SMS technology in Kuwait is limited. Research into students' perceptions of other ICTs in Kuwait showed that students had positive attitudes toward e-learning systems, educational websites and email (Al-Doub et al., 2008; AlAjlan, 2011; Alsanaa, 2012). In addition, research in this area showed that the integration of new technologies as learning tools in Kuwaiti higher education requires academics to plan in terms of increasing students' awareness of the technology and its attributes (Alajmi, 2011). Margaryan et al. (2011) recommend that, in order to inform policy and practice regarding technology integration, higher education practitioners should examine what technologies students have access to and what their preferences are, as well as the educational values of these technologies.

SMS is a popular technology among Kuwaiti people. SMS offers several advantages for developing countries. In order to inform practice regarding SMS use in Kuwaiti higher education, there is a need to understand students' perceptions and attitudes toward the integration of such technology.

2.6 Conclusion

SMS is a popular service for mobile devices all over the world. SMS technology provides users with an "anywhere and anytime" method of communication. It is fast, cheap, private, straight to the point, convenient, fun and useful for coordinating events. It is a personal mode of communication, and it is widely used by university students. SMS has been used in higher education in different ways including as an in-class discussion tool, a communication tool for administrative support, a persuasive and motivational tool, and an evaluation tool. The research that has examined the use of SMS in higher education is limited in terms of the small sample sizes and a shortage of research into students' reactions. For instance, the studies, discussed above in relation to the uses of SMS

technology in a higher education context have not examined students' attitudes toward and perceptions of the use of SMS in relation to other variables, such as ease of use and usefulness.

It has been found that the use of SMS to support learning and teaching was perceived by higher education students to have several advantages including: taking advantage of fragments of time to learn educational content, convenience in learning via SMS through an easy-to-access medium, increasing students' motivation to study, allowing the students to study short and manageable amounts of educational content and regulating students' study through receiving educational content regularly and at scheduled times. However, Margaryan et al. (2011) recommend that, in order to inform policy and practice regarding technology integration, higher education practitioners should examine what technologies students have access to and what their preferences are, as well as the educational values of these technologies. Therefore, there is a need to explore the advantages of SMS in higher education in more depth. In addition, students' adoption of, and attitudes toward, SMS need to be examined.

SMS technology is a type of ICT that can be integrated into higher education institutions. The use of ICT is popular in higher education to achieve administrative and educational outcomes. Developing countries are looking to integrate ICTs in their higher education in order to address their social and economic problems. However, the integration of ICTs in developing countries is faced with several barriers related to the lack of the required infrastructure, issues related to students' access to technology, and issues related to students' and faculty members' awareness and attitudes toward different ICTs. The integration of mobile phone services such as SMS to support teaching and learning in higher education does not need special infrastructure because the software and hardware are already in students' hands and the communication infrastructure is maintained by mobile companies.

GCC countries are distinguished among developing countries in terms of the adoption of technologies, and the high interest in integrating these technologies in higher education. Mobile phone and SMS technologies are popular among Kuwaiti people. The use of SMS in higher education could overcome several barriers to technology use such as the availability of infrastructure and student access to technology. There is a scarcity of

research on integrating SMS technology into higher education in Kuwait. If educators do not know how students perceive SMS technology then it will be hard to fully understand its value, which could lead to misunderstanding and misuse of the technology.

The research studies discussed above in relation to the use of SMS technology in a higher education context have not examined students' attitudes toward and perceptions of the use of SMS in relation to other variables, such as ease of use and usefulness. The scarcity of research studies that have investigated students' attitudes toward and perceptions of the use of SMS in Kuwaiti higher education might limit its integration in higher education and prevent educational institutions from taking advantage of such easy-to-access, low-price, and readily available technology. Therefore, this study employed the Technology Acceptance Model (TAM) (Davis, 1986) to investigate students' perceptions and attitudes toward the use of SMS to support learning and teaching at Kuwait University.

Chapter 3: Theoretical Framework

The Technology Acceptance Model (TAM) has been developed into a model for explaining and predicting users' attitudes toward and use of technology (Venkatesh, 2000; Lee et al., 2003; Straub, 2009). The current study employed the TAM developed by Davis (1986) to guide the investigation of the perceptions and attitudes toward SMS technology on the part of Kuwaiti students. SMS is popular among Kuwaiti people. SMS has several advantages as a communication and educational tool. Understanding students' reactions to the use of SMS as an educational tool and the factors that would influence such reactions are important determinants of the success of SMS integration in higher education. Students' responses to the use of SMS as an educational tool will inform the ways it is used in higher education. Margaryan et al. (2011) recommend that, in order to inform policy and practice regarding technology integration, higher education practitioners should examine what technologies students have access to, and what their preferences are, as well as the educational values of these technologies.

The theoretical framework chapter of this study starts with a brief overview of the Technology Acceptance Model (TAM). The second section discusses the use of TAM to investigate the adoption of SMS in different fields. To provide examples of the use of TAM in Kuwait, the third section discusses some studies that examine the use of TAM in different fields in Kuwait. The fourth section discusses some limitations of TAM studies. Finally, the conclusion of the chapter is presented.

In Kuwait, TAM has been used to assess users' adoption of camera mobile phone technology (Rouibah & Abbas, 2006; Rouibah, 2009; Rouibah, Abbas & Rouibah, 2011), instant messaging (Rouibah, 2008) and information systems in Kuwaiti government ministries (Almutairi, 2007). In addition, TAM has been employed to study users' perceptions and use of SMS banking (Amin, 2007), SMS advertising (Zhang & Mao, 2008; Muk & Chung, 2015) and library SMS services (Goh, 2011; Wang & Lu, 2011). The above studies have shown that TAM is useful for understanding and explaining users' levels of acceptance of the use of SMS technology for different purposes. In addition, most of the examined studies have shown that TAM is useful for understanding and explaining the adoption of different technologies in Kuwait.

In regard to SMS use, studies have looked at its implementation in higher education to support teaching and learning (Lu, 2008; Zhang et al., 2011; Kert, 2011). As a communication tool, university students perceived SMS as a personal, inexpensive, easy-to-use, fast, convenient and enjoyable tool (Balakrishnan & Loo, 2012; Tahat et al., 2014). Students' reactions to the use of SMS in higher education have been assessed in some research studies (Lu, 2008; Cavus & Ibrahim 2009). Findings have shown that the use of SMS as an educational tool has more positive aspects than negative attributes. These findings have shown that SMS is useful as an educational tool. In particular, students felt that they were able to take advantage of fragments of time in their studies (Lu, 2008; Zhang et al., 2011) and that SMS provided convenience in learning because it is an easy to access medium (Zhang et al., 2011) which motivates students to study (Cavus & Ibrahim 2009), allows them to study short and manageable amounts of educational content (Lu, 2008) and improves their learning (Lu, 2008; Cavus & Ibrahim 2009; Zhang et al., 2011). TAM can be used to guide the investigation of students' perceptions of and attitudes toward the use of SMS as an educational tool.

3.1 The Technology Acceptance Model (TAM)

TAM was derived from the principles of the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). TRA describes the relationship between beliefs, attitudes, norms, intentions and behaviour. Attitude is defined as representing "a person's general favourableness or unfavourableness toward some stimulus object" (Fishbein & Ajzen, 1975, p. 216). 'Subjective norm' was defined as "the person's perception that most people who are important to him think that he should or should not perform the behaviour in question" (Fishbein & Ajzen, 1975, p. 302). Therefore, based on TRA, to predict students' behaviour it is necessary to evaluate their attitudes and norms toward the behaviour.

Based on this theory, in the context of technology acceptance, the user's behaviour toward a technology is based on their intention to either use or reject the technology and this intention is shaped by the user's attitudes and subjective norms (Dillon & Morris, 1996). Attitude toward behaviour is a function of two factors: beliefs about the consequences of the behaviour and the affective evaluation of those consequences (Dillon & Morris, 1996). Subjective norms are influenced by the individual's normative beliefs and

motivation to comply (Dillon & Morris, 1996). Normative beliefs are related to people's beliefs about whether their main referent individuals or groups support or reject a given behaviour, while motivation to comply is an evaluation of how important it is to have the approval of important others (Ajzen, 1991). Examples of important referents included spouses, children, other family members, managers and doctors (Peters & Templin, 2010). For example, to measure a one's normative beliefs regarding use of technology, an individual can be asked to respond to a statement like "My [referent] think(s) that I should adopt this particular technology." To measure motivation to comply, the individual can be asked to respond to a statement like "When it comes to use of technology, I want to do what my [referent] wants me to do."

TRA is a general model while TAM is an adapted and modified form of TRA used to address why users accept or reject information technology. The goal of TAM is to explain and predict users' behaviour across a variety of computing technologies (Davis, Bagozzi & Warshaw, 1989). Davis (1986) argued that unlike TRA, in TAM, the effect of users' beliefs (e.g., regarding ease of use and usefulness) on user behaviour should be measured separately in order to assess their influence on a technology's acceptance. In addition, Davis (1986) argued that perceived ease of use has a significant one-way effect on perceived usefulness in models that explain the acceptance of a technology.

The TAM (Davis, 1986) argues that perceived usefulness (PU) and perceived ease of use (PEOU) factors can predict a user's attitude toward using a technology. Figure 3.1 shows the proposed relationships between TAM's factors.

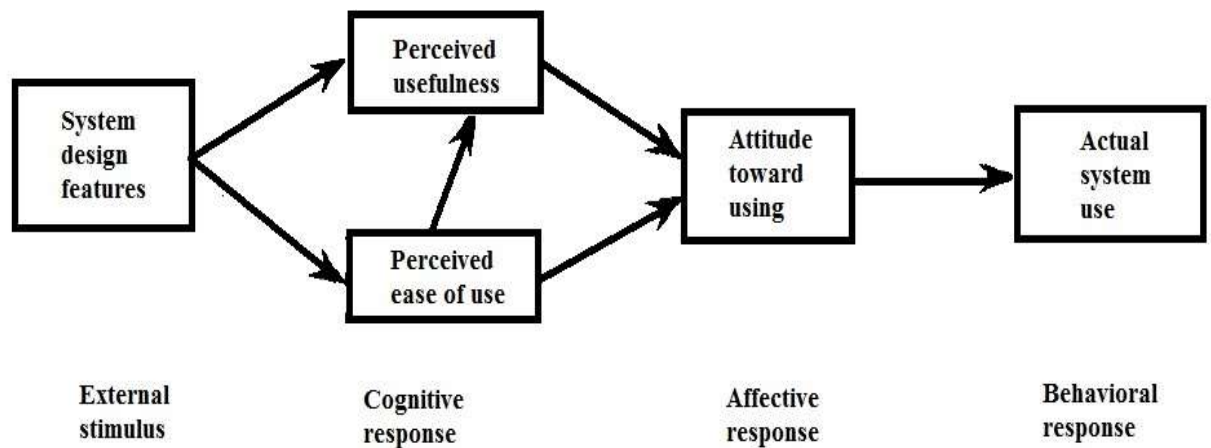


Figure 3.1. The Original Technology Acceptance Model (TAM) (Davis, 1986, p. 24)

Perceived usefulness (PU) can be defined as “the degree to which a user believes that using the system will enhance his or her job performance” (Davis, 1989, p. 320), while perceived ease of use (PEOU) can be defined as “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989, p. 320). The TAM shows that a user’s attitude toward a technology is a major influence on whether a user will accept or reject a technology. TAM shows that perceived ease of use (PEOU) affects an individual’s perceived usefulness (PU). However, both factors are affected by the technology’s characteristics and its design. The technology’s characteristics and its design represent a type of external stimulus. Choice of external variables differs from one study to another. The external variables intrude indirectly by influencing PEU and PU. There is no clear pattern with respect to the choice of the external variables considered in different studies (Legris, Ingham & Colletette, 2003). Examples of external variables include users’ characteristics such as major organisational factors like system accessibility (Park et al., 2012). PEU and PU represent a cognitive response to the introduction of the new technology. Based on their cognitive responses, potential users form their attitudes toward the use of new technologies. Potential users’ affective responses have a direct effect on their behavioural responses represented by their actual use of such technology.

The original TAM has been subjected to developments in order to enhance its ability to explain and predict technology use (e.g., Davis, 1993; Venkatesh & Davis, 1996).

Davis's (1993) study found that there were significant relationships between variables in the original TAM that were previously assumed to be insignificant. Davis (1993) conducted a field study in which 112 users of an electronic mail system and text editor completed a questionnaire to rate the two systems. The results showed that perceived usefulness affected actual system use. In addition, system characteristics are one of the predictors of a user's attitude toward using a technology. Figure 3.2 shows the relationships between the revised TAM's factors.

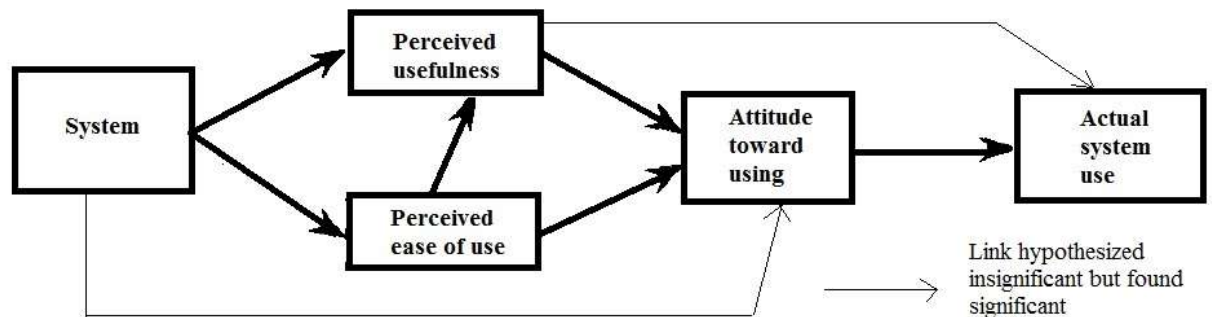


Figure 3.2. New relationships among TAM's factors(Davis, 1993, p. 481)

Another development of TAM was introduced by Venkatesh and Davis, (1996). These researchers found that perceived usefulness and perceived ease of use have direct influences on the user's behavioural intentions toward a technology. Figure 3.3 shows the new version of TAM.

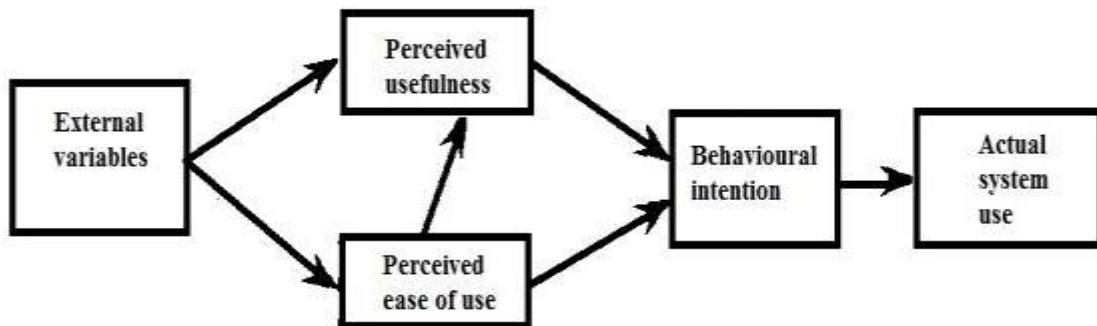


Figure 3.3. The New Version of TAM (Venkatesh & Davis, 1996, p. 453)

Another major development of TAM was presented in Venkatesh and Davis's (2000) study. The researchers proposed an extended model of TAM that was referred to as TAM2. The model was tested using longitudinal data collected on four different systems of technology at four organisations ($N = 156$), two involving voluntary usage and two involving compulsory usage. The model was tested three times within three months of the implementation of the systems. The model was supported in the four organisations on the three occasions it was used. Figure 3.4 shows the proposed TAM2.

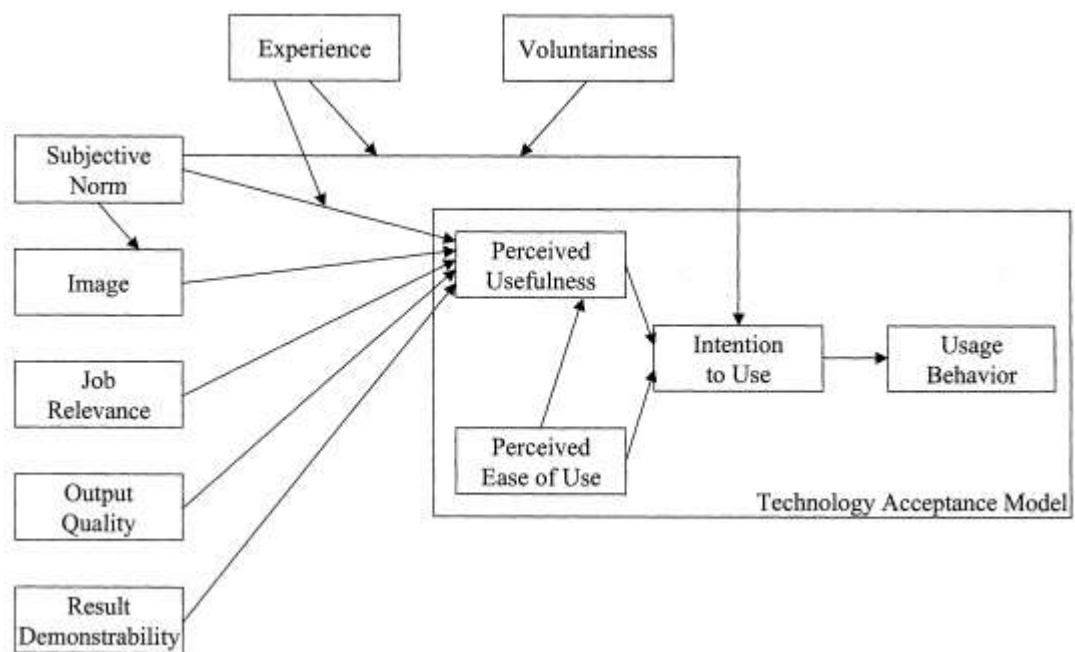


Figure 3.4. Proposed TAM2 – Extension of the Technology Acceptance Model (Venkatesh & Davis, 2000, p. 188)

TAM2 showed that social influence processes that consist of interrelated variables include: subjective norms, voluntariness and image. They were found to significantly influence user acceptance in direct and indirect ways. The researchers defined voluntariness as "the extent to which potential adopters perceive the adoption decision to be non-mandatory" (p. 188). Image was defined as "the degree to which use of an innovation is perceived to enhance one's ... status in one's social system" (p. 189). It has been found that additional cognitive instrumental processes including job relevance, output quality and result demonstrability, significantly influenced user acceptance in direct and indirect ways.

Job relevance was defined as an “individual's perception regarding the degree to which the target system is applicable to his or her job” (p.191). Output quality was defined as “how well the system performs tasks” (p. 191). ‘Result demonstrability’ was defined as “tangibility of the results of using the innovation” (p.192). The researchers provided more detailed explanations for their perceptions of a technology’s usefulness. The results showed that TAM2 was valid for both voluntary and compulsory usage.

A more comprehensive study that aimed to develop a unified view of technology acceptance based on TAM and another seven theories was presented in Venkatesh, Morris, Davis and Davis’s (2003) study. The new proposed model was empirically validated using data from four organisations with 215 participants. The model was tested three times within six months. Figure 3.5 shows the proposed Unified Theory of Acceptance and Use of Technology (UTAUT).

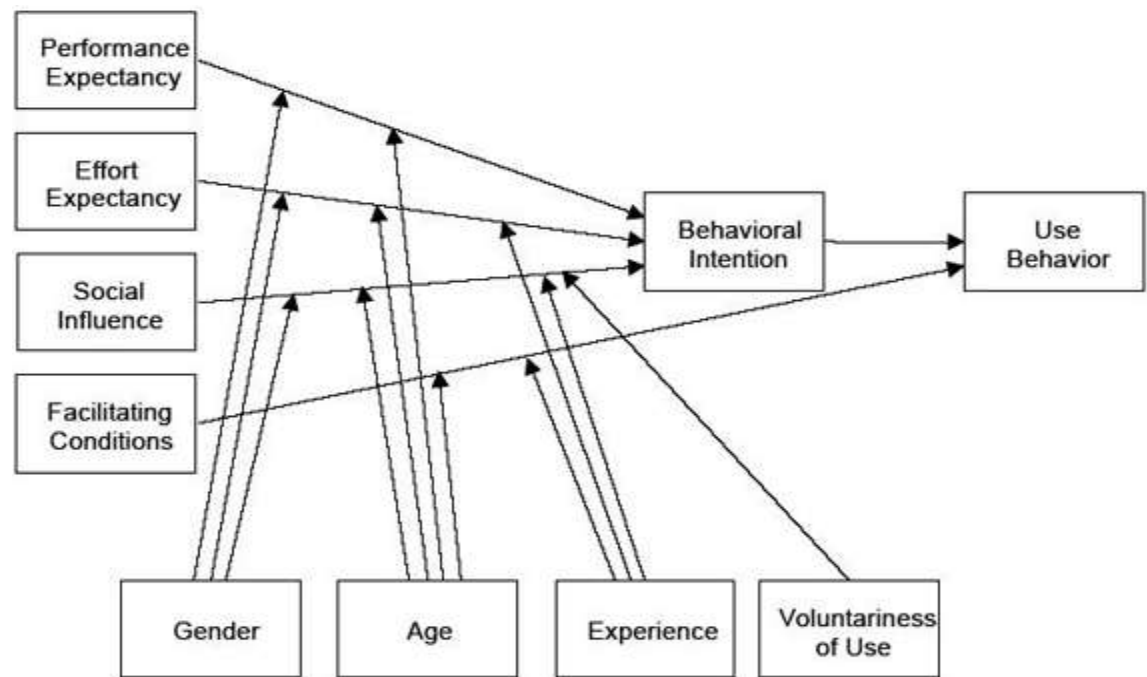


Figure 3.5. Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003, p. 447)

UTAUT proposed that individuals’ intentions to use an information system and succeeding usage behaviour can be determined using four main constructs: performance

expectancy, effort expectancy, social influence and facilitating conditions. However, only the facilitating conditions factor was a direct determinant of user behaviour. In addition, it was found that gender, age, experience and voluntariness of use moderate the impact of the four key constructs on usage intention and behaviour. Performance expectancy was defined as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance” (p. 447). ‘Effort expectancy’ was taken to refer to the “degree of ease associated with the use of the system” (p. 450). ‘Social influence’ was taken to refer to the “degree to which an individual perceives that important others believe he or she should use the new system” (p. 451). ‘Facilitating conditions’ were defined as the “degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” (p. 453).

The developments of TAM were introduced to enable it to provide a better understanding of users’ behaviour toward particular pieces of technology, as well as the factors that influence such behaviour. More factors and new relationships among factors were examined and this led to better prediction and understanding of user acceptance of technology.

In some studies, behavioural intention was considered as a component of attitude (Ruffell, Mason & Allen, 1998). Some researchers believed that attitude should not be replaced by behavioural intention in TAM and UTAUT. Based on their empirical research, Yang and Yoo (2004) suggest that attitude deserves more attention in information system (IS) research due to its significant influence on the individual and organisational usage of IS. Better understanding of students’ perceptions and attitudes toward technology have great practical value in terms of assessing student demand for the use of the new technology and for evaluating the new use of technology. Thomas, Singh and Gaffar (2013) found in their study of mobile learning adoption in developing countries’ higher education systems that including attitude in the model was a useful modification since it increased the descriptive power of the method.

There have been a number of revisions of TAM, including TAM2 and other adoption models such as TRA and the attempt to combine adoption theories in one: UTAUT. However, the original TAM is still appealing due to its simplicity, its wider use in a number of domains and its well supported validity (Edmunds et al., 2012). Edmunds et al.

(2012) stated, "The core concepts of ease of use and functionality prove to be a successful basis for a number of revised models. This suggests these two factors [ease of use and usefulness] are particularly valid in an understanding of technology use."

In the present study, the focus is on students' attitudes toward SMS rather than on intention to use SMS technology. Potential users' attitudes toward technology can predict their behavioural intention and actual future use (Ajzen, 1991). Students' attitudes toward technology greatly influence their adoption and acceptance of such technology (Yusuf & Balogun, 2011). In addition, the study measured the relationship between the two proposed factors in the original TAM, students' perceptions of usefulness and ease of use of SMS technology and students' attitudes toward using SMS.

To explore students' attitudes toward SMS technology, the current study employed the original TAM presented by Davis (1986) to guide the investigation of the attitudes toward SMS technology present in Kuwaiti students. The original TAM appears well suited to the present research objectives. Several research studies (e.g., Huang et al., 2012; Edmunds et al., 2012) have found that ease of use and usefulness factors were useful for predicting and explaining potential users' attitudes toward technology. Edmunds et al. (2012) examined students' attitudes toward technology in work, social and study contexts. Four hundred and twenty one university students completed a questionnaire related their attitudes toward technology. The results showed that usefulness and ease of use were key dimensions of students' attitudes toward technology in all three contexts.

The current study represents the first step in research in Kuwait in relation to the use of SMS as an education tool. Students' attitudes toward SMS use in learning are still unknown. The findings from this study might identify how the TAM can best be extended. Extended versions of TAM are common in studies that aim to examine technology acceptance. TAM has been repeatedly used to examine the adoption of SMS technology in different contexts. The following section discusses the applications of TAM in research that examines the use and adoption of SMS for different purposes.

3.2 SMS Technology and TAM

TAM has been developed to test the attitudes and adoption of SMS for different purposes, which include SMS banking (Amin, 2007), SMS advertising (Zhang & Mao,

2008; Muk & Chung, 2015) and an SMS library catalogue search service (Goh, 2011). Studies have shown that TAM was effective for predicting and understanding users' attitudes, intentions to use and actual use of SMS technology for different purposes. TAM can be used to better understand people's attitudes and use of SMS in different contexts.

A study using extended TAM investigated the intention to use SMS advertising among young Chinese consumers. Zhang and Mao (2008) used TAM with two additional factors: perceived trust and subjective norms, in addition to perceived usefulness and ease of use, to predict behavioural intentions to use SMS advertising. The researcher employed a cross-sectional study design in which there were 262 responses for a questionnaire. The findings showed that the four factors were significant in predicting consumers' intentions to use SMS advertising. The results showed that perceived usefulness had a stronger relationship with behavioural intention to use SMS advertising than it had with intention to use SMS advertising.

In a higher education setting, Goh (2011) used an extended version of TAM to investigate students' perceptions of an SMS library catalogue search service. The extended TAM included one additional factor, self-efficacy, along with perceived usefulness and ease of use to predict behavioural intentions to use an SMS library catalogue search service. Ninety university students participated in a cross-sectional study design. The findings showed that the model was effective in predicting students' intentions to use an SMS library catalogue search service. The correlation results showed that for the participants, perceived usefulness had a stronger relationship with intention to use than ease of use had with intention to use.

Muk and Chung (2015) conducted a study with the aim of investigating the factors that influence consumers' acceptance of SMS advertising in the United States and South Korea. The researchers used an extended version of TAM with one additional factor, social influence, in addition to the perceived usefulness and ease of use, to predict attitudes toward acceptance of SMS advertising. Three hundred and two university students participated in a cross-sectional survey. The findings showed that attitude toward SMS advertisements was significantly related to perceived usefulness and social influence. In addition, attitude toward SMS advertisements was positively related to intention to use

SMS advertisements. SMS ease of use was significantly related to perceived usefulness; it was not significantly related to attitude toward SMS advertisement

Overall use of the TAM in the SMS adoption context has been successful, indicating the robustness of the model and its value for understanding potential users' attitudes toward, intention to use and use of SMS technology for different purposes (Zhang & Mao, 2008; Goh, 2011; Muk & Chung, 2015). The common findings in the above studies were the significant effects that usefulness and ease of use had on users' acceptance of the use of SMS for different purposes. In order to understand potential users' acceptance of SMS, the results of the above studies suggests that investigating students' perceptions of the ease of use and usefulness of SMS is important. Usefulness and ease of use were key factors for predicting users' acceptance of the use of SMS technology. Another common finding in the previous research studies was the stronger effect of the usefulness of SMS on users' intention to use SMS compared to the effect of ease of use. This finding suggests that potential users' perceptions of the usefulness of SMS technology are more important than their perceptions of the SMS ease of use (Zhang & Mao, 2008; Goh, 2011; Muk & Chung, 2015)

While studies have used the TAM to examine users' attitudes and intentions regarding the use of SMS technology for advertising, banking and a library search service, research has not examined students' attitudes toward SMS technology in educational settings. Users' attitudes toward technology are a significant factor that influences their use of technology (Yusuf & Balogun, 2011). The higher educational setting has its own characteristics in terms of students' motivation and drives to use technology and there is a lack of research that employs TAM to understand university students' attitudes and adoption of SMS in the higher education context. However, the extensive implementation of TAM for explaining and predicting users' attitudes toward and use of technology gives an indication of its strength in this area of research (Edmunds et al., 2012). TAM has been used in a wide variety of technology acceptance studies (Edmunds et al., 2012). The next section discusses the applications of TAM in research studies that have been conducted in Kuwait.

3.3 TAM in Related Research in Kuwait

In Kuwait, some studies have employed TAM to assess users' adoption of different technologies (Almutairi, 2007; Rouibah 2008; Rouibah, 2009; Rouibah et al., 2011). One study found that TAM was not successful in predicting the usage of information systems (IS). Almutairi's (2007) study examined the applicability of the TAM in Kuwaiti government ministries for examining the usage of IS in Kuwaiti governmental organisations. Two hundred and ninety one employees participated in the study. The findings showed that there were no significant relationships between the examined factors, which were perceived usefulness, ease of use and actual use of IS. However, the relationship between perceived ease of use and perceived usefulness was significant. The researcher ascribed the findings that the relationships were insignificant to three potential reasons. The first potential reason was national cultural differences. The researcher argued that a lack of support of TAM in Kuwait suggested issues regarding the international validity of the TAM. However, other research studies (e.g. Al-Gahtani, 2011; Al-Ajam & Nor, 2013) that were conducted in the Arab world showed that TAM was applicable in Arab cultures. The second potential reason was related to characteristics of the public organisations because the TAM did not take account of the unique characteristics of the public organisations studied, such as economic authority and the political authority (Almutairi, 2007). The last potential reason was that the use of IS was mandatory. Unlike cases of volitional IS use, the users had no option in relation to IS usage. Therefore, users' perceptions and beliefs had a minimal role in influencing IS use.

Rouibah's (2008) study found that extended versions of TAM were successful in predicting the usage of Instant Messaging (IM) by Kuwaiti adults for social and entertainment purposes. Rouibah used an extended version of the original TAM with three additional factors: subjective norms, perceived enjoyment and curiosity about other people in addition to the perceived usefulness and ease of use. The researcher used these factors to predict the level of IM usage among the participants. A total of 191 Kuwaiti adults participated in the study. The findings showed that all of the factors, except for perceived usefulness, were significant predictors of IM usage. This study examined the use of TAM outside the workplace in Kuwait. These particular characteristics of the study might have affected the findings. In Almutairi (2007) and Rouibah's (2008) studies, the dependent

variable was actual use of technology rather than attitudes toward or intention to use the technology. The type of dependent variable used might have affected the applicability of TAM in these two studies.

In another study, the TAM was successful in predicting people's attitudes toward mobile phone cameras in Kuwait. In this study, Rouibah (2009) examined a group of 151 Kuwaiti participants' intentions to use mobile phone camera technology. An extended version of the original TAM, which involved using subjective norms, perceived usefulness, ease of use and external variables (image, job relevancy, output quality and result demonstrability) was used to predict Kuwaiti users' behaviour. The findings showed that users' intentions to use mobile phone camera technology were determined by three factors: subjective norms, ease of use and camera usefulness. Of the external variables, job relevance had a significant indirect effect on the users' intention through usefulness. The results showed that intention to use was more strongly related to perceived usefulness than it was to perceived ease of use. The findings of this study aligned with most research studies which have used TAM, in that it showed that ease of use and usefulness were primary determinants of the acceptance of technology.

In a more recent study, Rouibah et al. (2011) used TAM2 to explore the intention to use and acceptance of use of mobile phone cameras prior to retail purchases among Kuwaiti users. A sample of 151 users participated in the study. The results showed that the intention to use a mobile phone camera was only determined by subjective norms, ease of use and perceived usefulness. The results showed that the influence of usefulness on intention to use was higher than the influence of subjective norms and ease of use. Among the external variables, only job relevance had a significant influence on users' perceptions of the usefulness of mobile phone cameras.

It can be seen that studies have used the TAM to address users' acceptance of a limited number of technologies (e.g., information systems, instant messaging and mobile phone camera technology) in Kuwait in different settings (e.g., public organisations outside the workplace) (Almutairi, 2007; Rouibah 2008; Rouibah, 2009; Rouibah et al., 2011). The studies discussed above have yielded conflicting findings regarding the applicability of TAM in Kuwait. Almutairi's (2007) findings indicated that TAM is not applicable in Kuwait, but other studies such as Rouibah (2008), Rouibah (2009) and Rouibah et al.

(2011) have supported its applicability. The conflicting results regarding the applicability of TAM in Kuwait were due to the different characteristics of the environment, the type and nature of the dependent variables and the types of participants.

Only a limited number of studies have employed TAM to examine the adoption of different technologies in Kuwait (Almutairi, 2007; Rouibah, 2008; Rouibah, 2009; Rouibah et al., 2011). The findings of these studies suggest that TAM might be used to understand university students' acceptance of using new technologies such as SMS in their education. The current study was different from Almutairi's (2007) study. The current study took place in an institution of higher education rather than a governmental organisation and the use of SMS was optional rather than mandatory and the participants were university students rather than public employees. TAM studies have been subjected to criticism by some researchers. The following section will present some of these criticisms.

3.4 Limitations of TAM Studies

One of the main limitations of TAM is related to the type of data used to test the TAM model, as most studies investigating the usefulness of TAM have relied on self-reported data regarding the attitudes and adoption of technology collected through survey instruments (Chuttur, 2009). Self-reported data has been identified as a common source of method bias that "threatens the validity of the conclusions about the relationships between measures" (Podsakoff, MacKenzie, Lee & Podsakoff, 2003, p. 879). The data collected using a survey should be triangulated and validated through other means of data collection such as interviews. Since the triangulation of the results of the survey instrument with interviews would solve such an issue, the current study collected data regarding students' perceptions and attitudes through the use of a questionnaire instrument and interviews.

Another limitation of TAM studies is related to the generalisation of findings. Some research using TAM have examined the single use of one technology with a uniform group of participants in a cross-sectional study. Users' attitudes toward and perceptions of a particular piece of technology are functions of time; therefore, it is useful to examine attitudes and usage at more than one time (Lee et al., 2003). Therefore, the current research measured students' perceptions and attitudes toward SMS before and after its use as an educational tool during an academic semester.

In the current study, the original model of TAM (Davis, 1986) was used to study Kuwaiti students' attitudes toward the use of SMS technology to support learning and teaching. The research questions were formulated based on the original TAM (Davis, 1986). Since the study was pioneer research in the Kuwaiti higher educational setting, the researcher employed the original TAM to test the validity of the model in this unique setting. The original TAM has been validated in a large number of studies (Masrom, 2007), while the extended versions that have been used to examine the acceptance of SMS have not been validated as extensively. Based on the results of this study, it is possible to recommend further investigation of SMS technology adoption in Kuwaiti higher educational settings. The current research study examines attitudes, rather than actual use of SMS technology. Therefore, bias is still an issue but it is different in nature since expressing attitudes and perceptions is different than actual use.

The current study represents the first step in research in relation to the use of SMS as an education tool. Students' attitudes toward SMS use in learning are still unknown. The findings from this study might identify how the TAM can best be extended.

3.5 Conclusion

The aim of this study is to examine relations between students' perceptions of ease of use, usefulness and attitudes toward the use of SMS to support learning and teaching. To investigate this, the study examined students' perceptions of and attitudes to SMS before and after one semester of use in two university subjects. In this study, the original model of TAM (Davis, 1986) was used to study Kuwaiti students' attitudes toward the use of SMS technology to support learning and teaching. Potential users' attitudes toward the use of technology are important predictors of their intentions to use and their actual use of the technology. In addition, measuring students' attitudes toward the use of technology in education can help educators to plan for the use of such technology.

There have been a number of revisions of TAM and a number of other adoption models, beside the attempt to combine adoption theories in one model. However, the original TAM is still being used to examine the adoption of technology due to its simplicity, its wider use in a number of domains and its well-supported validity. In Kuwait, the current research study represents one of the first steps in research in relation to the use

of SMS as an education tool. Students' attitudes toward SMS use in learning are still unknown. The findings from this study might reveal how the TAM can best be extended.

The studies discussed in this review of the literature that used TAM to examine the acceptance of SMS showed that usefulness and ease of use were key factors for predicting users' acceptance of the use of SMS technology. Another common finding in the previous research is the stronger effect of usefulness on users' intention to use SMS compared to the effect of ease of use. This finding suggests the potential users' perceptions of the usefulness of SMS technology is more important than their perceptions of the SMS ease of use. The importance of the usefulness of SMS suggests that to improve students' attitudes toward technology, they should be aware of its usefulness.

In Kuwait, findings from the studies that used TAM have shown mixed results regarding the applicability of TAM in predicting the acceptance of different technologies in different settings. Since this research is a pioneer study in the Kuwaiti higher educational setting, the original TAM was employed to explain and to predict the use of SMS as an educational tool in this unique setting. The findings could inform practice in terms of understanding students' attitudes toward the use of SMS technology and the factors that influence their attitudes.

Propositions presented in this study will be able to provide higher education practitioners with insight into employing SMS technology as an educational medium.

Chapter 4: Methodology and Research Design

This chapter presents the methodology and research design used to explore students' perceptions and attitudes toward use of SMS to support teaching and learning. The current study followed a mixed methods approach in which data were collected using a quantitative method followed by interviews with some students. The focus of the study is the use of SMS technology in higher education. SMS technology is easy-to-use, cheap, popular among university students and readily available. Research has found that the use of SMS as an educational tool has some advantages which include, but are not limited to, allowing the students to study short and manageable amounts of educational content (Lu, 2008), improving their learning (Kert, 2011), taking advantage of fragments of time to learn educational content (Zhang et al., 2011), motivating students to study (Cavus & Ibrahim, 2009), allowing convenient access to educational content (Zhang et al., 2011), and regulating students' study through sending them educational content regularly and at scheduled times (Lu, 2008).

Margaryan et al. (2011) recommend that, in order to inform policy and practice regarding technology integration, higher education practitioners should examine what technologies students have access to and what their preferences are, as well as the educational values of these technologies. Therefore, in order to inform policy and practice regarding SMS integration in Kuwaiti higher education, this study was conducted to understand students' perceptions and attitudes toward the integration of such technology in their education. The aim of this study is to examine the relations between students' perceptions of ease of use, usefulness and attitudes toward the use of SMS to support learning and teaching. To investigate this, the study examined students' perceptions of and attitudes about SMS before and after one semester of use in two university subjects.

This chapter begins by describing the methodology used to explore the students' perceptions and attitudes toward use of SMS to support teaching and learning. The research design is then described, followed by a brief description of the site of the study. A description of the participants is presented, along with data collection procedure and instruments. Before presenting the ethical considerations, data analysis procedures were discussed. After that, the chapter concluded with a summary.

4.1 Methodology

The main driver in mixed methods research is the desire to obtain a “better understanding of a problem” (Creswell & Plano Clark, 2007; p. 5). The current study followed a mixed methods approach in which data were collected using quantitative pre-experimental procedures followed by interviews with some of the students. In the current study the questionnaire and interview approaches were given approximately equal weight. However, there was a greater emphasis on the quantitative analysis phase, in which interviews were used to explain and understand the quantitative results following a “sequential exploratory strategy” (Creswell, 2009).

The study investigated students’ perceptions and attitudes toward the use of SMS as an educational tool in higher education. People’s attitudes are complex and multidimensional, and they can be influenced by many factors (Triandis, Adamopoulos & Brinberg, 1984). Croninger and Valli (2009) argued that due to the complexity of attitudes and perceptions, they are best studied using a mixture of overlapping and related methodological approaches.

The underpinning philosophical assumptions of mixed methods research guide the methods of inquiry, data collection and analysis (Creswell & Plano Clark, 2007). As a paradigm, mixed methods research combines the epistemological and ontological philosophical assumptions (i.e., positivism and interpretivism) that underpin the qualitative versus quantitative debate (Creswell, 2011). Positivist research assumes that reality is “objective, tangible and single. Interest is focused on what is general, average and representative so that statistical generalization and prediction are possible” (Decrop, 1999, p.157). Questionnaires are one of most popular data collection methods in positivist social studies. Interpretivist approaches assume that “access to reality (given or socially constructed) is only through social constructions such as language, consciousness, shared meanings, and instruments” (Myers, 2013, p.39). Interviews have been one of most popular data collection methods of interpretivist studies.

However, a research design may include a mix of data collection from any and all relevant sources (Johnson, Onwuegbuzie & Turner, 2007). Data sources may come from both quantitative and qualitative approaches within single studies or even across several studies. Croninger and Valli (2009) further argued that a mixed methods design *should*

focus on the relationship between the quantitative and qualitative streams. They explained that “data might be used from one stream to expand, corroborate, or interrogate data from another stream or to stand alone as an independent investigation of a related phenomenon” (p. 543). Each approach has its own methodology and terminology. Ary, Jacobs, Sorensen and Razavieh (2010) explained this:

Quantitative research uses objective measurement to gather numeric data that are used to answer questions or test predetermined hypotheses. It generally requires a well-controlled setting. Qualitative research, in contrast, focuses on understanding social phenomena from the perspective of the human participants in natural settings. It does not begin with formal hypotheses, but it may result in hypotheses as the study unfolds (p. 22).

In mixed methods research, there are two options for the sequence of the quantitative and qualitative phases: concurrent or sequential (Creswell, 2009). In the concurrent approach, both forms of data, qualitative or quantitative, are collected at the same time during the study. In sequential approaches, there are two options for the sequences of the two phases. First, the study may begin with a qualitative phase followed by a quantitative phase. The qualitative phase has an exploratory purpose, while the quantitative method can check for the generalisation of results to a population. Second, the study begins with a quantitative method and following up with a qualitative method. The quantitative method would provide a measure of general points of view, while the qualitative method would involve detailed exploration with a few individuals.

The main benefits of a mixed methods design include triangulation and complementarity, both of which improve the study's validity and interpretability (Greene, Caracelli & Graham, 1989; Rocco, Bliss, Gallagher & Perez-Prado, 2003). Triangulation improves the study's validity through searching for convergence among different sources of information (Creswell & Miller, 2000). Complementarity improves a study's validity and interpretability through detecting overlapping and diverse facets of the investigated phenomenon, yielding deeper, detailed understandings of such phenomena (Greene et al., 1989). Hoppe-Graff and Lamm-Hanel (2006) argued that mixed-methods research is superior regardless of whether the goal of the research is nomothetic (i.e. it aims to generalise the results) or idiographic (i.e. it aims to obtain results which apply only to the

specific situation). They believed that mixed methods research can better meet generalisation and objectivity criteria for the results than research which only uses a qualitative or a quantitative approach.

The literature contains different examples of the use of mixed methods research. For example, Classen et al. (2007) combined quantitative data from national statistics and qualitative data from focus groups to examine older driver safety in the US. The two types of data showed similar results but from different points of view. Another example of mixed methods research, but with a different order in the qualitative and quantitative phases, is Tashiro's (2002) study that explored the health promoting lifestyle behaviours of college women in Japan. The study started with interviews. The interviews were analysed and the findings were used to develop a questionnaire. The questionnaire was used to determine if the findings from the qualitative phase could be generalised to a population.

In summary, students' perceptions and attitudes are multifaceted and multidimensional. This suggests that they should be studied by the use of a similar approach that has a mixture of overlapping methods: quantitative and qualitative. The above examples show the benefits of using mixed methods for understanding different points of view. The study consisted of two rounds of data collection. The first round took place before the SMS intervention and the second round after the SMS intervention. Each round included collecting data using a questionnaire and interviews.

In the quantitative component, questionnaires were used to measure students' perceptions and attitudes toward the use of SMS. Questionnaires were used to collect data about experiences that were not directly observable, such as attitudes and beliefs (Gall, Gall & Borg, 2003). Gall et al. (2003) summarised the advantages for using questionnaires to collect data: they can reach a large number of respondents with a low cost and less time in comparison with other data collection methods. However, they reported that a shortcoming of questionnaires is that they cannot probe deeply into respondents' beliefs and attitudes. Therefore, interviews were conducted to collect more in-depth information from some participants to better understand the questionnaire results and the results for the statistical analysis.

4.2 Research Design

The current study employed a mixed methods research design with a sequential procedure, including interviews before and after the SMS intervention, which had a one-group pre-test/post-test pre-experimental design (Leech & Onwuegbuzie, 2009). In sequential procedures, “the researcher seeks to elaborate on or expand the findings of one method with another method” (Creswell, 2009, p. 18). The research design involved two rounds of data collection. Each round included collecting data using a questionnaire and interviews.

Before the SMS intervention, a questionnaire was used to collect data regarding students' perceptions of and attitudes toward SMS. The SMS intervention involved sending short texts via mobile phones to the participants to serve educational purposes. Section 4.5 presents some examples of the educational content of the SMS messages sent. Full lists of the educational content and the frequency of the SMS messages sent for each class are presented in Appendices I and J.

These were followed up with semi-structured interviews with 12 students. After the use of SMS as an educational tool for one semester, round two of data collection took place. In the second round, questionnaires were completed and semi-structured interviews were conducted with the same 12 students. The aim of the second round of data collection was to explore students' perceptions and attitudes toward SMS after one semester of use (see Figure 4.1).

Group	Pre-test	Independent Variable	Post-test
E	Y1	X	Y2

*Figure 4.1.*Pre-Experimental Design (Ary et al., 2010; p.304)

In the first and second rounds of data collection, questionnaires were used to collect data regarding students' perceptions and attitudes toward the use of SMS as an educational tool. Questionnaire instruments are popular in studies which employ TAM to examine users' adoption of a technology (Davis, 1986). The TAM (Davis, 1986) argues that perceived usefulness and perceived ease of use factors can predict a user's attitude toward using a technology. The different components of TAM were measured through the use of questionnaires. In summary, a survey and one-group pre-test/post-test pre-experimental design that employed a mixed sequential procedure was used to examine students' perceptions and attitudes toward the use of SMS as an educational tool. The quantitative results provide a general measure of students' perceptions and attitudes toward SMS and their perceptions of SMS ease of use and usefulness and their attitudes toward the use of SMS as an educational tool.

In the first and second rounds of data collection, interviews were conducted to collect more in-depth information from some participants. There are three types of interviews: unstructured, semi-structured and structured (Ary et al., 2010). In this study, the researcher used semi-structured interviews. The questions were prepared prior to the interview; however, the interviewer adjusted them or asked more related questions during the interview process (Ary et al., 2010). The researcher used semi-structured interviews because of their flexibility and capacity to facilitate conversation between the interviewer and interviewee (Patton, 2000). The flexibility of semi-structured interviews is appropriate for gaining a deeper understanding of students' perceptions of and attitudes toward SMS. It would have been difficult to anticipate students' responses to questions regarding beliefs and perceptions about SMS in the interview design. The semi-structured interviews allowed for further questioning about new ideas and interesting comments as they arose during the interviews. This enabled the researcher to clarify students' responses. Therefore, the collected data is potentially more revealing about students' uses of and beliefs about SMS as an educational tool. Students' responses in the semi-structured interviews provided elaboration and justification of the perceptions and attitudes observed in the questionnaire responses.

4.3 Description of the Site of the Study

The study took place at Kuwait University which was the first public research university in Kuwait. It was established in 1966 (Kuwait University, 2015). The mission of the university is “To prepare a prominent human capital characterized by their exceptional knowledge, to meet the development requirements, to keep pace with the latest information and technology in higher education, and to lead in scientific research while upgrading in serving the community” (Kuwait University, 2015; p. 1). Kuwait University’s academic programs work on a semester calendar starting mid-September and finishing at the end of May. Each semester lasts about 15 to 17 weeks. The fall semester begins in the second week of September and lasts until the end of December. The spring semester commences at the end of January and lasts until the end of May. Kuwait University has 16 colleges (Kuwait University, 2015). The number of students enrolled at Kuwait University has reached 38648, while the number of employees is 3832 (Kuwait University, 2015).

4.4 Participants

Previous research studies have shown that SMS has been used as an educational tool in language and programming language classes (Lu, 2008; Kert, 2011). Therefore, the researcher decided to conduct this study in language and programming language classes in Kuwait. In order to select participants for the present study, the researcher identified several faculty members in the college of Computer Science and Engineering and the college of English language at Kuwait University through the university’s official website. The researcher contacted faculty members via email explaining the purpose of the study and asking them whether they would like to have their classes participate in the study. Five faculty members agreed to participate. Four of them were teaching the class of “Computer Programming for Engineers” offered at the college of engineering, while one of them was teaching a class in the “Advanced English Course” offered in the English language department. The language of instruction in the two classes was English. The researcher communicated with the faculty members via email and reviewed their course syllabuses to gain an understanding of their subjects and identify content that could be sent in short messages. The researcher met with the faculty members one week before the beginning of the semester in which the study took place, in order to further clarify the number of

registered students in each class and to finalise the inclusion of SMS technology in their classes. One week before the beginning of the semester, the questionnaire was pilot tested on 30 Kuwaiti university students who were not part of the study. The researcher met these students in the Kuwait university campus.

The student participants were university students from the two classes. The total number of students in the engineering class was 160, while the number of students in the English language class was 17. A large sample size of participants was required, as sample size affected the significance of the statistical tests that were performed on students' responses to the questionnaires (Ary et al., 2010). To ensure a large sample size all the students in the two classes were invited to participate and were given consent forms and paper-based information. In addition there was an in-class verbal presentation for the study (see Appendices A, B & C).

Students who agreed to participate in the study were asked to complete the questionnaire and to provide their phone numbers to receive educational mobile messages through the semester. A snowball sampling method was used to identify students for interviews. The last item in the questionnaire asked if participants were willing to participate in a follow-up interview. The researcher interviewed the students who agreed to meet for face-to-face interviews in the second week of the semester. Due to time constraints, the selection of the interview participants was based on their willingness to meet within the second week of the semester. Twelve students participated in the first round of interviews. The same 12 students were interviewed in the second round of interviews at the end of the semester. All the interview participants were from the engineering department.

4.5 Data Collection

The study took place in the first semester for the academic year of 2013–2014, which started on 9 September and lasted until 6 January. The study included two classes. Data were collected over two rounds, with each round including questionnaires and interviews. The questionnaires were completed in the class, while the tape-recorded interviews were conducted in an office at the university.

The researcher worked with coordinators of the selected classes to determine the content and the frequency of the SMS messages that were sent to the students. The first round of data collection took place within the first two weeks of the semester. Based on the instructors' opinions, one or two messages were sent each week. Examples of the SMS messages sent for each class are presented in Table 4.1. Full lists of educational content and the frequency of the sent SMS messages for each class are presented in Appendices I and J. To maintain confidentiality, initials were used to refer to the participating professors.

Table 4.1

Examples of the Educational Content of the Sent SMS for each Class

Course Name	SMS Examples
Computer Programming for Engineers	<ul style="list-style-type: none"> • If (a = 3) is ALWAYS true. The condition a = 3 is an assignment statement and assignments are always considered to be true. • Whereas: if (a == 3) is true ONLY if the value stored in "a" is the number 3. • The unary operator static cast <double> () creates a temporary floating point copy of its operand.
Advanced English Course	<ul style="list-style-type: none"> • The use of idioms in a presentation might create problems. Explain how/why • Determining the required steps, the duration of the presentation, and practising are key factors to the success of the demonstration presentation.

During the first week of instruction, the researcher and the instructor of each course verbally explained how SMS technology would be used in the subject, for those who agreed to participate. At the same meeting, the researcher distributed paper-format questionnaires to the students in the classes to explore students' perceptions and attitudes toward SMS and the use of SMS as an educational tool. In the second week, the researcher conducted interviews with 12 students. The researcher introduced the SMS interventions at the beginning of the second week of the semester till the end of the thirteenth week. The

KwtSMS online service was used to deliver bulk SMS to students. Such services allow SMS messages to be sent to predefined groups. In addition, the messages can be scheduled to be sent programmatically. KwtSMS was an easy-to-use service for sending messages reliably and instantly. In addition, it was cheaper than sending SMS through mobile phones. The students received SMS at around 2 pm on weekdays.

The second round of data collection took place in the thirteenth and fourteenth weeks of the semester after SMS had been used as an educational tool for twelve weeks. In the second lecture in the thirteenth week, the researcher distributed paper-format questionnaires to the students in the classes to collect data on their perceptions and attitudes about SMS, after they had used SMS as an educational tool. In the fourteenth week, the researcher conducted interviews with the same 12 students who had participated in the first interviews. The data collection procedure is presented Figure 4.1.

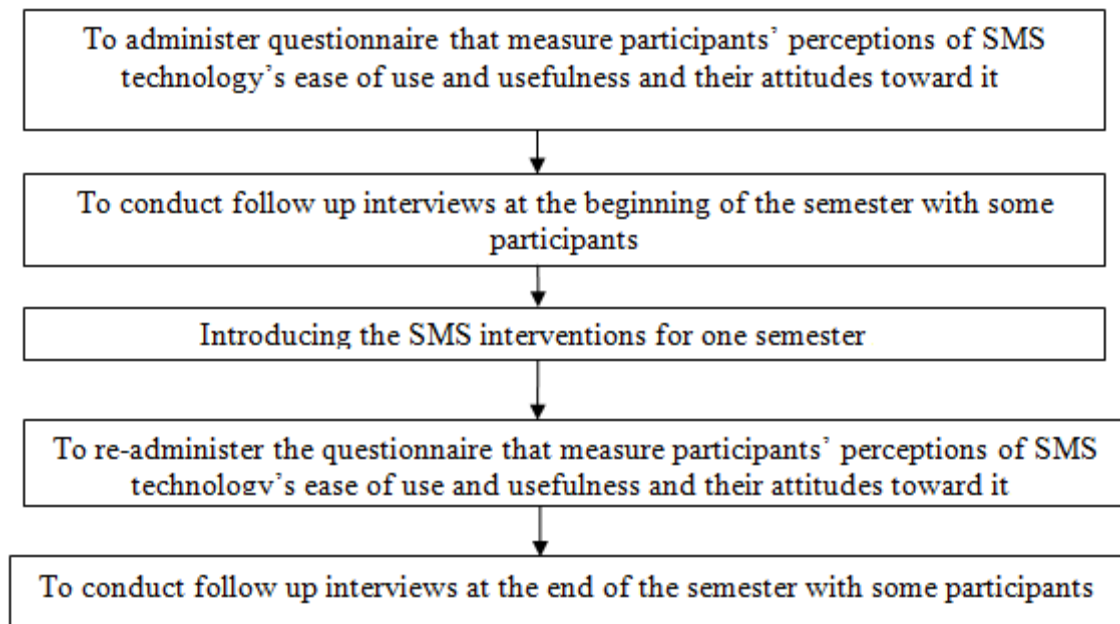


Figure 4.2. The Data Collection Procedure

4.5.1 Data Collection Methods

Two instruments were used to collect data in this study: questionnaires and interviews instruments. The questionnaire used in the first round of data collection comprised four parts. The first part collected demographic information about the

participants, such as age, gender, academic year, use of different ICT and use of SMS. The second section addressed students' perceptions about SMS ease of use and usefulness as a communication tool, and the third addressed perceptions of usefulness as an educational tool. The fourth section addressed attitudes toward using SMS to support teaching and learning. The second, third and fourth parts of the questionnaire used a seven-point Likert-type scale (see Appendix D). The questionnaire items were selected and developed based on different research studies. Examples of research studies that were used to develop questionnaire scales are as follows: ease of use and usefulness as a communication tool (e.g., Davis, 1986; Al-Failakawi, 2006; Lu, 2008; Zhang & Mao, 2008; Lominé & Buckingham, 2009; Balakrishnan & Loo, 2012), usefulness as an educational tool (e.g., Davis, 1986; Failakawi, 2006; Lu, 2008; Zhang & Mao, 2008; Lominé & Buckingham, 2009; Balakrishnan & Loo, 2012) and attitudes toward using SMS to support teaching and learning (e.g., Davis, 1986; Zhang & Mao, 2008; Lominé & Buckingham, 2009; Balakrishnan & Loo, 2012). Table 4.2 shows some examples of the items in the questionnaire instrument in the first round of data collection.

Table 4.2

Examples of the Items in the Questionnaire Instrument in the First Round of Data Collection

First scale: Demographic Data and Use of ICTs
Age, gender, academic year, ICT use, SMS use.
Second Scale: Perceptions of the Ease of Use and Usefulness of SMS Technology as a Communication Tool
<ul style="list-style-type: none"> • I think SMS is an easy way to communicate • Retrieving old received or sent messages on my phones is easy. • SMS is a useful way to communicate
Third scale: Students' Perceptions of the Usefulness of SMS Technology as an Educational Tool
<ul style="list-style-type: none"> • My learning would be more effective if I use SMS as an educational tool • My course performance would be improved if I use SMS as an educational tool.
Fourth scale: Students' Attitudes toward the Use of SMS as an Educational Tool
<ul style="list-style-type: none"> • I believe it would be a good idea to use SMS as an educational tool. • I think using the SMS technology as an educational tool would provide me with a lot of enjoyment.

The second questionnaire consisted of the same items as the last three parts of the first questionnaire (Appendix E). The three parts addressed students' perceptions of SMS ease of use and usefulness as a communication tool, perceptions of usefulness as an educational tool and attitudes toward their experiences of using SMS to support teaching. The students completed the second questionnaires after they had experiences with SMS in teaching and learning in one semester.

The questionnaires were translated into the students' native language (Arabic language) by the researcher. The Arabic language translation of this instrument was presented to 30 Arabic language native speakers, who were not part of the study, for revision purposes. The Arabic native speakers provided minor adjustments to the translated instrument, such as adjustments related to the Arabic grammar of some sentences. Their feedback was used to revise the instrument.

The questionnaires were then checked by three experts in the fields of instructional technology and curriculum and instruction. To maintain confidentiality, initials were used to refer to the reviewers (see Appendix H). The experts reviewed the questionnaire and provided feedback about the clarity and appropriateness of the items. To ensure validity and reliability of the questionnaire instrument, the researcher pilot tested the questionnaire on 30 Kuwaiti university students who were not part of the study. Cronbach's alpha for the three piloted scales were: SMS perceived ease of use and usefulness as a communication tool scale = .83, SMS perceived usefulness as an educational tool scale = .95 and attitudes toward the use of SMS as an educational tool scale = .88. Such values, that were greater than .8, indicated "good" measures (Aron, Aron & Coups, 2005).

The interview questions were designed and formulated by the researcher based on the theoretical framework and the literature review, and they were closely aligned with the questionnaire items. This was done to ensure that responses could be triangulated in analysis. The interviews were conducted by the researcher. In the first round of data collection, the interviews comprised three parts. The first part included questions related to students' perceptions of SMS ease of use and usefulness as a communication tool. The second part addressed questions related to the students' perceptions of the usefulness of SMS technology as an educational tool. The final part included questions related to participants' attitudes toward using SMS technology as a communication and educational

tool (see Appendix F). In the second round of data collection, the interviews, included the same three parts, but included additional questions regarding students' perceptions of SMS as an educational tool (see Appendix G), as the students in the second round of data collection had experience of using SMS as an educational tool for one semester.

The interview questions were translated into Arabic by the researcher. The Arabic version of the interviews was presented to the same 30 native Arabic speakers, who reviewed the questionnaire. The native Arabic speakers suggested minor adjustments to the questionnaire. Their feedback was used to revise the instrument.

The interview questions were checked by three experts in the fields of instructional technology and curriculum and instruction (see Appendix H). They reviewed the questions and provided feedback about their clarity and appropriateness. Their comments were used to make minor changes to the questions. The interviews were conducted in Arabic. They were approximately 30 minutes long and were audio recorded. All the students who agreed to participate in the interviews completed and returned the questionnaires in the first round of data collection. Ten out of the twelve participants completed and returned the questionnaires in the second round of data collection at the end of semester.

Table 4.3 presents examples of the questions in the interviews that were used in the first round of data collection.

Table 4.3

Examples of the Questions in the Interviews

<p>Perceptions of the Ease of Use of Usefulness of SMS Technology as a Communication Tool</p> <ul style="list-style-type: none"> • Do you find SMS easy or difficult to use? • What kinds of things do you find easy to do through SMS? • Do you find the SMS as a communication tool useful or not useful? <p>Students' Perceptions of the Usefulness of SMS Technology as an Educational Tool</p> <ul style="list-style-type: none"> • Do you think the use of SMS as an educational tool (e.g., to receive small bite of educational content such as Code Snippets) will be useful or not useful for your learning? Why? <p>Students' Attitudes</p> <ul style="list-style-type: none"> • What is something you like about SMS? • What do you like best and least about the use of SMS as an educational tool?

4.6 Data Analysis

Data analysis was conducted in four stages. Each data collection stage aligned to a stage of analysis. The first stage analysed results from the first questionnaire, while the second stage included the first round of interviews. The third and fourth stages comprised analysis of the second sets of questionnaire and interview data, respectively. Analysis of questionnaire data included descriptive analysis, comparison of means and inferential statistics. The findings were used to inform interview data, which was thematically and theoretically coded for analysis. Data were analysed using SPSS 16.0 and NVivo 7.0.

The first stage of data collection began with the generation of descriptive statistics for all questionnaire items. All negative items were reversed. To improve comparability, items addressing students' frequency of use of the internet for personal and educational purposes, as well as the frequency of sending and receiving SMS, were recoded (see Table 4.4).

Table 4.4

New Codes for Answers to Some Questions

Options	New code
Many times a day, 2-3 times a day,	Frequently
Once a day, 2-6 times a week,	Often
Once a week, 2-3 times a month	Rarely
Once a month Never	Never

Frequency distributions were then calculated for participants' demographic data, their use of ICT, use of mobile phones, and use of SMS technology. Descriptive statistics (e.g. frequencies, means and standard deviations) were used to answer Research Questions

1 and 2. Students' perceptions and attitudes toward SMS were examined for positive and negative trends and differences among different groups of students, (e.g. gender, age, ICT use). Independent sample t-tests were conducted to examine the differences in students' perceptions and attitudes toward the use of SMS based on their major (engineering or non-engineering), gender, use of smartphones for personal purposes, use of smartphones for educational purposes, use of laptop for personal purposes, and use of laptop for educational purposes. Analysis of variance (ANOVA) was conducted to examine variations in students' perceptions and attitudes toward the use of SMS based on: frequency of receiving SMS, frequency of sending SMS, academic year, frequency of using the internet for personal purposes, and frequency of using the internet for educational purposes. Fisher's Least Significant Difference (LSD) test was used as a post hoc pairwise comparison test to check for significant differences between the means (Williams & Abdi, 2010). The examination of such differences helped to build an understanding of students' perceptions and attitudes toward SMS. These results provided information on perceptions and attitudes toward SMS among different groups of students, which addresses Research Question 1 by addressing students' perceptions of the ease of use and usefulness of SMS. Further, Research Question 2 is also addressed by exploring students' attitudes towards the use of SMS to support learning and teaching

Correlation and regression analysis were used to answer Research Question 3. Based on Tabachnick and Fidell's (2006) suggestions, simple correlations were carried out (using Pearson product-moment correlation coefficient) to identify the size of relationships between the independent variables (ease of use and usefulness of SMS) and the dependent variable (attitudes toward SMS). According to Ary et al. (2010) correlation "seeks to determine if the variables are related (correlated). Correlation means the extent to which the two variables vary directly (positive correlation) or inversely (negative correlation)" (p.27). Regression analysis was used to assess the extent of the relationship between the dependent variable (attitudes toward SMS) and the independent variables (ease of use and usefulness of SMS), the percentage of discrepancy in the dependent variable predicted by regression, and the relative importance of the two independent variables in predicting the dependent variable. Before performing multiple regressions, assumptions of multicollinearity, normality, linearity and homoscedasticity of residuals were examined (Tabachnick &

Fidell, 2006). Multicollinearity refers to a situation where two or more independent variables are very highly correlated. The lack of multicollinearity was verified through the correlation factor of independent variables (ease of use and usefulness of SMS) and the variance inflation factors (VIF) for the independent variables, where “the rule of thumb states that multicollinearity exists if the VIF for any independent variable is greater than 10” (Webster, 2013, p. 134). The assumptions of normality, linearity and homoscedasticity between predicted dependent variable scores and errors of prediction were checked through the examination of the shape of the residual's scatter plot. If these assumptions were supported, this would justify the use of regression models for the purposes of prediction. In the results, the correlation tests and justified regressions analysis further addressed Research Questions 1 and 2 by exploring the relationship between students' attitudes toward using SMS and their perceptions of the usefulness and ease of use of SMS technology.

After the second round of data collection, students' responses to the second questionnaire were compared with students' responses to the first questionnaire. The paired t-tests for dependent samples were conducted to compare pre- and post-test scores of the same individuals (Ary et al., 2010). The comparison was used to determine whether students' perceptions and attitudes toward SMS had changed over the semester. However, studies of beliefs and perceptions suggest one semester might not be long enough to result in a significant change (Richardson, 2003).

Students' responses to the interviews in the first and second rounds of data collection were analysed using qualitative data analysis methods. The results of the qualitative data analysis contributed to answering the three research questions, as students' responses in the interviews helped to provide an understanding of, and explanations for, students' perceptions and attitudes toward SMS and how these perceptions and attitudes were related (Research Question #3).

The qualitative data were analysed through organising and familiarising, coding and reducing, and interpreting and representing (Ary et al., 2010). In the organising and familiarising stage, interviews were transcribed and translated into English. In the coding and reducing stage, students' responses were systematically grouped according to the research questions. After this essential grouping, following Ary et al.'s (2010)

recommendations, units of meaning that included words, phrases, sentences and subjects' ways of thinking inside each group were recognised and then tagged into initial codes. Then, related codes were combined and reduced into broader categories. After that, the relationships amongst categories were examined and then grouped into themes. To ensure validity, the analysis of the interview transcripts and the initial coding structures were checked by another graduate student in the field of education.

The TAM framework set the main factors which used to identify the codes and themes from the qualitative data. Examples of the initial codes in relation to SMS ease of use included: "clear", "easy", "required just a few clicks", "in smartphones that have large keyboards", "old phones", "difficult to type", "size of the keyboard", "communicate short message", "express feelings using SMS", "SMS cannot express feelings" and "Arabizi". These codes were selected because participants frequently reported them. They were grouped into two themes in relation to SMS ease of use: general positive perceptions of SMS ease of use and issues related to the use of SMS. In the interpreting and representing stage, data were reported using narratives; the narratives involved providing explanations of the findings and reflections on participants' responses in the first and second rounds of data collection. In addition, participants' quotes were used to demonstrate, illustrate and deepen the understanding of the qualitative findings (Corden & Sainsbury, 2006). The qualitative data were used to support and clarify the findings from the questionnaires.

4.7 Ethical issues

This research study considered the ethical issues involved in dealing with the participants. The ethical issues that were considered in designing this research study included explaining its purpose, informed consent, confidentiality, data access and ownership, and promises and reciprocity (Patton, 2003). In order to explain the purpose of this study to participants, the researcher provided them with an information sheet and consent form (see Appendices A and B). The information sheet clearly stated the purpose of the study, the benefits of the study for the participants and the estimated time for completing the questionnaires. The consent form explicitly stated that the participation in this study was voluntary, as the participants could choose to participate or not participate. This study followed the University of Wollongong's regulations regarding dealing with the

collected data. Interviews were conducted at the University during normal university time. The SMS was used only to send educational content. The expected discomfort for the participants was the time for the interviews.

The collected mobile numbers for the purpose of the research study were used exclusively to send educational content in the form of short text messages, as the phone numbers were not shared with anyone and they were used only for the purposes of the current study. For the purpose of confidentiality, the names of the participants in this study were not revealed under any circumstances. Based on Creswell's (2013) recommendation in relation to protecting the anonymity of individuals in interviews, pseudonyms were used to identify individual respondents. The participants were not promised any incentives to participate in the study.

4.8 Conclusions

The aim of this study was to examine relationships between students' perceptions of ease of use of SMS, usefulness of SMS and attitudes toward the use of SMS to support learning and teaching. The study employed a mixed methods research design, which included surveys and one-group pre-test/post-test pre-experimental methods in a mixed sequential procedure. Data were collected over two rounds, each of which included a questionnaire and interviews. The first round took place prior to the use of SMS as an educational tool and the second round took place after the use of SMS as an education tool for one semester.

The questionnaires were used to collect data about experiences that were not directly observable, such as attitudes and beliefs. Questionnaires can reach a large number of respondents with a low cost and less time in comparison with other data collocation methods. However they cannot deeply explore respondents' beliefs and attitudes. Therefore, interviews were conducted to collect more in-depth information from some participants. Findings from the interviews helped to explain students' perceptions and attitudes toward the use of SMS as an educational tool, the relationships among variables, and what the results of the statistical tests actually meant. Collecting data over two points of time, before and after the use of SMS as an educational tool, helped in understanding

students' experiences of using SMS and in identifying whether students' perceptions and attitudes toward SMS had changed over the semester.

Chapter 5: Results

The aim of this study is to examine relations between students' perceptions of ease of use, usefulness and attitudes toward the use of SMS to support learning and teaching. To do so, the study examined students' perceptions of and attitudes about SMS before and after one semester of use in two university subjects. This chapter starts with a summary of participants' characteristics and their use of ICTs. The second section presents descriptive statistics related to participants' perceptions and attitudes toward SMS as an educational tool. To understand the relationship between participants' characteristics and the components of TAM, the third section discusses the relationships between some of the students' characteristics and their perceptions and attitudes toward SMS. In order to check the validity of the TAM in explaining the results of the study, the fourth section examines the relationships between students' attitudes toward the use of SMS as an educational tool and their perceptions of the ease of use of SMS and its usefulness. To examine the effect of using SMS on students' perceptions and attitudes towards its use as an educational tool, the fifth section examines changes to students' perceptions and attitudes toward SMS after using SMS as an educational tool for one semester. The last section summarises students' responses to the interviews.

5.1 Participants' Characteristics and Use of ICTs

The collected data included participants' demographic characteristics, their use of ICTs, and their use of mobile phones and SMS.

5.1.1 Participants' demographic characteristics. The questionnaire instrument collected demographic data on the participants including their gender, age, major and academic year (Table 5.1).

Table 5.1

Descriptive Summary of Participants' Demographic data

	Category	Frequency	Per cent
Gender	Male	85	49.7
	Female	86	50.3
Age	18-20	7	4.1
	20-25	163	95.3
	26-30	1	.6
Major	Engineering	153	89.5
	Others	16	9.4
Academic year	1	3	1.8
	2	70	40.9
	3	80	46.8
	4	16	9.4
	5	1	.6

In the first round of data collection, 171 students completed the questionnaire. The number of participating male students was nearly equal to the number of female students. Most of the participants (95.3%; $n=163$) were between the ages of 20 and 25 and in the discipline of engineering (89.5%; $n=153$). Only 9.4% ($n=16$) were from other disciplines. The unequal distribution of the students' majors was due to the nature of the two classes in which the study took place. Out of the 171 participants, 154 participants were from a Computer Programming for Engineers class. The remaining of participants were from an Advanced English class. The Advanced English class was offered as an optional course for students from different academic disciplines. These two classes were selected based on faculty members' willingness to participate in the study. The non-engineering participants enabled useful comparisons to be made between engineering and non-engineering students in relation to their perceptions and attitudes toward the use of SMS as an educational tool

(see Section 5.3.1; for a summary of the specific majors of the participants, see Appendix K). The majority of participant (87.7%; $n=150$) were in their second or third academic year. The distribution of participants' academic years was a result of the two classes mainly being offered to students in the second and third years of their degrees.

5.1.2 Participants' use of ICTs for personal purposes. The questionnaire instrument collected data regarding participants' use of ICTs for personal purposes that included the use of the internet and different types of ICTs (Table 5.2).

Table 5.2

Descriptive Summary of Participants' Use of ICTs for Personal Purposes

	Category	Frequency	Per cent
Use of Internet for Personal Purposes	Frequently	157	91.8
	Often	9	5.3
	Rarely	4	2.3
	Never	1	.6
Types of ICTs Used for Personal Purposes	Smartphone	152	88.9
	Laptop computer	59	34.5
	mobile phone	21	12.3
	Memory stick	13	7.6
	MP3 player (iPod)	12	7
	Desktop computer	11	6.4
	Games console	11	6.4
	Digital camera	9	5.3
	Electronic organizer (PDA)	1	0.6

Almost all participants (99.4%, $n=170$) reported using the internet. The great majority of participants reported using the internet "often" or "frequently" (97.1%; $n=166$) compared to a small percentage of participants (2.9%; $n=4$) reporting that they "rarely" or "never" used it. Three of the five students who reported never or rarely using the internet were male. Three out of these five participants were in their third academic year and the

other two were in the second academic year. These five participants were between the ages of 20 and 25 and all of them were from engineering disciplines. These participants were typical university, undergraduate students, except they reported low use of the internet. This finding shows agreement with other studies that showed that Kuwaiti university students were frequent users of the internet. For example, in Kononova and Alhabash's (2012) study ($n=179$) found that 95% of their participants had wireless internet services in their houses and that they devoted large amounts of time ($M=14.13$; $SD=12.25$) to surfing the internet.

The results showed that, of the options presented in this questionnaire, the most popular ICT for personal use was the smartphone (88.9%, $n=152$), followed by laptop computers (34.5%, $n=59$). After these two, there was a significant decrease in the number of participants who reported using other ICTs. Among the 152 participants who reported using smartphones for personal purposes, approximately one-third (35.5%, $n=54$) also reported using a laptop computer. Conversely, among the 59 participants who reported using a laptop computer for personal purposes, the majority (91.5%, $n=54$) also reported using smartphones. The results suggested that most of the laptop users were also smartphone users but the opposite was not true: smartphone users were not necessarily laptop users. (For a full summary of participants' use of ICTs for personal purposes based on their use of smartphones and laptops (see Appendix L). In similar research that investigated Kuwaiti college students' use of technology, Kononova and Alhabash (2012) found regarding the students' weekly use of different media that they devoted an average of fifteen hours a week ($M=15.29$; $SD=13.19$) to using their phones. The popularity of smartphones among university students has been observed in other countries, such as Australia (Waycott et al., 2010) and the United States (Dahlstrom & Bichsel, 2014). In summary, most of the participants were internet users. The great majority of participants used the internet for personal purposes. Among different ICTs, the participants used their smartphones the most for personal purposes followed by laptop computers.

5.1.3 Participants' use of ICTs for educational purposes. The questionnaire instrument collected data regarding participants' use of ICTs for educational purposes that included the use of internet and different types of ICTs (Table 5.3).

Table 5.3

Descriptive Summary of Participants' Use of ICTs for Educational Purposes

Variables	Category	Frequency	Per cent
Use of Internet for Educational purposes	Frequently	101	59.1
	Often	45	26.3
	Rarely	23	13.5
	Never	2	1.2
Types of ICTs Used for Educational Purposes	Laptop computer	120	70.2
	Smartphone	105	61.4
	Desktop computer	13	7.6
	mobile phone	9	5.3
	Memory stick	5	2.9
	MP3 player (iPod)	3	1.8
	Digital camera	2	1.2
	Electronic organizer (PDA)	2	1.2
	Games console	1	0.6

The collected data showed that a high percentage of the students used the internet regularly for educational purposes. For instance, 85.4% ($n=146$) of participants reported using the internet “often” or “frequently”. Most participants reported using the internet frequently (91.8%; $n=157$) for personal purposes compared to a smaller percentage of participants (59.1%; $n=101$) reporting that they frequently used the internet for educational purposes. The high percentage of the students who reported frequent use of the internet for personal purposes might be explained through students’ heavy use of social networking sites (SNS) for social purposes. Hamade (2013) found that undergraduate students in Kuwait reported heavy use of Twitter and Facebook for social, political and cultural activities. He found that out of the 300 participants, more than three-quarters (75.6%; $n=227$) reported using their SNS accounts on a daily basis. Margaryan et al. (2011) found that despite the popularity of some technologies among students, they had limited skills and knowledge about how to use these technologies to support their learning.

The questionnaire responses showed the most popular ICTs used for educational purposes were laptop computers (70.2%, $n=120$) followed by smartphones (61.4%,

$n=105$). Other than laptops and smartphones, the other types of ICTs were not popular among participants. A suggested reason for the lack of popularity of these ICTs was the popularity of smartphones, as they contain applications that can be used to replace most other ICTs (Ai, Lu & Deogun, 2008). The hardware and applications available in smartphones can enable them to act like memory sticks, MP3 players, game consoles, digital cameras, electronic organisers and other devices. Smartphone applications can be downloaded through internet-based platforms.

Of the 105 participants who reported using smartphones for educational purposes, more than half (60%, $n=63$) reported also using laptops. Few participants who used smartphones for educational purposes reported using other ICTs. In addition, among the 120 participants who reported using laptops for educational purposes, just over half of them (52.5%, $n=63$) reported using smartphones. Few laptop users reported using other ICTs. For a summary of participants' use of ICTs for educational purposes, see Appendix M.

In summary, the majority of participants used the internet for educational purposes. More participants reported using the internet frequently for personal purposes than for educational purposes. Among different ICTs, the participants reported that the most popular ICTs for educational purposes were laptops followed by smartphones. After these two, there was a significant decrease in the number of participants who reported using other ICTs.

5.1.4 Participants' use of mobile phone. The questionnaire instrument collected data regarding participants' use of mobile phones that included ownership of a mobile phone, type of mobile phone owned and number of mobile phones owned (Table 5.4).

Table 5.4

Descriptive Summary of Participants' Use of Mobile Phone

		Frequency	Per cent
Own a mobile phone	Yes	170	99.4
	No	0	0
Type of mobile phone	iPhone 4/4s/5	89	52.0
	Samsung Galaxy10.1/ 2/3/4/S	83	48.5
	Blackberry z10/9900/9810/q10/	24	14.0
	HTC X/8X	3	1.75
	Sony Xperia	2	1.16
Number of mobile phone	1	96	56.1
	2	64	37.4
	3	8	4.7
	4	1	.6
	5	0	0
	More than 5	1	.6

The collected data regarding the ownership of mobile phones showed that all participants who answered the mobile phone ownership question (99.4%, $n=170$) owned a mobile phone. One participant did not provide a response to the question.

Most mobile phones were either iPhone or Samsung smartphones. A little more than one half of the participants (52.4%, $n=89$) reported owning iPhones. However, according to the national statistics, the most popular mobile device in Kuwait is the Samsung followed by iPhone (State Counter Website, 2014).

Slightly less than half of the participants (43.9%, $n=74$) owned two or more mobile phones. This finding aligned with the national statistics on mobile subscription rates, which show the number of mobile lines per 100 inhabitants in Kuwait in 2010 was 160.8 % (CITC, 2010; ITU, 2012). The Kuwaiti mobile subscription rate was higher than: the world average of 76%, the developing country average of 73% and the developed country average of 116% (CITC, 2010; ITU, 2012).

In summary, all the participants owned a mobile phone and almost half owned two phones. Most of the mobile phones were smartphones. The most popular brands of smartphones were Samsung and iPhone. Such findings reflect the popularity of smartphones among Kuwaiti students.

5.1.5 Participants' use of SMS. Data regarding participants' use of SMS technology, the age at point of first use, the frequency of receiving SMS, the frequency of sending SMS and purpose of using SMS were collected (Table 5.5).

Table 5.5

Descriptive Summary of Participants' Use of SMS

		Frequency	Per cent
Use of SMS	Yes	167	97.7
	No	4	2.3
Age of Starting Using SMS	8-11	21	12.3
	12-15	114	66.7
	16-18	30	17.5
Frequency of receiving SMS	Frequently	105	61.4
	Often	34	19.9
	Rarely	17	9.9
	Never	15	8.8
Frequency of Sending SMS	Frequently	67	39.2
	Often	35	20.5
	Rarely	34	19.9
	Never	35	20.5
Purpose of using SMS	To chat with family and friends	83	48.5
	To send and receive greetings	76	44.4
	Banking	62	36.2
	Advertising	28	16.4
	To vote in TV and Radio programs	9	5.2
	Others		
	• Emergency	10	5.8
	• Internet failure	6	3.5
	• To contact people without smartphone	6	3.5
		2	1.2
	• To receive university ads	2	1.2
	• To exchange personal information		

The majority of participants (97.7%, $n=167$) reported using SMS. Many (66.7%, $n=114$) started using SMS between the ages of 12 and 15. Male students tended to start using SMS earlier than female students. Of the 21 students who started using SMS between the ages of 8 and 11, fourteen (67%) were males and seven (33%) were females. Of the 30 students who started using SMS between the ages of 16 and 18, only 4 (13%) were males and 26 (87%) were females. However, there was little difference in the numbers of male and female students who started using the SMS between ages of 12 years and 15 years: 50 (44%) were female and 64 (56%) were male. Six participants did not provide responses regarding the age they started using SMS, and four of these students were among the ones who reported that they did not use SMS. The results indicated that most participants had at least five years of experience using SMS.

The majority of participants (81.3%; $n=139$) reported that they “often” or “frequently” received SMS and (59.7%; $n=102$) reported that they “often” or “frequently” sent SMS. The results suggest that participants received SMS messages more than they sent them. The purposes for using SMS varied among participants. Of the options presented in this questionnaire, the most common use was to chat with family and friends (48.5%, $n=83$) followed by sending and receiving greetings (44.4%, $n=76$). In addition, a decent percentage of participants (36.2%, $n=62$) reported using SMS for banking. A small percentage of students reported using SMS to receive commercial advertisements (16.4%, $n=28$) and to vote in TV and radio programs (5.2%, $n=9$). Participants also reported using SMS for other reasons such as emergencies when it is not possible to make a phone call, in response to internet failure and to contact people without smartphones. Two students reported using SMS to receive university advertisements and to exchange personal information.

In summary, most participants reported using SMS. Participants started to use SMS at different ages, with the majority starting to use SMS between the ages of 12 and 15. Just under two-thirds of participants received SMS frequently and more than one-third sent SMS frequently. The most reported uses were to chat with family and friends, to send and receive greetings and for banking. The findings suggest that the participants were familiar with the use of SMS, and that most participants had a few years of experience using SMS. The popularity of SMS among participants might suggest the potential applications of SMS

in student learning. The application of SMS in education is supported by Lominé and Buckingham's (2009) suggestion that there is a possible advantage of educational SMS because there is no need for familiarisation or training in its use, and the high levels of familiarity suggest this is an ICT that could be easily implemented in higher education. The following section presents descriptive statistics of participants' perceptions and attitudes toward SMS as an educational tool

5.2 Participants' Perceptions of and Attitudes toward SMS

Students' perceptions of and attitudes toward SMS were measured using three scales: perceptions of the ease of use and usefulness of SMS as a communication tool, perceptions of the usefulness of SMS as an educational tool, and attitudes toward the use of SMS as an educational tool. These three scales were developed based on TAM (Davis, 1986). Before discussing students' responses to the questionnaire, the reliability of the questionnaire instruments was checked.

Before determining the Cronbach's alpha coefficients, the scoring of all negatively stated statements was reversed. Cronbach's alpha coefficients were computed for data from the pilot study and from the two rounds of the study. Table 5.6 shows the results of the reliability analysis. The values of Cronbach's Alpha are greater than .8, indicating "good" internal consistency of the items in the scales (Aron et al., 2005). Based on the high value of the Cronbach's alpha coefficients in the pilot study, no changes were made on the questionnaire instruments in the actual study.

Table 5.6

Summary of Reliability Analysis

Scale	Number of scale items	Cronbach's Alpha		
		Pilot (N = 30)	Study, round one (N = 171)	Study, round two (N =132)
SMS perceived ease of use and usefulness as a communication tool scale	8	.83	.89	.89
SMS perceived usefulness as an educational tool scale	6	.95	.95	.95
Attitudes toward SMS scale	5	.88	.91	.91

The following sub-sections present the descriptive analysis of students' answers to the questionnaire instrument that were collected at the beginning of the semester in the first round of data collection. Students indicated their perceptions and attitudes toward SMS based on their expectations of the use of SMS as an educational tool rather than their actual experience since the data collection took place in the first week of the semester, and at that time the students had not received any educational mobile messages.

5.2.1 Perceived ease of SMS use and usefulness as a communication tool. The results regarding participants' perceptions of SMS ease of use and usefulness suggest that the participants had positive perceptions of the SMS ease of use and usefulness as a communication tool. Participants' perceptions of the ease of use and usefulness of SMS as a communication tool are discussed first (see Table 5.7).

Table 5.7

Descriptive Statistics of Participants' Responses to SMS Perceived Ease of Use and Usefulness as a communication tool Scale. (N = 171)

	SMS perceived ease of use and usefulness as a communication tool scale	<i>M</i>	<i>SD</i>
1	I think SMS is an easy way to communicate	5.39	1.76
2	Retrieving old received or sent messages on my phones is easy.	4.83	1.77
3	I think interaction with SMS is clear and understandable.	5.30	1.64
4	*It took me a long time to learn how to send and receive SMS.	5.94	1.64
5	Overall, I think SMS is easy-to-use.	5.91	1.62
6	I think SMS is an effective communication tool.	5.41	1.69
7	My communication is improved with the use of SMS.	5.02	1.78
8	SMS is a useful way to communicate.	5.43	1.67
	Overall	5.40	1.28

Note. 1 = 'Strongly Disagree', 2 = 'Moderately Disagree', 3 = 'Slightly Disagree', 4 = 'Neutral', 5 = 'Slightly Agree', 6 = 'Moderately Agree', 7 = 'Strongly Agree'

* *Negatively phrased statement.*

The participants' perceptions of the ease of use and usefulness of SMS as a communication tool were between "slightly agree" and "moderately agree" ($M = 5.40$, $SD = 1.28$). After reversing the scores for the negatively phrased statements, participants were found to have responded most positively to the negatively phrased item 4: "It took me a long time to learn how to send and receive SMS." ($M=5.94$, $SD=1.64$). Students' experiences of using SMS support this result, which pointed out that students perceive SMS is easy-to-use. Most participants reported using SMS to send and receive information and most of the students had at least five years of experience in using SMS. However, students did not totally agree that all the tasks of SMS are easy to perform: they responded least positively to item 2 "Retrieving old received or sent messages on my phones is easy." ($M=4.38$, $SD = 1.77$). Students' previous experience of using SMS made them see it as a useful communication tool.

5.2.2 SMS perceived usefulness as an educational tool. The results suggest that the participants had positive perceptions of the use of SMS as an educational tool. These results are presented in Table 5.8.

Table 5.8

Descriptive Statistics of Participants' Responses to SMS Perceived Usefulness as an educational tool Scale. (N = 171)

SMS perceived usefulness as an educational tool scale		<i>M</i>	<i>SD</i>
1	My learning would be more effective if I use SMS as an educational tool	4.25	1.76
2	My course performance would be improved if I use SMS as an educational tool.	4.32	1.58
3	I think using the SMS as an educational tool would increase my productivity in my coursework.	4.32	1.65
4	I could accomplish tasks more quickly, if I use SMS as an educational tool.	4.41	1.71
5	I would do better in my course if I use SMS as an educational tool.	4.43	1.64
6	Overall, I think using SMS as an educational tool would be useful.	4.63	1.85
	Overall	4.39	1.52

Note. 1 = 'Strongly Disagree', 2 = 'Moderately Disagree', 3 = 'Slightly Disagree', 4 = 'Neutral', 5 = 'Slightly Agree', 6 = 'Moderately Agree', 7 = 'Strongly Agree'

The participants' perceptions of the usefulness of SMS as an educational tool were between "neutral" and "slightly agree" ($M = 4.39$, $SD = 1.52$). Participants responded most positively to item 6, "Overall, I think using SMS as an educational tool would be useful." ($M=4.63$, $SD=1.85$) and least positively to item 1, "My learning would be more effective if I used SMS as an educational tool" ($M=4.25$, $SD=1.76$). The participants had positive expectations regarding the use of SMS as an educational tool, and expressed such perceptions before receiving any educational content via SMS. Data collection took place in the first week of the semester. At that time the students had not received any educational SMS.

5.2.3 Attitudes toward SMS as an educational tool. The results suggest that the students had positive attitudes toward the use of SMS as an educational tool. Participants' attitudes toward the use of SMS to support learning and teaching are presented in Table 5.9.

Table 5.9

Descriptive Statistics of Participants' Responses to the Attitudes toward the Use of SMS to Support Learning and Teaching Scale (N = 171)

Attitudes scale		<i>M</i>	<i>SD</i>
1	I believe it would be a good idea to use SMS as an educational tool.	4.72	1.73
	I think using the SMS technology as an educational tool would provide	4.48	1.72
2	me with a lot of enjoyment.		
3	*Using the SMS as an educational tool is not a good idea.	4.55	1.83
4	If it was made available, I would use SMS to receive educational content	4.78	1.71
5	Overall, I would like to use SMS as an educational tool.	4.75	1.86
	Overall	4.66	1.51

Note. 1 = 'Strongly Disagree', 2 = 'Moderately Disagree', 3 = 'Slightly Disagree', 4 = 'Neutral', 5 = 'Slightly Agree', 6 = 'Moderately Agree', 7 = 'Strongly Agree'

* *Negatively phrased statement.*

Participants' attitudes toward the use of SMS to support learning and teaching were between "neutral" and "slightly positive" ($M = 4.66$, $SD = 1.51$). Participants responded most positively to item 4, "If it was made available, I would use SMS to receive educational content" ($M=4.78$, $SD=1.71$) and least positively to item 2, "I think using the SMS technology as an educational tool would provide me with a lot of enjoyment" ($M=4.48$, $SD=1.72$). The findings suggest that students had slightly positive responses to the use of SMS as an educational tool but they had close to neutral perceptions about their enjoyment of using SMS as an educational tool. The participants formed their attitudes toward the use of SMS as an educational tool based on their expectations, since the students expressed such perceptions before receiving any educational content via SMS. Students' positive attitudes suggested that they would accept the use of SMS as an educational tool.

Students' responses to the first questionnaire showed that they perceived SMS as an easy-to-use and useful communication tool. Such findings aligned with students' reported

experiences of using SMS. The previous sections have shown that most students had used SMS to exchange information. The reported age of the participants and the reported age of starting to use SMS indicated that most participants had at least five years of experience in using SMS. Students were familiar with the use of SMS. The findings suggest that students' familiarity with SMS made them perceive it as an easy-to-use and useful communication tool. Users are expected to perceive a technology as easier to use if they have direct experience in using it (Hackbarth, Grover & Mun, 2003). The students had positive feeling regarding the idea of using SMS as an educational tool and they had positive but low perceptions and attitudes toward the use of SMS as an educational tool. The findings suggested that the students would accept the use of SMS as an educational tool. The institutions of higher education should take advantage of such acceptance by using SMS to support teaching and learning. The next section discusses the relationship between some of the students' characteristics and their perceptions and attitudes toward SMS.

5.3 Students' Characteristics and their Perceptions and Attitudes toward SMS

The relationships between students' perceptions of SMS ease of use, usefulness and attitudes, and some of their demographic characteristics and ICT use variables were examined through t-tests and analysis of variance (ANOVA) tests. Demographic characteristics and ICT use variables included gender, major, academic year, frequency of using the internet for personal purposes, frequency of using the internet for educational purposes, frequency of receiving SMS, the use of smartphones and the use of laptop computers. The results showed there were no differences in participants' perceptions and attitudes based on their gender, academic year, frequency of using the internet for personal purposes, frequency of using the internet for educational purposes, the use of smartphones and the use of laptop computers (see Appendix N). There were significant differences between the students' means for their perceptions and attitudes toward SMS based on their majors and frequency of receiving SMS. Details of such significant differences are discussed in the following sections.

5.3.1 Major and students' perceptions of and attitudes toward SMS. Students' responses to the SMS ease of use, usefulness and attitudes scales were compared, based on major through t-tests (Table 5.10).

Table 5.10

Results of t-tests and Descriptive Statistics SMS Ease of Use, Usefulness and Attitudes by Major

Outcome	Group						<i>t</i>	<i>df</i>	<i>p</i>	<i>r</i>
	Other			Engineering						
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>				
Ease of use	4.19	2.28	16	5.58	.98	153	-4.57*	167	.00	.35
Usefulness	3.46	2.15	16	4.53	1.38	153	-2.77*	167	.006	.28
Attitudes	3.75	2.50	16	4.78	1.32	153	-2.69*	167	.008	.25

* $p < .05$

The results showed significant variations between engineering and non-engineering students in their perceptions of SMS ease of use, usefulness and attitudes. Engineering major students perceived SMS as easier to use than did non-engineering students. The engineering majors believed that SMS was a potentially more useful educational tool than did non-engineering students.

Overall, the engineering major students had more positive attitudes toward SMS than non-engineering students. These findings are aligned with Margaryan et al.'s (2011) study, which found that that engineering students used more technology tools than non-engineering students. They suggested that this was because engineering courses required more concentrated and broad access to technology than non-engineering courses such as social work. Students with positive attitudes toward a technology tend to adopt such technology (TAM, 1986). The findings suggest that educational SMS would be more acceptable to engineering students than to other students.

5.3.2 Receiving SMS and perceptions and attitudes toward SMS. Students' responses to the frequency of receiving SMS were grouped into four categories: frequently, often, rarely and never. A one-way ANOVA was used to compare students' responses to

SMS ease of use, usefulness and attitudes scales differences based on their frequency of receiving SMS (Table 5.11).

Table 5.11

One-Way ANOVA- students' responses to the SMS ease of use, usefulness and attitudes scales for frequency of receiving SMS as a communication tool

Outcome	<i>df</i>	<i>F</i>	<i>p</i>	η^2
SMS Ease of Use and Usefulness as a communication tool	3	4.73	.003	.078
SMS Usefulness as an educational tool	3	2.91	.04	.05
Attitudes toward SMS as an educational tool	3	2.10	.10	.036

Note. 1 = 'Frequently', 2 = 'Often', 3 = 'Rarely', 4 = 'Never'.

The results showed that students' perceptions of SMS ease of use and usefulness as a communication tool, as well as their perceptions of its usefulness as an educational tool, differed based on their frequency of receiving SMS. But students' attitudes to SMS did not differ based on their frequency of receiving SMS. Post hoc pairwise comparison showed differences between the means of students' responses to SMS ease of use and usefulness as a communication tool were found between three pairs of groups: the students who frequently received SMS and the students who never received SMS, the students who often received SMS and the students who never received SMS, and the students who rarely received SMS and the students who never received SMS. Participants who frequently received SMS ($M = 5.63$, $SD = 1.26$) perceived SMS as easier to use and more useful as a communication tool compared to the students who never received SMS ($M = 4.40$, $SD = 1.75$; $p < .05$). Participants who often received SMS ($M = 5.22$, $SD = 1.12$) perceived SMS as easier to use and more useful as a communication tool than students who never received

SMS ($M = 4.40$, $SD = 1.75$; $p < .05$). Participants who rarely received SMS ($M = 5.27$, $SD = .81$) perceived SMS as easier to use and more useful as a communication tool than students who never received SMS ($M = 4.40$, $SD = 1.75$; $p < .05$).

Using the LSD test, the post hoc pairwise comparison showed that the only significant difference between the means of students' responses to the usefulness of SMS as an educational tool was found between the students who frequently received SMS and the students who never received SMS. Participants who frequently received SMS perceived SMS as more useful as an educational tool ($M = 4.59$, $SD = 1.55$), than the students who never received SMS ($M = 3.58$, $SD = 1.60$; $p < .05$).

The current study was designed for students receiving educational SMS rather than sending them. The results of ANOVA showed that only students' perceptions of SMS ease of use and usefulness as an educational tool differed in relation to frequency of sending SMS (see Appendix N). The findings support the previous suggestions that students' experiences of using SMS contributed to making them perceive it as an easy-to-use and useful communication tool. The results regarding the significant relationship between frequency of receiving SMS and perceptions of the use of SMS as an educational tool suggest that the participants who frequently received SMS would perceive it as an easy-to-use tool and would have positive perceptions of its use as an educational tool compared to other participants who reported little experience with receiving SMS. Most of the participants reported that they received SMS either frequently or often. Such use of SMS would positively influence students' perceptions of SMS ease of use and usefulness as a communication tool and as an educational tool.

In summary, students' perceptions and attitudes toward SMS differed based on their majors. Engineering students had more positive perceptions and attitudes toward the use of SMS as an educational tool than non-engineering students. Students' perceptions of SMS differed based on their frequency of receiving SMS. Participants who frequently received SMS perceived it as an easy-to-use and useful communication tool and they had positive perceptions of its use as an educational tool compared to participants who reported little experience with receiving SMS. The findings suggest that the use of SMS as an educational tool would be more acceptable among engineering students than non-engineering students. In addition, students' experiences of receiving SMS were likely to positively influence their

perceptions of SMS ease of use and usefulness as a communication tool and as an educational tool. In order to check the validity of the TAM in explaining the results of the study, the following section examines the relationships between students' attitudes toward the use of SMS as an educational and their perceptions of SMS ease of use and usefulness.

5.4. Relationships among Students' Attitudes toward the Use of SMS and their Perceptions of the SMS

The previous findings showed that students' perceptions and attitudes toward SMS were related to their major and frequency of receiving. The TAM (Davis, 1986) argues that perceived usefulness and perceived ease of use factors can predict a user's attitude toward using a technology. To examine the relationship between participants' attitudes toward the use of SMS technology to support learning and teaching and their perceptions of SMS ease of use and usefulness, Pearson's product moment correlation coefficient and regression analysis were used.

Before performing multiple regressions, there are some assumptions that need to be considered. These assumptions include absence of multicollinearity as well as normality, linearity and homoscedasticity of residuals (Tabachnick & Fidell, 2006). The assumption of a lack of multicollinearity was verified through examining the correlation factor between the two independent variables and the variance inflation factors (VIF) for the independent variables. The two independent variables were students' perceived usefulness of SMS as an educational tool and perceived ease of use of SMS and the dependent variable was students' attitude toward using SMS technology. The significant positive relationship between ease of use variable and usefulness variable ($r=.50, p<.05$), suggest violation of the lack of multicollinearity assumption. Further examination of the multicollinearity assumption was conducted using VIF for the independent variable, where "the rule of thumb states that multicollinearity exists if the VIF for any independent variable is greater than 10" (Webster, 2013, p. 134). The VIF for the two independent variables, ease of use and usefulness was 1.32; therefore the assumption for lack of multicollinearity was not violated.

The assumptions of normality, linearity and homoscedasticity between predicted dependent variables scores and errors of prediction were checked thorough the examination

of the shape of the residuals scatter plot (Tabachnick & Fidell, 2006). A scatter plot (see Appendix O) shows a random spread out of the majority of the points across the horizontal x-axis. In addition, scores are concentrated along the horizontal centre in a random variation with no obvious systematic pattern of points occurred. These results suggest no serious concerns regarding the violation of the assumptions of normality and linearity. The shape of residuals is approximately equivalent in width at all values of the predicted dependent variable, demonstrating no concern regarding homoscedasticity assumption (Tabachnick & Fidell, 2006).

The correlation test was carried out to investigate the strength of relationships among the variables, SMS ease of use, perceptions of the usefulness of SMS and attitudes toward SMS. The results of the correlation test are presented in Table 5.12.

Table 5.12

Bivariate Correlations among Perceptions of SMS Ease of Use, Perceptions of the Usefulness of SMS and Attitudes toward SMS

	Attitude	Ease of use
Attitude	1	.
Ease of use	.51*	1
Usefulness	.86*	.50*

* $p < .05$

The correlation test showed that there were significant relationships among the three variables. The results showed that the students' perceptions of the usefulness of SMS as an educational tool were strongly correlated with their attitudes toward the use of SMS as an educational tool, $r = .86$, $p < .05$. Regression analysis was conducted to investigate the strength of the relationships between students' attitudes and their perceptions of SMS ease of use and usefulness (Table 5.13).

Table 5.13

Multiple Regression on Dependent Variable (Attitude toward SMS)

	B	SE B	Beta
(Constant)	.42	.26	
Ease of use	.13	.05	.11
Usefulness	.81	.04	.81

Note. $R^2=.75$ ($p<.05$)

The results of the regression analysis indicated the two predictors, students' perceptions of SMS ease of use and students' perceptions of the usefulness of SMS explained 75% of the attitude variance ($R=.867$, $F(2,168)=254.66$, $p<.05$). The size of standardised coefficients (Beta) provides information regarding which of the independent variables has a greater effect on the dependent variable. In the current study, the value of standardised coefficients indicates that students' perceptions of the usefulness of SMS as an educational tool made a larger contribution to predicting students' attitudes toward the use of SMS ($\beta = .81$, $p<.05$) than students' perceptions of SMS ease of use ($\beta = .11$, $p<.05$). The results were expected since the two scales, students' perceptions of the usefulness of SMS and attitudes toward the use of SMS, measure perceptions of and attitudes toward SMS as an educational tool. The third scale measured students' perceptions of SMS ease of use as a communication tool rather than as an educational tool. The results aligned with TAM's (Davis, 1986) assumptions that argue that perceived usefulness and perceived ease of use factors can predict a user's attitude toward using a technology.

In summary, students' attitudes toward the use of SMS as an educational tool strongly correlated with their perceptions of SMS ease of use, as well as their perceptions of the usefulness of SMS as an educational tool. In addition, it was found that students' perceptions of SMS ease of use and students' perceptions of the usefulness of SMS significantly predicted their attitudes toward the use of SMS as an educational tool. The students' perceptions of the usefulness of SMS as an educational tool made a larger contribution to predicting students' attitudes toward the use of SMS than students' perceptions of SMS ease of use. Therefore, the results suggest that in order to effectively improve students' attitudes toward the use of SMS as an educational tool, they should be

aware of the benefits that educational SMS would offer. To examine the effect of using SMS on students' perceptions and attitudes toward the use of SMS as an educational tool, the following section examines changes to students' perceptions and attitudes toward SMS after using SMS as an educational tool for one semester.

5.5. Comparison of Students' Perceptions of and Attitudes toward SMS after Using SMS as an educational tool for One Semester

The changes in students' perceptions of and attitudes toward SMS were examined through the three scales: students' perceptions of the ease of use and usefulness of SMS as a communication tool, students' perceptions of the usefulness of SMS as an educational tool and students' attitudes toward the use of SMS as an educational tool. The use of SMS as an educational tool lasted for twelve weeks. One or two messages were sent a week for each student in the experiment. In the second round of data collection, 132 students completed the questionnaire.

In order to compare the students' perceptions and attitudes toward the use of SMS before and after using SMS as an educational tool for one semester, a paired sample t-test was performed on students' responses to the three scales: the SMS ease of use and usefulness communication tool scale, the usefulness of SMS as an educational tool scale, and the attitudes toward SMS scale before and after using the SMS as an educational tool for one semester.

Regarding the SMS ease of use and usefulness communication tool scale, the results indicated that there were no significant changes between students' responses to most of the scale items (see Appendix P). However, there was significant change in students' beliefs that "Retrieving old received or sent messages on my phones was easy", $t(131) = -2.2$, $p < .05$ (Table 5.14).

Table 5.14

Results of Paired t-tests for Significance Differences of Participants' Perceptions of SMS Ease of Use before and after Using SMS as an educational tool

Outcome	Pre-test		Post-test		95% CI for	t	df
	M	SD	M	SD	Mean Difference		
Retrieving old received or sent messages on my phones was easy.	4.81	1.79	5.25	1.65	-.82,-.05	-2.2*	131

* $p < .05$.

The results suggest students found it easy to retrieve old SMS on their phone at the end of the semester. Regarding the usefulness of SMS as an educational tool scale, the results showed that there were no significant changes in students' responses to most of the scale items (see Appendix P). However, there was significant change in students' belief that "They did better in their course because they used SMS as an educational tool", $t(131) = 2.11$, $p = .03$ (Table 5.15). The students had overly optimistic perceptions of SMS before its use as an educational tool. The students had positive perceptions of the effect of SMS on their learning performance when they learnt about how it would be used as an educational tool. However, after its use for one semester, such perceptions were lower than what they had expected.

Table 5.15

Results of Paired t-tests for Significance Differences of Participants' Perceptions of the Usefulness of SMS before and after Using SMS as an educational tool

Outcome	Pre-test		Post-test		95% CI for		df
	M	SD	M	SD	Mean Difference	t	
I did better in my course because I used SMS as an educational tool.	4.51	1.65	4.14	1.70	.02, .70	2.11*	131

* $p < .05$.

Regarding the attitudes toward SMS scale, the results showed that there were no significant changes in their attitudes toward the use of SMS as an educational tool (see Appendix P). Participants' attitudes continued to be between "neutral" and "slightly positive".

In summary, there were no significant changes in the overall perceptions of SMS ease of use and usefulness as a communication tool, perceptions of the usefulness of SMS as an educational tool and attitudes toward the use of SMS after the use of SMS as an educational tool for one semester. However, students believed that retrieving old received or sent messages on their phones was easier after the use of SMS as an educational tool for one semester. The students might have acquired more knowledge and skills related to finding old SMS in their phones during the use of SMS as an educational tool for one semester. The use of SMS during the semester made some students locate old received educational SMS for reviewing their courses. The use of SMS as an educational tool for one semester made the students gain more experience with using SMS.

However, students' beliefs about the effect of using SMS on their academic performances were less positive after its use for one semester. A suggested explanation for such a significant change is that the use of SMS was limited to one or two messages a week, and such a limited number of messages might not have affected students' performances as much as they expected. In addition, the students might have had overly optimistic perceptions of SMS before its use as an educational tool.

Students' acceptance of SMS as an education tool continued after its use for one semester. The results suggest that one semester of using SMS as an educational tool was not enough time to change students' overall perceptions and attitudes toward SMS. Therefore, to better understand students' reactions to the use of SMS as an education tool, SMS should be used for a longer period of time.

5.6. Findings from Interviews

Twelve students participated in the interviews. The interview sample comprised an equal number of males and females and between the ages of 18 and 30. All the interview participants were from engineering departments. Six were in their third school year, five in their second school year and one student was in their fourth year. The interview sample reported being internet, smartphone and SMS users. In regard to frequency of SMS use, responses are presented in Table 5.16.

Table 5.16

Interview Participants' Frequency of SMS Use

<i>n</i> of 12 participants	Frequency receiving SMS	<i>n</i> of 12 participants	Frequency sending SMS
8	Frequently	4	Frequently
0	Often	1	Often
2	Rarely	3	Rarely
2	Never	4	Never

Note. Frequently = 1-2, Often = 3-4, Rarely = 5-6, Never = 7-8

The majority of interview participants used SMS frequently. The mean frequency for sending SMS for the questionnaire sample was between rarely and often ($M = 2.2$, $SD = 1.17$) and the mean frequency for receiving was between often and frequent ($M = 1.6$, $SD = .96$). The mean frequency for sending SMS for the interview sample was between rarely and often ($M = 2.4$, $SD = 1.3$) and for receiving SMS the mean frequency was between often and frequent ($M = 1.8$, $SD = 1.3$). While the interview sample may have demonstrated less frequency, the distribution of sending and receiving SMS among the interview participants was a good representation of different SMS users. This suggests that the combined participant perceptions and beliefs about SMS would cover a range of views.

Indeed, the interview results indicate that they had different perceptions and attitudes toward SMS and its use. This difference was primarily related to perceptions of usefulness and attitudes towards the use of SMS as an educational tool. This and other trends in the sample are explored in the next chapter.

The following sections present students' responses regarding perceptions of and attitudes toward SMS. Specifically, topics address SMS perceived ease of use, SMS perceived usefulness as a communication tool, SMS perceived usefulness as an educational tool, attitudes towards the use of SMS as a communication tool and attitudes towards the use of SMS as an educational tool. Perceived ease of use was defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). Perceived usefulness was defined as "the degree to which a user believes that using the system will enhance his or her job performance" (Davis, 1989, p. 320). Attitude was defined as a "person's general favourableness or unfavourableness toward some stimulus object" (Fishbein & Ajzen, 1975, p. 216).

5.6.1 Findings from the first round of interviews. The first round of interviews took place in the second week of instruction, and the educational SMS began to be sent from the second week of instruction. While all students had experience in using SMS for communication at that time, participants' beliefs regarding the usefulness of SMS as an educational tool were based on little to no experience of actually using SMS in an educational setting. In the second week of semester, some participants had received only one educational message, and others received only two educational messages.

5.6.1.1 Participants' perceptions of SMS ease of use. Results from the whole sample showed that the participants perceived SMS as easy-to-use ($M = 5.40$, $SD = 1.28$), however there were varying perceptions of specific types of communication and content. First, typical perceptions about general use of SMS were:

It was easy-to-use. It was clear. – Abd

It was easier than the other means of communication. – Amon

It was very easy-to-use. Everything with SMS was easy-to-use. Its use required just few clicks. – Horea

It was easy, there is nothing difficult related to the use of SMS. – Asmhan

These views of SMS were expected, as most of the participants either sent or received SMS regularly. Questionnaire results showed that the participants had at least five years of experience using SMS. The findings suggest that students' familiarity with SMS would lead to perceptions that it was easy-to-use as a communication tool. Users are likely to perceive a technology as easier to use when they have direct experience in using such technology (Hackbarthet al., 2003). Participants' majors may contribute to their perceptions of SMS ease of use. All participants were engineering students. Their major required them to deal with different types of ICTs such as computers and internet applications (Margaryan et al., 2011).

Participants believed that SMS was easy-to-use because it required simple steps to send or receive messages. The use of SMS did not require user names and passwords like other internet-based communication tools. Participants reported owning smartphones. They felt that using SMS on smartphones was easier than on regular mobile phones. For instance:

iPhone that relies on touch made the use of SMS easier. – Bshra

I have two phones "iPhone" and another one "Nokia"... I'm very fast on typing on them. – Mo

In smartphones that have large keyboards the use of SMS became very easy. – Masri

Participants perceived SMS as an easy-to-use communication tool. Participants' regular use of SMS and their major would explain their perceptions of SMS ease of use. Furthermore, the participants believed that the use of SMS required simple steps compared to other communication tools.

While they felt SMS was easy-to-use, some participants reported problems that limited the effectiveness of SMS use. These most commonly related to specific communication-related issues of typing text using old mobile phones or new mobile phones and the limited number of characters that can be sent in one SMS. However, these also affected issues related to interpreting message content such as understanding the received SMS, use of SMS for long conversations and understanding the feelings of the sender of the SMS.

The first communication-specific issue was related to typing text. Masri believed that in some types of old phones typing SMS was difficult because the limited number of keyboard buttons that require users to press the same button more than once to print one letter. Masri explained:

At the beginning of the use the old phones were a little difficult to type text, if you want to type the third character on a certain button you have to press on it three times in a row.

In addition, some participants complained about the difficulty of speed typing on a new phone. Mo stated:

I had some difficulty if I changed phones. I might find a difference in the size of the keyboard which causes difficulties in typing.

However, the technological developments in mobile phones have resolved such issues. For instance, typing SMS over touch-screen smartphones is easier than typing SMS over regular mobile phones (Kim & Sundar, 2014). Abd stated, "It was easy-to-use and there are no difficulties in using SMS because the use of phones is becoming clear and understandable."

The second group of communication issues were related to the limited number of characters that can be sent in one SMS. The participants reported difficulties related to understanding a message received by SMS in such a short format. Specifically, using SMS for long conversations and expressing and understanding feelings via SMS:

For example, you may ask someone about himself then he would reply typing 'good' while he could say 'good, thank god' so the way he replied could be more understandable. – Tamer

Sometimes a person sent you couple of words that you could not understand.
– Faiez

The brevity of SMS sometimes made it difficult to understand messages. Tamer reported that sometimes there was a need to call people to understand what they meant in the message they sent. Tamer believed understanding received SMS depends on the relationship between the sender and the receiver. He reported that when two people understood each other in face-to-face communication, then they have a greater chance of understanding each other using SMS. Furthermore, some participants believed that the

brevity of SMS made it suitable for short conversations rather than long ones and made it difficult to express and to understand the feelings of the user in the content of an SMS:

Its [SMS] job is to communicate short message rather than initiating chat for hours. – Alian

It was hard to express feelings using SMS, so you cannot know whether the writer of the message was feeling angry or not. – Amon

SMS cannot express feelings and might be understood in wrong and unintended ways. – Bshra

You cannot understand the feelings of the SMS sender. – Abd

Current developments in chat technologies as well as the availability of internet access in cell phones made some students compare the use of SMS with the existing chat technologies. For instance, the existing mobile messaging applications (such as WhatsApp) do not limit the number of characters in one message. In addition, these chat messages allow users to send emoticons as pictorial representations of facial expressions that would allow the receiver to understand the intentions and feelings of the sender (Shafie, Osma & Darus 2011). Smartphones also allow users to send and receive emoticons and that helps in expressing and understanding feelings via SMS.

A final specific content-related issue was the use of Arabizi in SMS and the associated difficulties interpreting the received SMS. It is common for Arab people to text each other using Arabic but with English letters (Farrag, 2012). However, since the number of English letters does not match the number of Arabic ones, the SMS user uses English Arabic numerals to substitute Arabic letters. Such use of English letters and Arabic numerals to express Arabic words is known as Arabizi (Yaghan, 2008). Therefore, SMS users have to be familiar with the meanings of the Arabic numerals to understand SMS. Difficulties related to the use of Arabizi in SMS were categorised as content-related issues. Amon reported that she had difficulty using SMS because of the use of Arabizi.

While there were a number of limitations to SMS use these did not have a significant effect on students' overall perceptions of SMS ease of use, and all the participants had overall strong positive perceptions of SMS ease of use. The findings suggest that the use of SMS as an educational tool has an advantage in that it does not need familiarisation and training. Therefore, the results begin to suggest that in regard to ease of

implementation of SMS, students' high levels of familiarity would make it easy to implement in higher education, as long as the specific issues of communication were taken into account. Based on students' perceptions, the educational content of SMS should be short and fit in one message without the need to interpret emotions. The content-related issues suggest that the common Arabizi alphabet should not be used in educational SMS. These issues are unpacked in more depth in the following chapter.

5.6.1.2 Participants' perceptions of the usefulness of SMS as a communication tool. Results from the whole sample showed that almost all the participants (97.7%, $n=167$) reported using SMS. About two-thirds of the participants (66.7%, $n=114$) started using SMS between the ages of 12 and 15. All the participants believed that SMS was a useful communication tool. The participants' positive perceptions of the usefulness of SMS as a communication tool were strongly related to their positive experiences of using SMS, where the reported reasons for their positive perceptions were related to their actual use of SMS as a communication tool. The reasons underpinning positive perceptions of the usefulness of SMS as a communication tool were related to SMS supported or enhanced communication of content. Positive perceptions included: low cost communication, always easily available, convenient messaging for the sender and receiver, quiet and private messages, straight to the point information and one-to-many messages.

The first reason for the positive perceptions of SMS as a communication tool was the low cost. Participants believed that the affordability of SMS resulted in communicating more:

It was useful when I did not have credit to call so I used SMS since it was cheaper. – Aya

If I did not have enough money to make a phone call, I could use SMS instead of calling or I could send an SMS to someone telling him to call me. – Abd

According to participants, low cost resulted in more communication. They were more likely to send a message because they were not limited by cost. Other studies in different countries have shown that SMS was perceived as a cheap communication tool (Mante & Piris, 2002; Song & Fox, 2005; Leung, 2007; Kim, Park & Oh, 2008; Balakrishnan & Loo,

2012). This is of particular importance in a developing country, where economic conditions are a limiting factor of technology use.

In regard to SMS itself, participants reported that SMS was a useful communication tool because it was available all the time. SMS was believed to be useful when there was a weak internet connection or no connection, or when they could not make a phone call:

SMS service was available in the absence of the Wi-Fi internet or the 3G on phone ... sometimes I travel without internet so I use SMS to communicate with people. – Alian

I found SMS very important when the communication signal was weak so I could not make a voice call. – Asmhan

Participants felt SMS was a way one could communicate, even with weak network and internet signals. Therefore, compared to other mobile messaging applications, SMS is considered to be a more available and reliable technology for mobile communication (Church & de Oliveira, 2013). One reason for always being available was that SMS does not require the internet to operate. Students particularly valued the convenience of communication using SMS, where the receiver could open the SMS message at anytime, anywhere. Unlike phone calls, the phone user can postpone opening the received SMS. The convenience of using SMS was found to be one of the main advantages of using SMS technology among university students (Leung, 2007). This was specifically seen as a useful way to communicate important information that needed a response from the receiver, but not necessarily immediately:

I used SMS for important information, so the other person would pay attention to it and would read and reply through a call or another SMS. – Faiez

I think SMS is useful to communicate very important information. – Tamer
When I receive an SMS I can open it at any time that is convenient for me. – Amon

Using SMS guarantees that the information that I want to send would be received. – Asmhan

SMS information can be received and saved on a phone regardless of whether the receiver accepts the SMS or not. This information can then be easily accessed when needed. Lan and Sie (2010) reported that SMS was useful for instant information delivery such as

notifying or reminding students of some time-sensitive matters. However, participants believed SMS was not useful when the sender was in an emergency. In addition, Bshra believed that in the case of emergencies, it was more useful to use phone calls rather than SMS. Tamer believed that SMS was less efficient in emergencies because the receiver needed extra time to read and understand the message.

The participants also appreciated the privacy and the quietness of communication through SMS. They identified the silence of communication as an important feature:

When I wanted to know where my friend was and I was afraid she would be in a lecture, I found it was easier to send her a short message to avoid embarrassing her with her teacher. – Bshra

When someone calls me while I am in a meeting I answer him through SMS. In smartphones, there are automatic SMS replies like “I will call you later” that can be sent in few steps. – Masri

These comments suggest that being able to contact someone quickly without disturbing others is important. The usefulness of silent and quiet communication has been identified in research studies that have examined students' motives for using SMS (Balakrishnan & Loo, 2012).

Participants also identified positive perceptions about the shortness of messages. They felt this helped communication to be straight to the point and reduced time and effort in communication:

It [SMS] would reduce the time and effort in communication; it made the communication straight to the point. – Horea

SMS is useful for communicating certain types of information such as a question about the location of place or to exchange greetings ... Its job is to communicate short messages rather than initiating chat for hours. –

Alian

These comments show that students valued the time saved through short and concise messages. This also suggests that a conversation may be too much effort and not always needed in some cases. Tahat et al. (2014) also found that most university students perceived SMS as a useful communication tool in terms of saving their effort and time in communication. A specific way that students found SMS useful in saving time was the

sending of messages to large groups. Some of the participants believed this provided a very useful way of communication in terms of coordinating events and sending greetings to large groups of people:

I found SMS very useful if you wanted to invite people to a specific occasion. – Bshra

In holidays, if I wanted to send greeting cards, my phone had 450 names listed in the contacts list. That means I could not call them all so I replaced that by sending greeting cards to them through SMS using the option “Send to Many” which exist in my phone. – Mo

This comment suggests usefulness was perceived in relation to communicating with one person directly and to a large number of individuals simultaneously. University students' positive perceptions of the usefulness of SMS for coordinating social events and for sending greetings were consistent with findings in other studies (Leung, 2007; Tahat et al., 2014).

The participants reported several beliefs related to their positive perceptions of the usefulness of SMS as a communication tool. These perceptions illustrate how participants believed SMS supported or enhanced the communication of content through being a low cost form of communication, always being easily available, being a convenient form of messaging for the sender and receiver, enabling quiet and private communication, providing straight to the point information, and enabling the dissemination of one-to-many messages. However, limitations were discussed in relation to the usefulness of SMS in emergencies. Overall, the findings suggest that the interview participants had strong positive perceptions of the usefulness of SMS as a communication tool. Positive perceptions towards the usefulness and ease of use of SMS contribute in forming students' attitudes toward the use of SMS as a communication tool.

5.6.1.3 Participants' attitudes toward the use of SMS as a communication tool.

All interview participants said that they liked the use of SMS as a communication tool. Some participants ascribed their favourable attitudes toward the use of SMS as a communication tool to their positive experiences of using SMS for different purposes:

I used SMS to receive religious quotes and to contact friends. – Horea

[I used SMS] for receiving commercial advertisements. – Aya
 I used it [SMS] ... to receive information from my bank ... Sometimes I received SMS advertisements that did not relate to me such as advertisements for hair salons; I really did see it as unnecessary. It was annoying. I did not like it. – Faiez

Further, Mo, Masri, Noorhan and Tamer reported that they liked SMS because they could use it for keeping in touch with relatives. The results illustrate that students had positive attitudes towards toward the use of SMS because of their positive experiences of using SMS for social and information purposes. Examples of social uses of SMS included contacting family and friends, while examples of receiving information uses of SMS included commercial advertisements, religious quotes and banking information.

In addition to their positive experiences of using SMS, participants ascribed their favourable attitudes toward the use of SMS as a communication tool to their positive perceptions of SMS ease of use:

I liked SMS because it was easy-to-use. – Bshra
 It was easy to deal with. – Amon

In addition to SMS ease of use, participants reported that they liked SMS because it was useful in different ways:

SMS can be read at any time, not necessarily at the time you receive it. – Amon
 I used it to invite people for specific occasions. – Bshra
 I like it for silent communication ... I use SMS with my sister so she does not need to call me in front of other students. – Masri

The advantages of SMS in terms of convenient messaging for the sender and receiver, quiet and private messages, and one-to-many messages were mentioned as reasons underpinning students' positive perceptions of the usefulness of SMS as a communication tool. These comments suggest students' attitudes towards the use of SMS as a communication tool are closely associated with their perceptions of the usefulness of SMS as a communication tool. The findings regarding the strong association between students' perceptions of SMS ease of use and usefulness as a communication tool and their attitudes toward its use as a communication tool aligned with TAM's (Davis, 1986) assumptions that perceived

usefulness and perceived ease of use factors can predict a user's attitude toward using a technology.

However, the issues regarding the use of SMS as a communication tool, previously discussed, also related to some less positive attitudes. For instance, in terms of the limited number of characters that can be sent in one SMS, some participants felt this made it difficult to express feelings and intentions. Others did not like spending a long time using SMS to communicate, which relates to the perception that SMS was not useful for long conversations. Noorhan stated, "It might waste my time." However, the findings suggest that the students' positive attitudes toward the use of SMS as a communication tool might have positively influenced their attitudes toward the use of SMS for different purposes. This suggests that students are likely to feel favourably towards using SMS as a communication tool for certain types of university communication.

5.6.1.4 Participants' perceptions of the usefulness of SMS as an educational tool.

The previous sections show that overall, the students had positive perceptions and attitudes toward the use of SMS as a communication tool. The participants believed that SMS was easy-to-use, and useful for communication, and they liked to use it. Perceptions of SMS ease of use as a communication tool were reflected in perceptions of use as an educational tool, where the use of SMS as an educational tool did not differ from perceptions of its use as a communication tool. This would be expected as the actual uses of SMS, such as opening and sending messages, would be the same. Perceptions were largely based on students already knowing how to open received SMS regardless of its content. Therefore, the following section discusses participants' perceptions of the usefulness of SMS as an educational tool.

In the first set of interviews, students were asked to respond to questions based on their expectations of the usefulness of SMS as an educational tool. This approach was taken because students had not previously used SMS in their learning. While all students had experience using SMS for communication at that time, participants' beliefs regarding the usefulness of SMS as an educational tool were based on little to no experience of actually using SMS in an educational setting. The first round of interviews took place in the second week of instruction, when the educational mobile messages started to be sent. At this time,

some participants had received only one educational message, and others had received two educational messages. In the following discussion, interviewed students were divided into two groups depending on their perceptions of the usefulness of SMS as an educational tool. Ten students reported that SMS would be useful as an educational tool, while two participants had different opinions.

Students with positive perceptions explicitly expressed their perceptions of the usefulness of SMS as an educational tool. Examples of these statements are as follows:

SMS would very helpful to my study. – Asmhan

It would be useful; I think it would be a good way to help students. – Alian

Yes, [educational SMS would be] very helpful. – Horea

For sure, it [educational SMS] would be useful. – Abd

I think it would be useful. – Faiez

Different reasons were reported for participants' positive perceptions of SMS as an educational tool. They have been grouped into three categories: i) access to educational content; ii) implications for learning experience, such as allowing the students to utilise their short periods of free time, reminding and motivating the students to study, improving their connections to the class and instructor and regulating their study; and iii) information type and learning, such as allowing the students to receive key points of the lectures.

The participants believed that receiving educational content via SMS would allow convenient access to educational content:

I had my phone with me at all times, it means if I forgot one of the pieces of information that had been sent to me, I could simply click on my phone and look into inbox and read it. – Amon

The phone was always at hand and I could read the messages whenever I wanted. – Masri

In regard to usefulness as a communication tool, the convenience involved was highlighted by participants. The participants reflected the same belief in relation to receiving educational SMS. They felt this would allow them to access educational content at any time and anywhere. Students also believed that it was easy to access received SMS. Other studies examining the use of SMS as an educational tool have indicated the expediency of

using SMS in terms of allowing the students to easily access educational information anywhere and at any time via their phones (Lu, 2008; Lominé & Buckingham, 2009).

The second sets of reasons for students' positive perceptions of the usefulness of SMS as an educational tool were related implications for learning experience. They specifically identified that SMS would allow them to use their short periods of free time, reminding and motivating them to study, improving their connection to the class and instructor and regulating their study. In regard to utilising their free time, participants stated:

It would be possible to be sitting with my friends when I receive educational SMS so I can save it until the time for study comes and I can read it. I think educational SMS would enable a useful investment of time.

– Horea

I would exploit my free time with reading and studying it. – Faiez

According to participants, receiving short educational SMS would be likely to help them take advantage of short periods of free time, particularly to review course content. Similar studies have shown that students who received educational SMS devoted their small fragments of time to reading messages (Zhang et al., 2011). Besides allowing the students to take advantage of free time to review educational content, participants believed that educational SMS would motivate them to study:

It [educational SMS] would encourage me to study and it would remind me to study... it would make me wait for the expected information. – Asmhan

It might motivate me to look for more information. It would remind me about information. – Mo

These comments suggest that educational SMS might motivate the students to study in different ways. Educational SMS messages would remind them to study. They would expect educational messages, and would make them look for more information related to the content of the messages. They believed this would have a role in regulating their academic study time. Asmhan explained, "It encouraged me to study all the time and it made me wait for the information that was coming. SMS would regulate my study." The role of SMS in encouraging and motivating the students to study has been reported in similar studies (Zhang et al., 2011). Sending SMS regularly and at specific times would

help students organise their study time for their classes. The findings regarding the role of SMS in regulating students' study are aligned with the findings from similar research studies (Goh et al., 2012).

Participants believed the use of SMS as an educational tool would enhance students' connections to the class and enhance communication with the teacher of the class:

It would make the students more connected with their courses. – Alian

It would be very important for enhancing communication between the teacher and his students. – Amon

These comments suggest that educational SMS would encourage students to think about the class content outside the lectures. In addition, educational SMS would improve communication and social relationships between students and their instructors. The findings regarding the role of SMS in improving students' relationships to their classes and instructors align with findings from similar studies (Lim, Fadzil & Mansor, 2011).

The third category for students' positive perceptions about the usefulness of SMS as an educational tool is related to information type. For example SMS messages enable students to receive the key points of their lectures. Students believed SMS would be a convenient way to receive important course information. They attributed this usefulness to the brevity of SMS. Alian stated, "The content of SMS would be very important as it has to deal with critical information in the class, the key points." In a similar study, students said that SMS would be useful for providing important educational content (Lim et al., 2011).

The findings from the interviews showed that students' reasons for their positive perceptions of SMS as an educational tool were strongly related to the reasons for their positive perceptions of the usefulness of SMS as a communication tool. For instance, students' perceptions that SMS provided convenient and quiet communication made them believe that educational SMS would allow convenient access to information. In addition, students' positive perceptions of the usefulness of SMS for communicating important and straight to the point information made them believe that educational SMS would allow them to receive the key points of their lectures. Students' experiences of using SMS were related to their positive perceptions of SMS as an educational tool. For instance, students' use of SMS for social purposes like connecting with family and friends made them believe

that educational SMS would be useful for keeping them connected with their classes and instructors.

However, Bshra and Noorhan explicitly stated that they would not find SMS useful as an educational tool. In addition, participants did have some concerns regarding its usefulness as an educational tool. These issues can be grouped into two categories: i) information type and learning (e.g. sending complicated information needing comprehension rather than memorisation, sending administrative information and sending quizzes and use as an assistant tool rather than an educational delivery tool); and ii) aspects of sending educational SMS (e.g. inappropriate time and frequency of messages and phrasing SMS in a way that would gain students' attention).

On the first issue, participants believed SMS would be useful to send simple educational content related to memorisation rather than comprehension. For instance, Noorhan stated, "it [SMS] would be good to send educational materials that need to be memorised rather than comprehended". The belief here was that more complex 'comprehension' information would need face-to-face support. Such perceptions might originate from the perceived deficiencies of SMS in sending detailed messages due to the limited number of characters than can be sent in one SMS. Many of the participants believed that SMS could be more appropriately used to deliver administrative information or quizzes related to the class:

It would be useful if it is used to remind the students about something like the date of the exam ... or the material that would be included in the exam.

– Tamer

If it is used as a reminder for the exam date or due dates for the homework,

I think I would accept it. – Bshra

If the instructor sent a quiz through then that would encourage me to study.

–Asmhan

The above comments suggest that students would accept the use of SMS to communicate time-sensitive administrative information or educational content in the form of short questions – information that is easily understood and not complex. Other studies have shown that SMS would be accepted by university students as a means of communicating administrative information (Thornton & Houser, 2004; Naismith, 2007). In addition, SMS

has some application for sending quizzes in higher education (Shahreza, 2006; Abu Ziden & Abdul Rahman, 2013). Some other participants believed that SMS should act as a complementary educational tool rather than a primary educational tool. Amon stated, "I would not like the use of SMS as the main way to deliver information. I would like it as a tool to help students". The brevity of SMS and the lack of face-to-face support might have made the students believe that SMS would not be suitable as the main tool to deliver educational content.

Participants also highlighted the potential problems of the timing and frequency of educational SMS:

It is possible that the timing of the messages may not be appropriate – for example when students are sleeping. – Aya

If I received a message every hour of the twenty-four hours in the day then SMS would be boring and I would ignore the messages that I received. –

Horea

The comments suggest that students' lack of experience in SMS as an educational tool made them express concerns related to receiving educational SMS at inappropriate times and receiving too many educational mobile messages. These issues may relate to beliefs about the convenience of SMS and concerns that one may spend too much time on SMS.

In addition, one participant pointed to the issue of phrasing the educational content. They believed that the educational content should be phrased in a way that would attract students' attention. Horea commented on this:

I would like the information to be sent in a way that would attract attention to avoid boring the reader. For example, sending a word and its meaning would be boring and rigid but asking "Do you remember the meaning of this word?" would be more interesting.

This comment suggests that it would be advisable to use attention-getting introductory phrases in educational SMS. The interview findings suggest there is an association between students' perceptions of SMS ease of use and their perceptions of the usefulness of SMS as an educational tool. For instance, the reported difficulties of using SMS due to the limited number of characters that can be sent in one SMS made the students believe that SMS is useful for sending simple educational content that depends on memorisation rather than

comprehension, short administrative information, or short quizzes. In addition, limitations related to long conversations and comprehension of messages may be due to students' beliefs that SMS would be useful as a supporting educational tool rather than as the main way to deliver educational content. Such findings align with the questionnaire results that students' perceptions of the usefulness of SMS as an educational tool correlated with their perceptions of SMS ease of use.

At the time of the first interviews, the participants did not have experience in using SMS as an educational tool. Students' expected reasons for the usefulness of SMS and issues related to SMS use as an educational tool. These reasons and issues regarding the use of SMS as an educational tool would inform ways of using SMS as an educational tool, and they have implications for the use of SMS in students' learning.

5.6.1.5 Participants' attitudes toward the use of SMS as an educational tool. The previous sections have demonstrated that the majority of interview participants had largely positive perceptions of the use of SMS as an educational tool. This section discusses participants' attitudes towards the use of SMS to support their education. Ten students reported positive attitudes toward the use of SMS as an educational tool, while two had more negative attitudes.

Students with positive attitudes toward the use of SMS as an educational tool explicitly expressed their attitudes. Typical attitudes about the use of SMS as an educational were:

Yes, I would like the use of SMS as an educational tool. – Asmhan

Of course I would like it [educational SMS]. – Horea

Yes, sure I would accept it [educational SMS]. – Abd

I would like using SMS as an educational tool ... I would look forward for it. – Faiez

Participants attributed their positive attitude toward SMS to their positive perceptions of the usefulness of SMS as an educational tool. For instance, some participants reported that they liked the idea of using SMS as an educational tool because it would allow them easy and convenient access to educational information through their phone:

The phone is an important thing in everyone's life so the best thing to do is to send the information through it. – Amon

I would like it and accept it, I really have a good feeling regarding receiving educational SMS ... The messages remain saved on my phone so I can receive and review them at any time, I think there is a great benefit in it. I could use the SMS to review the course. – Mo

The comments suggest that participants liked receiving SMS via their phones since their mobile phones are always available. Therefore, they believed educational SMS would also be very accessible and convenient. Participants liked the idea of using SMS as an education tool because they believed it would allow them to take advantage of short periods of spare time to review the educational content. They liked the idea that this might encourage and motivate them to study:

I like the fact that I could use SMS to take advantage of my spare time. – Faiez

I like it and I am the first one who would encourage using SMS as an educational tool ... I could take advantage of my spare time. I would remember the information that I received by SMS for a long time. – Amon
Using SMS as an educational tool would be favourable to me because it would encourage me to study all the time and it would make me wait for information to arrive. – Asmhan

I would participate in a future educational SMS service ... It would be good if the students had a lot of courses to encourage them to study and organise their study. – Tamer

It might motivate me to look for more information. It would remind me to look for information. – Mo

Taking advantage of free time and motivation to study were important to students. They saw the convenience of SMS as a good way to address these issues. This was an underlying reason for students' positive perceptions of the usefulness of SMS as an educational tool.

Students' attitudes toward the use of SMS as an educational tool were also affected by the way that SMS might be implemented. For instance, some participants reported that they liked the idea of using SMS as an educational tool but they would not like to receive

SMS at inappropriate times and they would not like to receive too many educational mobile messages:

I would like it with conditions the timing of the messaging should be appropriate. – Tamer

If a maximum of two messages were sent a day ... I expect the process would be successful. – Horea

They felt SMS would be less useful if messages were sent inappropriately. Furthermore, some participants believed that they would not like SMS if it was the main communication tool between students and their instructors. Amon stated, "I would not like the use of SMS as the main way to deliver information". In addition, some participants believed that the phrasing of SMS messages would affect whether they liked them. These findings are similar to the underlying perceptions which influenced participating students' views on the usefulness of SMS as an educational tool. The way SMS was used was likely to affect students' attitudes towards its use as an educational tool.

In addition to the way of sending educational SMS, their content also affected students' attitudes toward their use. Students wanted to receive short, simple and important educational content rather than long and detailed messages. For instance, Mo stated:

I would like the use of SMS as an educational tool but it's important to send simple basic information, for example you could send a mathematical equation in a message, but if it was a long message containing many explanations I would prefer to receive it face-to-face and to use my notebook to write it down.

Some participants liked the idea of using SMS to deliver administrative information along with educational content. For instance, Abd believed that SMS would be helpful for sending the dates of exams, the due dates of homework, announcements regarding teacher absences, or educational website addresses. Asmhan believed that SMS would be helpful for sending exam dates and test scores. Tamer believed that SMS should be used to send reminders to students about exams. The findings are similar to the findings related to the reasons behind students' perceptions of the usefulness of SMS as an educational tool. The content of SMS is likely to shape students' attitudes towards its use as an educational tool.

Two participants explicitly expressed their negative feelings toward the use of SMS as an educational tool:

I would not like it [educational SMS]. – Bshra

Honestly I would not like it [educational SMS]. – Noorhan

One reason for the students' negative feelings was not related to the use of SMS necessarily, but to an overall negative perception of the use of technology in education:

I do not like technology in education ... I feel the information does not remain in my mind unless I read it on paper. In addition, I do not use technology, like the internet, in my study. So I do not like the use of SMS.

I always use books in my study. – Bshra

The above comment identifies that the student prefers to study using books, which may not be an uncommon learning preference. A second reason for students' negative feelings was related to a preference for face-to-face interaction in learning:

Even if the course was computerised I would not like the use of SMS to deliver educational content. I like it when teachers explain the educational content in face-to-face settings. – Noorhan

Most participants expressed an overall positive attitude toward the use of SMS as an educational tool. There were strong associations between students' attitudes toward the use of SMS as an educational tool and their perceptions of the usefulness of SMS as an educational tool, where the reported beliefs that would affect students' attitudes toward the use of SMS as an educational tool were the same as the ones that contributed to shaping students' perceptions of the usefulness of SMS as an educational tool. In addition, findings from the interviews showed that there were associations between students' perceptions of SMS ease of use and their attitudes towards the use of SMS as an educational tool. For instance, students ascribed positive attitudes toward the use of SMS as an educational tool to their expectations of convenient access to educational content via SMS. Students thought they would prefer short and to-the-point messages (e.g., simple educational content, short administrative information, or short quizzes).

The findings from the interviews regarding the relationships between students' perceptions of SMS ease of use and usefulness from one side and their attitudes towards the use of SMS as an educational tool from other side are aligned with TAM's (Davis,

1986) assumptions and the findings of previous quantitative research (see Section 5.4) that showed that students' attitudes toward the use of SMS as an educational tool were strongly related with their perceptions of SMS ease of use, as well as their perceptions of the usefulness of SMS as an educational tool. The findings suggest that the interviewed students had an overall acceptance of the use of SMS as an educational tool. Institutions of higher education should take advantage of the favourable attitudes toward the use of SMS as an educational tool through using such technology to support teaching and learning.

5.6.2 Findings from the second round of interviews

In the first round of interviews, the participants reported their beliefs regarding the usefulness of SMS as an educational tool based on little experience. At the time of the first interviews, the participants had only received one or two educational messages. The second interview took place after one semester of using SMS as an educational tool. Over the semester the students received a total of 3,356 SMS messages. The second interviews were conducted with the same participants. In total, 12 students participated in the second interview. The following sections discuss their perceptions and attitudes toward SMS.

5.6.2.1 Participants' perceptions of SMS ease of use. Similar to their responses in the first interviews, all the participants reported that SMS was easy-to-use due to its simplicity since it required few steps to send or open messages. The participants continued to compare the use of SMS with common electronic communication tools such as emails:

SMS is easier than any other electronic texting service; there is no need for a user name or password to log in. – Masri

SMS was faster and easier than email. – Noorhan

While they felt SMS was easy-to-use, participants continued to report problems that limited the effectiveness of SMS use. These most commonly related to specific communication related issues of typing text using old mobile phones or new mobile phones and the limited number of characters that can be sent in one SMS. However, they also reported issues related to interpreting message content such as understanding the received SMS, use of SMS for long conversations and understanding the feelings of the sender of the SMS. Participants expressed these issues in different ways:

It was difficult to write SMS on old phones, which forced me to press the button more than once to get the character that I wanted. – Horea

It is just useful for question and answer there was no way to make conversation using SMS. – Horea

It was hard to express my feeling via SMS, the receivers of SMS could not know if I was tired or sad from the reading the SMS. – Mo

Due to the limited number of characters that can be sent in one SMS, participants continued to feel SMS was difficult to use to express feelings and it was difficult to understand the intentions of the sender, or to maintain long conversations. They strongly believed that SMS was appropriate for exchanging short messages. In the second interview, the content-related issue of understanding Arabizi in SMS was not mentioned.

All the participants continued to believe that SMS was easy-to-use and that it was simple. The students continued to report some communication-related issues, but they did not mention difficulties related to the use of Arabizi. A possible reason for this might be that the language used in the educational SMS was English.

All the participants had previous experience of using SMS as a communication tool before its use as an educational tool. Students' use of SMS as an educational tool did not differ to its use as a communication tool. Overall, the use of SMS as an educational tool for one semester did not change their perceptions of SMS ease of use. The findings suggest that using educational SMS is easy for university students, as they do not need familiarisation and training. The high levels of familiarity suggest SMS is an ICT that could be easily implemented in higher education. However, communication issues related to the limited number of characters and understanding feelings associated with short messages could have an effect on students' perceptions and attitudes toward the use of SMS as an education tool.

5.6.2.2 Participants' perceptions of the usefulness of SMS as a communication tool. In the two rounds of interviews, the participants repeated similar responses related to their positive perceptions of the usefulness of SMS as a communication tool. These reasons underpinning positive perceptions of the usefulness of SMS as a communication tool where SMS supported or enhanced communication. Consistent positive responses included: SMS is inexpensive, it is always easily available, it is convenient for the sender and receiver, it is

quiet and private, it provides straight-to-the-point information and it can be used for sending one-to-many messages. However, in the second interview, new reasons for students' positive perceptions of the usefulness of SMS as a communication tool were also identified. These included the belief that the brevity of SMS can save time and effort, SMS can be useful for informal learning, and SMS can help address some cultural communication issues.

Participants continued to believe that SMS was a useful and low-cost communication tool. The participants reported that SMS was cheaper than other communication tools such as phone calls or internet-based communication tools. Tamer stated, "I needed to send information to a friend and I did not have enough money to call so I sent a short message to him." As discussed previously, it is free to receive SMS in Kuwait. Kuwaiti service providers often offer mobile plans that include free unlimited SMS, and they often charge more for regular phone calls than for SMS (Zain, 2014a; Ooredoo, 2014a; Viva, 2014a Zain, 2014b; Ooredoo, 2014b; Viva, 2014b).

The participants also continued to report that SMS was more readily available than other means of communication. For example when the internet was down, they could not access other means of communication:

I used SMS to communicate with my sister only when there was no internet connection in the parking lot. – Masri

One time, I was travelling and I could not communicate with my mother to tell her that I arrived to a certain place so I sent her a short message. It was very useful. – Abd

I used it to send international messages to relatives outside Kuwait. In addition, it was very useful when there was no internet signal. – Alian

These comments demonstrate that students' positive perceptions of the availability of SMS were consistent. Participants also continued to appreciate the convenience of using SMS at any time and anywhere, and the capacity to access messages at any time. This was specifically related to communicating important information:

If I wanted to tell someone about something without disturbing him, because he might be sleeping I would send him a short message and he could read it when he wanted to. – Asmhan

When I send an SMS to a person, he understands that it is an important matter so he will answer me immediately; when a person does not answer my phone I send him an SMS so he will call me. – Faiez

I used it as a reminder for necessary things such the things that I need to buy from the market. – Masri

I can always go back to my mobile messages since they are saved on my phone. – Amon

However, participants believed SMS was not useful when the sender was in an emergency. For instance, Bshra believed that sending a short SMS might cause people to panic in an emergency, as SMS cannot be used to send details related to the emergency. Bshra stated:

I had a car accident and I did not have enough money to call so I sent a short message, but its impact was so bad on my family as they felt very scared because it was short and did not explain what really happened.

The perception of convenience also related to the privacy and quietness of communication. The participants continued to perceive SMS as a quiet and private communication tool:

When I was in a meeting I could not answer the calls, but I still could read messages. – Tamer

SMS is useful if I want to tell someone about a special thing and I do not want anyone to hear me. SMS is good for privacy. – Asmhan

While most participants felt the use of SMS on a mobile is private and secure, Amon saw some risk in SMS being opened by anyone who could access her phone. Participants continued to believe that SMS was useful because it allowed for straight-to-the-point communication, as well as a communication with groups of people. For instance, Horea stated, “SMS is straight to the point, no extra details.” Alian stated, “I used SMS to send holiday greetings to relatives.” The straight-to-the-point communication via SMS is related to the brevity of an SMS and limitations in understanding the sender’s meaning. This belief reinforces the idea that the purpose and content of an SMS need to be carefully considered when communicating different types of information. Overall, the comments illustrate that beliefs about the convenience of SMS were consistent over the semester.

New beliefs about usefulness were also identified in the second round of interviews. Participants said that some types of SMS content can save time and effort, SMS can be useful for informal learning, and SMS can be used to overcome some cultural communication issues. Beliefs about saving time and effort included:

SMS is useful for requesting bank account information. It saves the time and effort of going to the bank. – Faiez

I used SMS to reserve a seat in the soccer stadium. –Abd

Participants believed SMS was useful for saving time and effort when performing daily administrative tasks. These tasks would otherwise have required going to a location or making phone calls. Mobile banking has been reported in other research studies. For instance, Thulani, Kosmas, Collins and Lloyd (2011) reported that the benefits of SMS banking included convenience, availability, accessibility, reduced costs, reduced labour, wider customer reach and better security.

SMS was also identified as useful for informal (non-university) learning. Some participants used SMS to receive religious quotes or nutrition tips. For instance, Aya stated, “I found it easy to learn some things through SMS, such as the information that we were receiving through SMS or through the subscriptions for certain services such as sayings of the prophet or information about diets.” It is possible that students’ use of SMS as an educational tool for one semester and participation in the research made them aware of other benefits and uses of SMS for other types of learning. The previously reported uses of SMS can be listed as information-related as they all relate to accessing information. A final use was related to convenience within the culture of Kuwait:

I used SMS to contact men because it enabled me to avoid embarrassment. – Bshra

I preferred SMS to phone calls because there was no direct contact with the receiver of the message. – Amon

Female participants believed that communication through SMS would help them avoid the embarrassment that might come from phone calls, mainly between females and males, due to cultural issues. This could be classified as a social advantage of the use of SMS, where it primarily addresses contact between genders.

The findings show that interview participants continued to have strong positive perceptions of the usefulness of SMS as a communication tool. These findings suggest several ways that institutions of higher education could draw on university students' positive perceptions of SMS as a communication tool to incorporate SMS in higher education settings. Institutions of higher education could take advantage of the privacy that SMS offers through sending students information they might not like to share with other people, such as exam results or absentee rates. Students' positive perceptions of the usefulness of SMS for conveying straight-to-the-point information suggests that institutions of higher education could use SMS to send clear and short messages and educational content (e.g., students' key dates for registration and the main concepts from lectures). Similar to the findings in the first interview, the participants continued to appreciate that SMS can be sent to large group of people at once. Some participants reported using SMS to send greetings to several relatives at once.

5.6.2.3 Participants' attitudes toward the use of SMS as a communication tool. In the second interview, all the participants continued to express positive attitudes toward the use of SMS as a communication tool. Similar to their responses in the first interview, participants had positive experiences of using SMS as a communication tool for different purposes. For instance, some participants liked SMS because of the ease and convenience of receiving information such as religious information and banking information. Faiez had positive feelings regarding SMS because he could use it for "receiving reminders to fast on certain days in addition to banking information." In addition, Masri continued to like SMS because it kept him in touch with relatives and friends. The findings continued to reflect students' positive attitudes towards the use of SMS resulting from using SMS for different purposes.

In addition to the positive experience of using SMS, participants continued to attribute their positive attitude toward the use of SMS as a communication tool to their positive perceptions of SMS ease of use and usefulness as a communication tool:

It was easy to read since I have my phone with me all the time. – Asmhan

[I like SMS because] of the ability to communicate at any time and

anywhere, even in conferences. – Tamer

[I like] the simplicity and ease of use. SMS is straight to the point. – Horea
Messages are saved on my phone, it acts as reference, it does not need the
internet. – Masri

These comments reflect the associations between students' attitudes towards the use of SMS as a communication tool and their perceptions of the usefulness of SMS as a communication tool. The participants liked SMS because it is always easily available, convenient for the sender and receiver, quiet and private, and straight to the point. While positive perceptions were consistent, the issues identified with using SMS were also consistent. Participants continued to report negative feelings about the limited number of characters allowed in an SMS and difficulties in understanding feelings and intentions in some types of messages. A new issue was receiving advertisements via SMS. Abd stated, "Some messages were advertisements and I did not want to receive them." In addition, Faiez complained about receiving the same advertisement several times. They did not feel these messages were useful and therefore did not like receiving them on their mobiles.

Overall, the findings showed that there were no major changes in students' attitudes toward the use of SMS as a communication tool after its use as an educational tool for one semester. Similarly, students' answers to the questionnaires and interviews showed that there were no significant changes in students' perceptions of SMS regarding its ease of use and usefulness as a communication tool. As the previous findings showed, and as TAM's (Davis, 1986) assumptions suggest, students' perceptions of the ease of use and usefulness of SMS as a communication tool were strongly related to their attitudes toward the use of SMS as a communication tool. However, the focus of the current study was on students' acceptance of the use of SMS as an educational tool and this is explored in the following sections.

5.6.2.4 Participants' perceptions of the usefulness of SMS as an educational tool.

After using SMS to support teaching for one semester, the majority of interview participants continued to believe SMS was useful as an educational tool. The 10 students who reported positive perceptions of the usefulness of SMS as an educational tool in the first round of interviews continued to express the same beliefs. The other two participants continued to have the same negative perceptions. These findings are reflected in the

questionnaire results (see Section 5.5) showing that there were no significant changes in students' overall perceptions of the usefulness of SMS as an educational tool after use over one semester. The reasons for students' positive perceptions of SMS as an educational tool in the first and second interviews have been grouped into three categories: i) access to educational content; ii) implications for learning experience, (e.g. allowing the students to use short periods of free time for study, reminding and motivating the students to study, improving their connection to the class and instructor and regulating their study); and iii) information type and learning, (e.g. allowing the students to receive key points of the lectures).

In the second interview, perceptions of the usefulness of SMS as an educational tool were as follows:

Educational SMS was useful for my learning. – Asmhan

It [educational SMS] was helpful. – Horea

It [educational SMS] was useful. – Mo

Beliefs about the usefulness of SMS in education continued to be positive. However, after one semester of use students were also able to elaborate on those beliefs:

SMS was with me all the time; I would never forget my phone while I might forget my books. – Asmhan

I read the messages before sleeping; the phone was in my hands all the time.
– Abd

I read the received educational messages more than once. The information sent by SMS was stuck in my mind. – Mo

I could access SMS anytime, and since all the messages were arranged one after the other I could review them all at once. – Asmhan

Participants were able to discuss how the use of SMS as an educational tool specifically made their access to educational content easy and convenient. In particular they believed access to educational content at anytime and anywhere was useful, since they always carried their phones with them. Since the received SMS were usually saved on their phones unless the user deleted them, smartphones sort SMS based on the senders. The students appreciated the convenience of reviewing all the received educational SMS at once.

In the context of the implications of SMS for learning experiences, the participants continued to believe that educational SMS were useful in allowing them to take advantage of small fragments of time:

I could review the received SMS on my way to the class; I carried my phone all the time. – Asmhan

I might receive the SMS at any time so I could take advantage of my spare time. – Horea

The reported usefulness of educational SMS in allowing the students to take advantage of small fragments of time to review educational content is related to the previously mentioned advantage of educational SMS in terms of allowing the participants to access to educational content easily and conveniently. One particular aspect of this was receiving SMS at fixed times and frequencies. They felt this helped in organising their academic study time. Masri stated, “It [SMS] contributed to regulating my study”. However, there was a concern about the rigidity in phrasing the educational SMS:

The thing I liked least about the educational SMS was the absence of fun or attraction. The type of SMS was important, like phrasing the SMS content in a way that attracts attention. – Horea

Overall, students felt positive about the SMS message format. In particular this was a result of participants carrying their smartphones with them all the time, meaning they could read the received SMS whenever they had short periods of free time.

The participants continued to believe that SMS had an important role in motivating them to study. Educational SMS motivated students in different ways. The educational messages motivated students to think about the main points of their classes. In addition, they motivated the students to look for more information related to the information received via SMS:

When I received the information through short messages, I found simple pieces of information without any explanation, which meant I was motivated to ask the teacher questions. So I found it good and useful. The SMS gave the educational principle; they will motivate students to look for more information. – Abd

Educational SMS made me look for more information related to the received SMS. – Faiez

Educational SMS made me curious about the next SMS that I would receive. I used to think about the content of the next SMS based on the lectures I attended. I thought about what were the most important points in the lecture that would be sent via SMS. – Masri

In addition, students believed that receiving educational SMS made them connected to the class and its instructor:

Receiving the information at a time when I did not want to study kept me in touch with the course. I remember once I was sitting with my family and I was not thinking of the course or the university and then I received the SMS and it made me start thinking of the course and it made me connected to the course. – Alian

It reminded me all the time to study and it make me close to the class.

[SMS] made me keep connected to the class. – Horea

SMS kept the students in touch with the course. SMS kept the students connected to the class. – Masri

It made the instructor closer to the students. I felt like the professor was with me all the time. –Alian

Receiving educational SMS helped students to feel more connected to the class and think about educational content. It improved their connection to the class and improved their social relationships with the instructor. This suggests an improvement in their feelings about the class, in that this connection seemed to motivate students.

The third category of reasons for students' positive perceptions of the usefulness of SMS as an educational tool was related information type and learning:

Received SMS messages reminded me of important information. It made me remember the key points of the class and it made me study more. – Faiez

SMS messages focused on the important things in the course ... They showed the main points in the chapter. – Asmhan

It made me aware of the some important information related to the course. – Mo

Students were particularly positive about receiving key points related to their lectures. They saw this as a very useful aid in their learning. This had been identified in the first round of interviews. After using SMS for one semester, participants reported new positive beliefs related to learning. These fell into two categories: i) implications for learning experiences (e.g. the role of SMS in reminding and making the students understand educational content); and ii) information type and learning (e.g. allowing the students to pay attention to small details related to the course). Participants believed that SMS content, such as key lecture points, helped them to remember and to understand their subjects:

When I received a message it reminded me of information I had forgotten.

Educational SMS consolidated information that I already knew. – Tamer

It happened once that while the professor was lecturing about some topics I received information about via SMS, which made me understand the topic better. – Masri

It was useful in providing me with educational information that I could use to solve my homework problems. – Abd

Once I looked at the SMS before the exam and at the exam I used the same SMS content to answer a question. – Aya

SMS made me achieve better grades in quizzes. – Amon

Students felt educational SMS supported deeper understanding of the educational content and helped them to complete their homework. They felt this had a positive influence on their learning performance in terms of acquiring high grades in exams and quizzes. These findings are reflected in findings from other research studies (Kert, 2011; Zhang et al., 2011). However, to achieve this, participants believed that the type of educational content of the SMS was important:

In programming one needs to pay attention to small details, SMS helped for this. – Abd

It was short and to the point. – Alian

Comments suggest that beside the key points of lectures, educational SMS can be used to send important details that students might miss. These perceptions were strongly related to students' perceptions of SMS as a communication tool. For instance, students' positive perceptions of the usefulness of SMS for communicating important and concise

messages were similar to participants' beliefs that SMS improved their learning in the class by providing small but important details into relation to their courses.

Students' concerns regarding the timing and the frequency of the educational SMS were not mentioned in the second interview. However, participants did value the timing and the frequency of receiving SMS. Faiez stated, "The timing was perfect and so was the frequency of SMS". Participants did not mention concerns regarding the use of SMS as a complementary educational tool rather than the main delivery tool. In addition, participants did not mention their preferences for using SMS to receive administrative information, quizzes and simple information. It is likely students did not experience issues with timing and inappropriate use in the class due to the design of the SMS intervention in this study.

The two interview participants who did not feel positively about SMS use in education continued to report negative perceptions of the usefulness of SMS as an educational tool:

It [educational SMS] was not useful for my learning. – Bshra

It [educational SMS] was not useful for my learning ... It did not attract me as an educational tool. – Noorhan

These beliefs were also consistent over the semester. As with positive beliefs, these comments reflect relationships between attitudes towards SMS use and perceptions about their usefulness. These beliefs related to perceptions of usefulness of SMS in teaching programming:

I received short messages that did not explain that much. – Bshra

C++ was difficult and SMS was inappropriate for teaching a programming language. – Noorhan

The findings support the previously reported finding that educational SMS should be used to support face-to-face instruction rather than as the main educational tool in the class.

While these two students expressed negative beliefs, their comments relate to new beliefs about usefulness identified by other students. Besides the reported negative belief related to information type and learning, (e.g. usefulness of SMS in teaching programming), some participants reported some negative beliefs related to aspects of sending educational SMS, such as synchronisation and two-way communication.

The synchronisation between lecture content and educational SMS is a key aspect of the usefulness of SMS. Amon explained:

It was not useful when the messages did not match the information that the teacher explained to us in the lecture, so there were some messages I could not understand. I could not understand SMS when its content had not been explained in the lectures yet.

It is important to synchronise the educational content of SMS and the lectures. This suggests students felt SMS was less useful if it did not match course content they had already encountered. Students felt content should be addressed in lectures before sending the SMS, so the SMS was more of a study and memory aid. This relates to other beliefs about the usefulness of SMS. For instance, the reported difficulties of using SMS due to the limited number of characters may relate to the usefulness of sending long, detailed messages.

A second new reported issue was the lack of two-way communication between the students and their instructors. In two-way communication students can ask questions related to the educational content and instructors can use SMS to answer students' questions. Bshra stated, "I like two-way [SMS] communication, so the educational SMS were not like my previous experiences." The participants were used to using SMS for social purposes, which tends to involve two-way communication. This made some students feel SMS was less useful when only used as a one-way educational tool.

Overall, students continued to perceive SMS to be a useful educational tool. At the time of the second interviews, the participants had experienced using SMS as an educational tool for one semester only. The students reported their beliefs regarding the use of SMS as an educational tool and provided more information regarding their perceptions of the usefulness of SMS as an educational tool. The limitations and opportunities associated with SMS as an education tool were related to the use of SMS for communication.

5.6.2.5 Participants' attitudes toward the use of SMS as an educational tool. After using SMS to support their teaching for about one academic semester, the majority of interview participants continued to express positive attitudes toward the use of SMS as an

educational tool. The ten students who reported positive attitudes toward the use of SMS as an educational tool continued to express similar attitudes. Two participants continued to have the same negative attitudes toward the use of SMS as an educational tool. Such findings aligned with the questionnaire results (see Section 5.5) which showed there were no significant changes in students' overall attitudes after one semester of use.

Most of the reasons underlying positive attitudes towards the use of SMS as an educational tool were observed in the first interviews. For example, some participants continued to like educational SMS because it allowed them convenient and easy access to educational information through their phone:

Using SMS allowed me to easily review educational content. – Aya

It was easy to read since I have my phone with me all the time. – Asmhan

I preferred it because it was easy, inexpensive and my phone resided with me all the time. I wished [educational SMS] existed in all classes. – Faiez

Some participants liked SMS because of its implications for their learning:

I liked it because I received messages at times which were not intended for study. I could take advantage of my spare time. – Horea

I felt like the professor was with me all the time. – Alian

SMS kept the students in touch with the course. SMS made the students connected to the class and it regulated their study. – Masri

Their comments suggest that participants' reasons for their positive perceptions were closely related to their attitudes towards the use and usefulness of SMS as an educational tool. They believed SMS allowed them to take advantage of short periods of free time, made them connected to the class and to the instructor, and regulated their academic study time:

It made me aware of the some important information related to the course. – Mo

One advantage of SMS was using it as a reminder of important things or small notes or hints that helped me to solve homework problems. – Abd

It [educational SMS] acted as a reminder of important information. It made the students focus on particular content. It reminded the students of the main points in the course. It might help students in their exams. – Alian

Participants liked the use of SMS because it provided them with important information regarding the course. In addition, the participants liked SMS because it helped them remember and understand educational content that improved their learning and performance in different ways. Similarly, the participants believed the educational SMS were a useful educational tool because they allowed them to obtain deeper understandings of the educational content and helped them to solve their homework problems and acquire high grades in exams and quizzes.

However, other participants attributed their positive attitudes toward the use of SMS as an educational tool to more general positive attitudes toward the use of technology and SMS as a communication tool:

I liked the use of new technology in education. – Tamer

I am the kind of person who really likes to read SMS so I liked receiving educational SMS. – Mo

These more general beliefs about the use of technology would be expected of engineering students. As previously discussed, two participants reported concerns:

I do not like the use of technology in education ... It [educational SMS] does not attract me as an educational tool. I like books or written notes. – Noorhan

I do not carry my phone with me all the time and I was not used to using SMS. I do not like my phone at all ... I like to communicate with the teacher face to face. – Bshra

The students repeated the same reasons for not liking the use of SMS as an educational tool that they had given before the semester began. Negative attitudes toward the use of SMS as an educational tool were not necessarily related to the use of SMS; some were related to participants' negative attitudes toward the application of technology in education in general and the application of mobile phones to education in particular.

Similar to the first interviews, the findings from the second interviews showed that there were strong associations between students' attitudes toward the use of SMS as an educational tool and their perceptions of the usefulness of SMS as an educational tool as well as their perceptions of SMS ease of use. Such relationships are aligned with TAM's (Davis, 1986) assumptions and findings in previous quantitative data (see Section 5.4). In

order to improve students' attitudes toward the use of SMS as an educational tool, institutions of higher education should consider the positive beliefs and negative issues that underpin students' perceptions and attitudes towards the use of SMS such as students' preferences for using SMS, their preferences regarding the content of SMS and SMS's implication for students' learning.

5.7 Conclusions

The research sample ($N=171$) consisted of about equal numbers of female and male students. Most were enrolled in their second or third year of undergraduate engineering and they were between 20 and 25 years old. The questionnaire sample included a small number of participants from non-engineering disciplines. Among different ICTs, the participants used their laptop computers the most for educational purposes followed by smartphones. A little less than two-thirds of participants received SMS frequently and more than one-third sent SMS frequently. The participants reported using SMS for different purposes. The most frequently reported uses were to chat with family and friends, to send and receive greetings and for banking.

Perceptions of SMS use, usefulness and attitudes were positive. Perceptions and attitudes toward SMS differed between students enrolled in engineering and those enrolled in other subjects. Students' attitudes toward the use of SMS as an educational tool were strongly related to their perceptions of SMS ease of use and the usefulness of SMS as an educational tool. The results aligned with TAM's (Davis, 1986) assumptions that perceived usefulness and perceived ease of use factors can predict a user's attitude toward using a technology. Perceptions and attitudes did not significantly change over one semester of use.

The data collected from the interviews supported and clarified the trends observed in the questionnaire results. The interviews were conducted with twelve students. Most of the interviewees had positive perceptions and attitudes toward the use of SMS as an educational tool. Some participants reported negative issues that limited the effectiveness of SMS use in the first and second interviews. These perceptions most commonly related to specific communication-related issues of typing text using old mobile phones or new mobile phones, and the limited number of characters that can be sent in one SMS. However, these also affected issues related to interpreting message content such as

understanding the received SMS, use of SMS for long conversations and understanding the feelings of the sender of the SMS.

In both the first and second interviews, the reasons for students' positive perceptions of the usefulness of SMS as a communication tool were related to communication of the content. These reasons included using SMS for low cost communication, always being easily available, convenient messaging for the sender and receiver, quiet and private messages, concise information and one-to-many messages. In the first interviews, the participants complained about the rigidity of the use of SMS in emergencies. These beliefs were repeated in the second interviews, thus suggesting they were consistent. Additional beliefs about the usefulness of SMS were also mentioned after one semester of use. Students said that the content of SMS can save time and effort, that SMS can be useful for informal learning and that SMS can help address some cultural communication issues. Only one new issue was reported in the second interview: the potential increased privacy that SMS provides.

Participants' positive perceptions of using SMS to communicate important straight-to-the-point information suggest that the educational content of SMS should be important key points of lectures or critical small details of the lectures that students need to remember and understand. In both rounds of interviews, positive perceptions of the usefulness of SMS as an educational tool were related to three categories: i) access to educational content ; ii) implications for learning experiences (e.g. allowing the students to utilise their short periods of free time, reminding and motivating the students to study, improving their connection to the class and instructor and regulating their study); and iii) information type and learning, (e.g. allowing the students to receive key points of the lectures). In the second interviews, students also identified that the usefulness of SMS as an educational tool related to: i) implications for learning experiences; and ii) information type and learning.

Students' concerns regarding the timing and the frequency of the educational SMS were not mentioned in the second interviews. Participants did not mention concerns regarding the use of SMS as a complementary educational tool rather than as the main delivery tool. In addition, participants did not mention their preferences for using SMS to receive administrative information, quizzes and simple information. But participants continued to complain about the rigidity in the phrasing of educational SMS. Using SMS

for one semester made the students report some new issues related to the usefulness of SMS as an educational tool that were not reported in the first interviews. These issues were related to two categories: i) information type and learning (e.g. doubtful perceptions of usefulness of SMS in programming courses); and ii) aspects of sending educational SMS (e.g. the lack of synchronisation between SMS and lectures; and use of SMS as two-way communication tool).

Interview participants had positive attitudes toward the use of SMS as an educational tool. Students' attitudes toward the use of SMS as an educational tool were strongly related to their perceptions of its ease of use and their perceptions of its usefulness as an educational tool. Such relationships are aligned with TAM's (Davis, 1986) assumptions and findings from quantitative data. The findings suggest that students would accept the use of SMS as an educational tool in their higher education as they believe SMS is easy-to-use and useful for their learning.

Chapter 6: Discussion

In the previous chapter, the results regarding higher education students' perceptions of, and attitudes towards, the use of SMS as a communication and educational tool were presented. Relationships among these variables were examined through participants' responses to the questionnaire and the interviews. This chapter discusses the findings of the study. The first section addresses the TAM and relationships between students' attitudes toward the use of SMS as an educational tool and their perceptions of SMS. The following sections discuss the qualitative findings regarding participants' perceptions of SMS ease of use, the usefulness of SMS as a communication tool, its usefulness as an educational tool and attitudes toward the use of SMS as an educational tool compared with other research in the field. Based on the discussion of the results, several recommendations are presented. Finally, the conclusion section presents a summary of the chapter.

6.1 TAM and the Relationships between Students' Attitudes toward the Use of SMS as an Educational Tool and Perceptions of SMS

Students' attitudes toward technology have been commonly acknowledged as an important factor for the successful integration of that technology in education (Margaryan et al., 2011). The TAM (Davis, 1986) argues that perceived usefulness and perceived ease of use factors can predict a user's attitude toward using a technology. The combined questionnaire and interview findings from the current study showed that the TAM framework was valid for explaining the relationships between students' perceptions of SMS and their attitudes toward its use.

The findings showed that almost all the participants (97.7%, $n=167$) reported using SMS and that they had been using SMS for approximately five years. These findings aligned with results from other international studies showing that SMS was popular among university students in developed countries such as Hong Kong (Lin, 2005), Australia (Kennedy et al., 2008), the United States and Canada (Smith & Caruso, 2010). Similar findings have been obtained in developing countries such as Malaysia (Balakrishnan & Loo, 2012) and Jordan (Tahat et al., 2014).

In the current study, students held slightly to moderately positive beliefs that SMS was easy-to-use and useful as a communication tool ($M = 5.40$, $SD = 1.28$). Users are likely to perceive a technology as easier to use and useful if they have direct experience in using it (Hackbarth et al., 2003). After the use of SMS as an educational tool for one semester, students' questionnaire responses showed that overall their perceptions of SMS ease of use and usefulness as a communication tool did not significantly change. Such unchanged perceptions were expected, where the use of SMS in the current experiment was limited to sending educational content. Therefore, the students' receipt of educational content did not affect their perceptions of SMS ease of use and usefulness as a communication tool. Students indicated that it was easier to retrieve old SMS on their phones at the end of the semester. It is possible that through the experience of using SMS over the semester they acquired more knowledge and skills related to finding old SMS in their phones. The absence of changes in students' overall perceptions of SMS ease of use and usefulness can be ascribed to their long experience using SMS before the current study. Institutions of higher education should take advantage of the positive perceptions of SMS ease of use and its perceived simplicity. The high levels of familiarity suggest SMS is an ICT that could be easily implemented in higher education without training students. However, the results show that not all students have the same experience or perceptions. This provides some insight into how students may respond to the use of SMS in their learning differently.

An indication of students' positive perceptions of the usefulness of SMS as a communication tool was clear in their use of SMS. Analysis showed that participants found SMS useful for two main purposes: social interaction and receiving information. Examples of the social use of SMS included contacting family and friends, while examples of receiving information included commercial advertisements, religious quotes and banking information. For social purposes, the participants used SMS to chat with family and friends (48.5%, $n=83$) and to exchange greetings (44.4%, $n=76$). For receiving information, the participants used SMS for banking (36.2%, $n=62$) and to receive commercial advertisements (16.4%, $n=28$). In the interviews, the participants elaborated on their use of SMS for social purposes and for receiving information. For instance, some interview participants reported that they used SMS for social purposes such as to arrange for social

events and to send greetings. In addition, some participants reported using SMS for receiving different types of information (e.g., religious quotes and nutrition tips).

University students' use of SMS for social purposes is confirmed through other studies. For instance, Al-Fadhli and Dashti (2014) found that social interaction was the main motive for using mobile phones in Kuwait. Tahat et al. (2014) found that the most popular use of SMS was to keep in touch with friends, and 75% of the 497 college students in their study reported that they used SMS to contact friends. Balakrishnan and Loo (2012) reported that most of the university students in their study used SMS to communicate regularly with friends and family. The use of SMS for receiving information (e.g., banking details) aligned with findings from a similar study in Kuwait. Al-Failakawi (2006) reported that 3% ($n=68$) of the Kuwaiti participants reported using SMS for getting information regarding their bank accounts.

Kuwaiti students' responses to the questionnaire showed that they believed that SMS was useful as an educational tool. The participants' perceptions of the usefulness of SMS as an educational tool ranged from neutral to slightly positive ($M = 4.39$, $SD = 1.52$). The questionnaire data showed that overall the participants' perceptions of the usefulness of SMS as an educational tool did not significantly change after its use as an educational tool for one semester. Similar to their perceptions of the usefulness of SMS as an educational tool in the first questionnaire, the participants' perceptions of the usefulness of SMS as an educational tool ranged between neutral to slightly positive after its use for one semester. However, students did not indicate that they did better in their course because of SMS at the end of semester. It is possible that students had overly optimistic perceptions of SMS before its use as an educational tool. The students had positive perceptions of the effect of SMS on their learning performance when they learnt about how it would be used as an educational tool. However, after its use for one semester, such perceptions were lower than they were at the start of the semester. The use of SMS was limited to one or two messages a week, and this limited number of messages might not have affected students' performance to the extent they expected.

Differences in perceptions of usefulness among groups of students based on frequency of SMS use revealed some differences. This suggests that students as a group may not all hold the same beliefs about technology use. There were significant relationships

between frequency of receiving SMS and students' perceptions of SMS ease of use and usefulness as a communication tool and as an educational tool. This suggests that the participants who frequently received SMS tended to have more positive perceptions than other participants who reported little experience with SMS.

Kuwaiti students reported positive attitudes toward the use of SMS as an educational tool. Participants' attitudes toward the use of SMS to support teaching ranged from neutral to slightly positive ($M = 4.66, SD = 1.51$). The students were motivated by their positive perceptions of SMS ease of use and usefulness as a communication and educational tool. The questionnaire data showed that overall attitudes of the participants toward the use of SMS as an educational tool did not significantly change after the use of SMS for one semester. Again, the period of time of using SMS as an educational tool was short and that might explain why changes in the students' attitudes were minimal.

Differences in perceptions and attitudes based on students' majors show that students may not all hold the same beliefs about technology use. The engineering major students perceived SMS to be easier to use, and more useful as a communication tool and educational tool, and they expressed more positive attitudes than non-engineering students. A possible explanation is that engineering students are more familiar and experienced with the use of technology in education and that would make them perceive SMS to be a useful educational tool (Margaryan et al. 2011).

Correlation tests showed that students' perceptions of SMS ease of use and their perceptions of the usefulness of SMS as an educational tool were correlated $r(169) = .50, p < .01$, and these findings aligned with TAM's (Davis, 1986) propositions that perceptions of technology ease of use affect perceived usefulness. Further, students' attitudes toward the use of SMS as an educational tool were strongly correlated with their perceptions of SMS ease of use, $r(169) = .51, p < .01$ and perceptions of the usefulness of SMS as an educational tool, $r(169) = .86, p < .01$. Such significant correlations indicate strong relationships among the three variables in relation to communication and education. Interestingly, the results showed that relationships between participants' perceptions of the usefulness of SMS and their attitudes toward its use as an educational tool were stronger than the relationship between students' perceptions of ease of use and attitudes toward the use of SMS as an educational tool. This means that students' perceptions of the usefulness

of SMS as an educational tool were likely to be more important than their perceptions of SMS ease of use in forming their attitudes towards its use as an educational tool. These results were confirmed through regression analysis, which indicated that the two predictors, students' perceptions of SMS ease of use and students' perceptions of the usefulness of SMS explained 75% of the attitude variance ($R=.867$, $F(2,168)=254.66$, $p<.05$). It was also observed that students' perceptions of SMS ease of use significantly predicted their attitudes toward the use of SMS ($\beta = .11$, $p<.05$), as did students' perceptions of the usefulness of SMS ($\beta = .81$, $p<.05$).

Several studies have shown a positive relationship between perceptions of technology ease of use, usefulness and attitudes (Davis, 1993; Legris et al., 2003; Huang et al., 2012; Saricam, 2014). For instance, in the studies that used TAM to examine the acceptance of the use of SMS, it was found that the relationship between the users' perceived usefulness of SMS and their acceptance of it was stronger than the relationship between the users' perceived ease of use of SMS and their acceptance of it (Zhang & Mao, 2008; Goh, 2011). This is important, because perceived usefulness has been shown to be a more reliable predictor of Kuwaiti users' acceptance of mobile phone cameras than their perceptions of its ease of use (Rouibah, 2009). However, this is contradicted in some other research studies using different technologies. For instance, users' perceptions of ease of use and perceived usefulness were not significant in predicting Kuwaiti people's acceptance of instant messaging (Rouibah, 2008), where the particular characteristics of the study might have affected the findings. Three factors, in addition to the original TAM factors, were used to predict the actual use of instant messaging (Rouibah, 2008). Students' attitudes toward technology represent an important predictor for their intention to use, and actual use of, technology (Davis, 1986; Davis, 1993; Venkatesh, 2000).

Margaryan et al. (2011) recommended that, in order to inform policy and practice regarding technology integration, higher education practitioners should examine what technologies students have access to and what their preferences are as well as the educational values of these technologies. Questionnaire findings provided insight into students' use of and attitudes towards SMS as commonly available and readily accessible educational tool. The following sections discuss the findings from the in-depth interviews with some participants.

6.2 Participants' Perceptions of SMS Ease of Use

Similar to findings from the questionnaire, all interviewees reported SMS was easy to use. The interviewees explained that their main reason for such perceptions was that SMS required simple steps to send or receive messages. For instance, the use of SMS did not require user names and passwords like other internet-based communication tools (e.g., email). The findings suggest that SMS as an educational tool has an advantage in that it does not need familiarisation and training for the university students to use it. Therefore, students are likely to possess high levels of familiarity, which would make it easy to implement in higher education. However, for effective implementation specific issues of communication would need to be taken into account. The findings from the interviews regarding students' perceptions of SMS ease of use added to and explained the questionnaire results. The questionnaire results showed that participants had moderately positive perceptions regarding SMS ease of use, and the results from the interviews explained why these perceptions were only moderately positive, since the interviewees reported some difficulties related to the use of SMS.

In the first interview, these were primarily centred around difficulties in communication, such as typing texts, the limited number of characters than can be sent in one SMS and the use of Arabizi in SMS. However, the participants in the second interview did not mention the difficulties of using Arabizi. Each of the reported difficulties are discussed in the following sections.

6.2.1. Typing text using old mobile phones or new mobile phones. In the first and second interviews, some participants complained about difficulties related to the use of SMS in terms of typing text using old mobile phones or new mobile phones. Old mobile phones have a limited number of keyboard buttons; therefore, for some letters the users are required to press the same button more than once. MacKenzie and Tanaka-Ishii (2007) discussed this, calling such keyboards “ambiguous keyboards”. The limited number of buttons on these mobile phones might negatively affect the speed of typing (Curran, Woods & Riordan, 2006). The issue related to the difficulties of typing SMS on old mobile phones is now not as common with the widespread use of smartphones that have large electronic

touch screen keyboards that show all the letters at once (Henze, Rukzio & Boll, 2012). The questionnaire results showed that most participants owned smartphones. Typing SMS over touch-screen smartphones is easier than typing SMS over regular mobile phones (Kim & Sundar, 2014). Therefore, this may be an issue that becomes less common as ownership of smartphones approaches 100%. That said, participants with less experience still encountered difficulties using SMS on new phones because of different mobile keyboard sizes. The arrangements of the characters on phones screen followed international standards (Curran et al., 2006); therefore, all the phones' keyboards are basically similar. A little practice can overcome the difficulties associated with typing SMS on new phones.

The issue of typing text using old mobile phones or new mobile phones is related to sending SMS rather than receiving SMS. The students tended to perceive receiving SMS to be easier than sending SMS, as receiving SMS does not require typing text. This provides some guidance for institutions of higher education, in that receiving information was perceived as easier. They can take advantage of this by integrating SMS in a way that enables students to receive various types of information like educational content.

6.2.2. The limited number of characters than can be sent in one SMS. The other reported technical limitation of SMS was the limited number of characters than can be sent in one SMS. SMS is used to send messages of up to 160 characters (Kennedy & Levy, 2008). In the first and second interviews, participants reported some difficulties understanding the received SMS. In some cases, this resulted from the number of characters that can be sent in one SMS. This limitation may cause some people to not elaborate in their communication or to use abbreviations. As a result, participants sometimes had difficulty understanding the received SMS. Furthermore, due to the shortness of SMS, the interview participants complained about understanding and expressing feelings via SMS. The difficulty of understanding SMS has also been reported in similar research studies. For example, Grinter and Eldridge (2001) found that difficulties in determining the sender's intent from the content of SMS was one of three problems related to the use of SMS. Another consequence of the limited number of characters that can be sent in one SMS was that some of the interviewed students reported difficulties related to using SMS in long conversations. They felt other approaches, such as an email or phone calls, were better

suited for this. Similar findings regarding this issue were reported in a similar study (Horstmanshof & Power, 2005). Lan and Sie (2010) found that other communication tools such as e-mails are better than SMS in terms of content richness and so may be applied for extensive information delivery.

The issue of the limited number of characters that can be sent in one SMS and the results suggest that integration of SMS for educational purposes should consider the nature of the courses in which SMS can be used to support teaching and learning. The educational content in these courses should suit the limitations of SMS communication, as in some courses many aspects could be reduced to small messages (e.g. one programming statement) that could stand alone and retain meaning. The educational content of SMS should be short, so that it can fit in one message, yet remain clear and understandable. Examples of this are found in the current study, where courses included foreign language and programming language courses. A foreign language tip or a code statement and an explanation of it were sent in single SMS messages. The results showed that students were able to easily use these pieces of information in their study as memorisation and study aids, and to support their motivation. This suggests that carefully selected educational SMS content were accepted and adopted by students. The educational content of SMS should not be used to interpret feelings or emotions.

6.2.3. The use of Arabizi. It is common for Arab people to text each other using Arabic, but with English letters. However, since the number of English letters does not match the number of the Arabic ones, the SMS user often applies Arabic numerals to substitute for Arabic letters. SMS users have to be familiar with the meanings of the Arabic numerals to understand SMS using Arabizi. One participant reported having difficulty using SMS because of the use of Arabizi. Participants in the second interview did not mention the difficulties of using Arabizi. This may result from the fact that educational SMS used in the courses did not include Arabizi. The difficulties in understanding Arabizi have been documented in other studies (Farrag, 2012; Bies, et al, 2014). The findings suggest that institutions of higher education intending to use SMS as an educational tool should avoid using the Arabizi alphabet, as not all the students are familiar with SMS abbreviations. Arabizi language popular and may seem appropriate for engaging students

by using an informal language, but it cannot be assumed that all students are able to understand it. If there is a need to use such abbreviations in the educational content, the participants should be trained in such languages.

These three main issues relating to students' perceptions of SMS ease of use contributed to their attitudes toward use of SMS as an educational tool, and they are strongly related to students' perceptions of the usefulness of SMS as an educational tool. These strong associations suggest that institutions of higher education would be able to take advantage of these positive perceptions to employ SMS as an educational tool. The SMS technology does not need familiarisation or training for most university students to use it regularly. However, in the use of SMS as an educational tool it is necessary to consider issues of typing text, understanding content in very brief messages, and difficulties with emotion and language. These issues may obstruct the use of SMS and negatively impact on students' perceptions and attitudes toward the use of SMS as an educational tool.

6.3. Participants' Perceptions of the Usefulness of SMS as a Communication Tool

Both the questionnaire and the interviews revealed positive perceptions of the usefulness of SMS as a communication tool. The interview results explained in more depth the reasons behind participants' positive perceptions of the usefulness of SMS as a communication tool. In the first and second interviews, the reasons given for students' positive perceptions were primarily related to how SMS supported or enhanced the communication of content. Participants believed SMS was useful for convenient and direct communication. In the second round of interviews after one semester of use, participants provided more explanations and information regarding their perceptions of the usefulness of SMS. Some felt SMS was useful for informal learning and may be useful in overcoming some cultural communication issues. Students' direct experiences with SMS for one semester introduced ways in which SMS was also useful as an education tool. As might be expected, these were strongly related to their perceptions of SMS ease of use and usefulness as a communication tool. The findings from the interviews regarding students' perceptions of the usefulness of SMS as a communication tool explained the questionnaire results. The results from the whole sample showed that almost all the participants reported using SMS and most of them had been using it for at least five years. All interviewees

believed that SMS was a useful communication tool. They reported some specific reasons for their positive perceptions. These reasons were related to convenience, directness and informality.

6.3.1. SMS is useful for convenient communication. The interview participants perceived SMS as a useful communication tool because it was convenient. This perception was based on the fact that SMS is low cost, always available and time saving. This has typically been the most common advantage of mobile phone and SMS use, in a number of studies. Another research study in Kuwait that investigated the use of SMS among Kuwaiti people showed that one of the main reasons for their use of SMS was its low cost (Al-Failakawi, 2006). Other international studies have shown that SMS is perceived as a cheap communication tool (Mante & Piris, 2002; Song & Fox, 2005; Leung, 2007; Kim et al., 2008; Balakrishnan & Loo, 2012).

The participants perceived SMS as a useful communication tool, and reported that SMS was more available than other types of mobile messaging applications (e.g. WhatsApp) and phone calls. Participants reported that they used SMS when they could not make phone calls or when there was an internet failure or a weak internet signal and they could not use other mobile messaging applications. Further, phone users could send and receive SMS at any time, as well as open SMS whenever they had the chance. Leung (2007) found that the main motivation for the use of SMS was its convenience. The perceived convenience of SMS for the sender and receiver of SMS has been reported in other research studies that investigated people's motives for using SMS (Lai, 2004; Horstmanshof & Power, 2005; Balakrishnan & Loo, 2012).

Participants also appreciated the convenience of SMS for saving time and effort in communication, as well as for other tasks that could be completed through the use of a mobile phone (e.g., banking). The uses of SMS for these purposes represent examples of the use of SMS for receiving information. This perception extended to the usefulness of SMS to communicate important information. The participants felt an advantage of SMS was that it did not need to be accepted to be received and saved on the phone. However, participants believed that SMS was rigid and inflexible in communicating emergency-related information. For instance, it was reported that SMS is not useful when the sender is

in an emergency. In addition, because of the brevity of SMS, it might be interpreted in wrong way in an emergency.

Lan and Sie (2010) reported similar findings. They found that SMS was perceived as useful for instant information delivery, such as notifying or reminding users of time-sensitive matters. In the second interview, some participants said that SMS is useful for reminders because the received and the sent SMS were saved on the phone and they could return to them whenever they wanted. For instance, some participants reported using SMS for shopping lists. A second example was using SMS for banking services. The use of SMS for banking was also reported in the questionnaire results, where about a third of the participants (36.2%, $n=62$) reported using SMS for banking services. Thulani et al. (2011) reported that the benefits of SMS banking included convenience, availability, accessibility, reduced costs, reduced labour, wider customer reach and better security. Furthermore, one participant believed that SMS could save time and effort when reserving seats in a soccer stadium.

Some participants found the ability of SMS to be sent to large groups of people at once to be useful in saving time and effort. Participants reported that they used SMS to arrange social events and to send greetings. The usefulness of SMS in sending holiday greetings to large groups of people at once was reported in the Kuwaiti media (Al-Nashi, 2002; Alrai Mediagroup, 2010). These uses have also been identified in other research. Tahat et al. (2014) found that about one-third of the participants in their study used SMS to exchange greetings on special occasions. Grinter and Eldridge (2001) found SMS was used widely to coordinate with family and friends. Leung (2007) found that college students, who were the group that used SMS the most, were motivated by its convenience, its low cost, and its utility for coordinating events. Bulk SMS allow mobile phone users to contact large groups of people at once, and therefore bulk SMS is useful in saving time and effort in holidays and organising large events. For instance, it is reported that in 2010 for the Muslim celebration of Eid, 24.2 million SMS were exchanged through only one mobile network in Kuwait within three days (Alrai Mediagroup, 2010), a country of about three million people.

The use of SMS in education does not require special expensive infrastructure for university students, as the students have the required software and hardware in their hands

all the time. This is critical in developing countries, in which students often have limited access to expensive ICTs that might be used to support higher education.

Since students are familiar with using SMS to exchange important information, this opens up a number of possible uses in higher education. For example, students are likely to feel positive about receiving time sensitive administrative information related to class management such as key dates for registration and enrolment, assignment due dates and absentee rates. On the educational side, SMS can be used to send important key points of lectures or critical details of lectures that students need to remember and understand. After the use of SMS as an educational tool for one semester, the findings from the questionnaire showed that students found it easy to retrieve old SMS on their phones. The findings suggest that educational SMS would be saved on university students' phones, so they can review them at anytime and anywhere. All SMS should be sent from one particular phone number in order to make it easier for the students to review the received messages SMS from the university at once.

In addition, since it is very cheap to send SMS, institutions of higher education can use SMS in two-way communication and as an educational tool, where the students can use SMS to request information and the university can reply it via SMS. Given students' positive perceptions of the usefulness of SMS to save time and effort in exchanging information, university tasks such as using SMS to register for classes, to inform students about cancelation of classes, or to inform students about instructor absence would be reasonable. Since students are used to using SMS for coordinating events and sending social greetings it can be used in higher education institutions for key social functions (e.g., to invite students to attend events and to send holidays greetings to them).

6.3.2. SMS is useful for direct communication. Participants identified several areas where SMS provided a method of direct and private communication with one person or a group. Some participants appreciated the quiet and private mode of communication that SMS offers, where they can read and reply to SMS without disturbing the surrounding people. In a privacy context, Horstmanshof and Power (2005) explained that "Messages can be sent quietly and hence privately between communicators who may even be engaged in other activities such as travelling on public transport, watching television, attending

meetings, classes, or lectures” (p. 34). Balakrishnan and Loo (2012) found that a popular motive for college students to use SMS was its privacy. They stated, “The privacy afforded by SMS also enables young people to communicate freely and discreetly” (p. 366). Some participants reported privacy issues related to the use of SMS. While participants believed that SMS was useful for private communication, one participant complained that the received SMS might be opened by anyone who could access their phone. However, this issue was only reported by one student and does not reflect that all students hold the same belief.

In the second interviews, students reported they believed that SMS was a useful tool to overcome some cultural communication issues between females and males. In this use SMS was an indirect communication tool between them, which meant they did not have to speak face-to-face. In their descriptions of the Arab culture that restricts direct male and female interaction, Rouibah and Hamdy (2009) stated, “Arab culture is masculine, clear gender roles are the norm, and social interactions with the opposite sex are not tolerated” (p. 5). Therefore, SMS might represent an alternative communication medium between women and men to overcome the cultural norms and expand the possibility of communication within higher education courses.

The brevity of SMS made the participants perceive it as a useful, straight-to-the-point communication tool which reduces the time and effort required in communication. In other research studies SMS was described as a *straight to the point* communication tool (Barwise & Strong, 2002; Van der Walldt, Rebello & Brown, 2009). SMS messages were described as “low in information” but high in “social grooming” (Horstmanhof & Power, 2005, p. 48). Tahat et al. (2014) found that about two-thirds of the participants in their study perceived SMS as a useful communication tool in terms of saving effort and time in communication.

Student perceptions inform the type of the content that can be sent via SMS to university students. Institutions of higher education can use SMS to send short, understandable and clear administrative and educational information for their students. University students' positive perceptions of the quietness of using SMS would suggest that institutions of higher education can take advantage of such perceptions by using SMS to send different types of private information that students may not wish to share with other

people such as exam results or absentee rates. Such findings would suggest that institutions of higher education can use SMS as an optional communication channel for students with limited internet access or those who are not present on campus.

6.3.3. SMS is useful informal learning tool. Some participants believed that SMS was a useful learning tool. Types of reported information that can be received via SMS included religious quotes or nutrition tips. The use of SMS for health purposes such as SMS intervention on dietary habits or for weight loss was investigated in several research studies that showed the benefits of such uses of SMS (Patrick et al., 2009; Shaw & Bosworth, 2012). The use of SMS to receive Islamic religious messages such as religious edicts, short quotes from the prophet, or short quotes from Muslim holy books is common among Muslim youth (Roman, 2006; Sunarwoto, 2012). However, such use of SMS is not limited to the Islamic religion; other research studies have reported the use of SMS in other religions such as Christianity (Roman, 2006). The use of SMS for religious purposes is part of the larger application of technology for religious purposes called 'Techno-spiritual practices' (Bell, 2006) that represent the implementation of technology to support a range of religious activities around the world (Wyche, Caine, Davison, Arteaga & Grinter, 2008). The use of SMS to receive religious quotes or nutrition tips represents an example of the use of SMS for the purposes of *receiving information*. Students' acceptance of SMS as an informal learning tool suggests that it would be accepted as a tool to support university students' formal learning. Institutions of higher education should take advantage of the positive perceptions of SMS as a learning tool through using SMS in similar ways (e.g., to send short educational content). This is addressed in more depth in the following section.

Students' positive perceptions of SMS as a communication tool resulted from their use of SMS as a communication tool. All the participants reported that they use SMS as a communication tool. Regarding the usefulness of SMS as a communication tool, the reported positive points exceeded the negative ones. The institutions of higher education should take advantage of the positive perceptions of SMS as a communication tool among students by using SMS to communicate different types of information (e.g., administrative and educational content). The use of SMS in higher education should consider the reasons for students' positive perceptions of SMS as a communication tool.

6.4 Participants' Perceptions of the Usefulness of SMS as an Educational Tool

The findings from the questionnaire showed close to neutral perceptions about the usefulness of SMS as an educational tool. The questionnaire measured students' general perceptions of the usefulness of SMS as an educational tool such as the effect of using SMS on learning performance, effectiveness and productivity. However, the interview data showed that students held more specific and informed beliefs about SMS, than the ones that were addressed in the questionnaire, and these views could be useful. For instance, the interviewees believed that SMS gave them access to some important educational content in a fast and easy form. In addition, they believed that educational SMS helped them to exploit short periods of free time, and that the SMS messages motivated them to study, improved their connection to the class and instructor, and regulated their study.

The majority of the interview participants believed that SMS would be useful as an educational tool. Specifically, in the first and second interviews, the participants reported similar reasons related to their positive perceptions of the usefulness of SMS as an educational tool, which could be divided into three categories: i) access to educational content; ii) implications for learning experience (e.g. allowing the students to utilise their short periods of free time, reminding and motivating the students to study, improving their connection to the class and instructor and regulating their study); and iii) information type and learning (e.g. allowing the students to receive key points of the lectures). These beliefs became more specific after one semester of use, after real experiences using SMS in supporting their learning. Additional reasons for students' positive perceptions of SMS as an educational tool were related to learning experiences (e.g. the role of SMS for educational reminders and for making the students understand educational content); and information type and learning (e.g. allowing students to pay attention of small details related to the course). The following section discusses students' specific beliefs in relation to the use of SMS as an educational tool.

6.4.1. Access to educational content. In the first interviews, students expressed positive beliefs regarding the role of SMS in allowing convenient access to educational content. In the second interview, after one semester of use, they felt the same. The participants valued the convenience of accessing educational content using SMS and that

educational content sent via SMS would be saved on their phone to be accessed at anytime and anywhere. This belief was still evident after one semester of use. The findings suggest that students' positive perceptions of SMS as an educational tool were strongly related to their positive perceptions of SMS ease of use and usefulness as a communication tool. As a communication tool, students believed that SMS allowed for convenient communication and easy-to-access information, and this made them believe that educational SMS would be convenient. Ease of accessing SMS content and the convenience of receiving SMS were found to be one of the main motives for mobile users to receive different type of services via SMS. As an educational tool, Zhang et al. (2011) found that students reported convenience is one of the main advantages of learning English vocabulary via SMS. Regarding receiving English vocabulary via SMS, one student in their study stated, "The first advantage for vocabulary learning via mobile phones is convenience. The second is convenience and the third is still convenience" (p. 209). Other research studies have also reported the ease of using SMS as an educational tool in terms of allowing the students to access useful educational information anywhere and anytime via their phones (Lu, 2008; Lominé & Buckingham, 2009).

Students' positive perceptions of the use of SMS as an educational tool in terms of allowing them to receive educational content anywhere and at any time suggest a range of uses for institutions of higher education. The findings imply that that educational SMS could be used as both an out-of-class educational tool and potentially in class. Out of their classes, not all students have access to educational content, such as online lectures or materials. Therefore, saved educational SMS on students' phones can offer students 24/7 easy access to some educational content via their phones. SMS should be sent from one particular phone number so students are able review all the received SMS from the class's instructor at once, under one number. In regard to SMS use in classes, while this has been examined in education (Markett et al., 2006), it was not part of the current study. Students' perceptions of SMS ease and convenience and the fact that they are always available, suggest positive beliefs about using them about SMS communication during lectures.

6.4.2. Implications for learning experience. Students consistently identified the ability to utilise their short periods of free time, receiving reminders and motivators,

improving connection to the class and instructor, and regulating study as important aspects of using SMS in education. These responses related to SMS educational content always being available and convenient, and to the information being brief. The benefit of SMS in allowing students to invest their small fragments of time and free time has been reported in other research. Zhang et al. (2011) found that university students reported the advantages of using SMS as an educational tool in terms of allowing them to use fragments of time such as while they are riding the subways or standing in queues.

Students also reported motivational benefits of using SMS as an educational tool. Some reported that educational SMS made them wait for future educational content, which suggests some level of curiosity and a game-like element. This could be related to students being engaged in learning, in some capacity. Others believed that educational SMS stimulated them read more, follow up on the messages and look for more information related to the course content. Some students reported that educational SMS made them think about the main points of their classes. All of these results point to students being motivated to engage in learning beyond the lecture or classroom. Some participants also believed that educational SMS should be phrased in a way that would attract the students' attention. Therefore, besides indicating the importance of selecting appropriate educational content, this finding suggests students felt SMS should motivate students to pay attention to the educational content, such as starting with questions or indicating importance (e.g. "*do you remember ...*", "*do you know ...*", or "*do not forget ...*"). These are important considerations, as students' motivations play a critical part in their learning (Weiler, 2005). Similar studies have found that university students believed that educational SMS had a stimulating effect on them as they reminded and motivated them to study (Moura & Carvalho, 2010; Zhang et al., 2011; Lim et al., 2011).

Engagement with SMS and with learning outside of class was important to students. Participants felt an improved connection to the class and to the instructor was an indirect benefit of the use of SMS as an educational tool. Improving students' connections to their classes and improving their feelings of social connection to the instructor improved their learning. Analysis of students' questionnaire responses regarding their use of SMS (Section 5.1.5) showed that the most popular use of SMS was for social purposes (e.g., to contact friends and family). In the second interviews, some participants identified an issue of using

educational SMS in terms of a lack of two-way communication between the teacher and the student. This has implications for receiving SMS from their instructor, students feeling they are close to their instructor and that they are socially connected to their instructor. Lim et al. (2011) stated, "it [educational SMS] also enables the university to reach out to learners outside of conventional communication spaces, and it helps to keep learners connected to the university, their peers, and their tutors."

Some students believed that SMS would regulate their academic study time. For instance, at the time of receiving SMS, the students would review the educational content and look for more information related to that content. Goh et al. (2012) found that SMS can improve students' self-regulated learning strategies. In addition, Lim et al. (2011) reported that SMS could help university students in managing their studies better. Supporting students' self-regulated learning represents an important factor for improving students' learning (Goh et al., 2012).

However, students believed that SMS should be used as a supplementary educational tool rather than the main educational tool. They believed that the short format of SMS made it potentially difficult to deliver new educational content. In the current study SMS was used as a supplementary tool to support traditional face-to-face classes. Therefore, this issue was not reported in the second interviews. Several applications of SMS in higher education have shown that SMS has been used as a complementary tool rather than as the main educational tool (Brett, 2011; Kert, 2011; Hayati, Jalilifar & Mashhadi, 2013).

In the second interviews, and as a direct benefit from the use of SMS as an educational tool, students expanded their beliefs about use in learning to include remembering and understanding educational content. Specifically, students felt SMS helped them to remember and understand the course materials, acquire high grades in exams and quizzes and solve homework problems. This finding does not mean students' learning is directly affected, but does demonstrate a positive belief about the usefulness of SMS in learning. The positive effect of accessing educational content via SMS and the students' learning and educational performance aligns with findings from other studies identifying possible learning gains (e.g., Lu, 2008; Cavus & Ibrahim, 2009; Zhang et al., 2011).

Some participants expressed concerns regarding the timing and frequency of the SMS messages sent. Participants reported that times when educational messages are sent should be selected carefully to avoid inappropriate times like too early in the morning or at night. In addition, they highlighted the potential problem of receiving too many SMS. These issues may relate to beliefs about the convenience of SMS and concerns that one may spend too much time on SMS. These comments were from the first round of interviews and may have related to students' lack of experience in using SMS as an educational tool. The issues of timing and frequency have been noted in other research studies. Recommendations from other studies are to send one SMS a day between 10 am and 1pm (Kennedy & Levy, 2008). Cavus and Ibrahim (2009) found that the majority of participants preferred to receive SMS between nine in the morning and five in the afternoon. Since the students did not complain about the timing and the frequency of SMS after its use for one semester, it is recommended to follow the timing and frequency adopted in the current study, which sent SMS in the afternoon at about 2 pm, with a frequency of one or two messages a week. After a semester of use, students made more specific comments about when it was useful to send SMS. They felt it was important that SMS messages were synchronised with lectures. The students had difficulties in understanding educational content received via SMS when the content had not previously been explained in their lectures. These findings suggest that, in the current study, students preferred the use of SMS as a motivating educational tool to support face-to-face instruction and re-engage with educational content outside of lectures and classes.

Findings relating to student learning experiences have a number of implications for the use of SMS in higher education. On a very basic level, the use of SMS as an educational tool to help students to utilise their short periods of free time represents a significant advantage of educational SMS, particularly as it is something students felt was an asset of SMS. In the current study, students received SMS every week. Participants found SMS helped them keep connected to the class, helped them to keep thinking about educational content, and kept them in touch with the class. Beliefs that SMS was motivating and improved learning are very positive perceptions of the usefulness of SMS. Institutions of higher education can take advantage of the motivational benefits of educational SMS to help students organise and manage their study time. This suggests that institutions of higher

education could usefully implement educational SMS to promote learning, as long as an appropriate number of messages was timed properly and was appropriately synchronised with lectures.

In addition, SMS can be used to improve other aspects students' self-regulated learning strategies. SMS can be used to encourage students to attend lectures, tutorials and workshops, as well as to complete assignments. The findings suggest that to improve students' academic study time during the semester, educational SMS should be sent over the whole semester regularly and at specific times in order to help students organise their study time. SMS could also be used to develop and maintain a feeling of connection throughout the academic semester, and to provide social and academic support to first year university students to improve their transition from school to university. In addition educational SMS can be used to support students who might be at risk in certain classes.

6.4.3 Information type and learning. Students consistently identified the type of the educational content as an important aspect of using SMS in education. They believed that SMS would be useful to send the key points of lectures. However, after the use of SMS as an educational tool for one semester, the participants also appreciated receiving short details related to their course. Since SMS were perceived as short and straight to the point, the students believed that SMS would be useful for sending the key points of the lectures and that they would help in the reviewing process for the course. The participants believed that SMS would be useful for summarising and for sending important information from the classes. Similar to the findings regarding the role of educational SMS in communicating important information and the main concepts related to their classes, Lim et al. (2011) found that learners believed that SMS messages were useful in providing them with important information related to their courses. Students believed that SMS was useful for convenient and direct communication. Such beliefs were reflected in their perceptions of SMS's usefulness as an educational tool. The brevity of SMS made some participants believe that educational SMS made them focus on small details related to their courses.

The novelty of SMS as an educational tool, the brevity of SMS technology, the popularity of mobile phones and SMS among students, and their positive perceptions of SMS ease of use and usefulness as a communication tool made them believe that SMS

would be useful to for receiving educational content from their classes. However, the participants reported some issues related to the type of information that can be received via SMS.

In the first interview, some participants said they believed that educational SMS should contain simple educational content that needed to be memorised rather than complicated educational content that needed to be comprehended. Such perceptions might have originated from the perceived deficiency of SMS in sending detailed messages due to the limited number of characters that can be sent via one SMS. The brevity of SMS made the students believe that they could not be used to send large amounts of information, and should therefore be used to send short messages that need to be memorised rather than to send large amounts information that needed to be comprehended. Previous research studies supported using SMS to support teaching and learning in courses that depend on memorisation such as foreign vocabulary in language learning courses (Lu, 2008; Cavus & Ibrahim, 2009).

Some participants believed that SMS would be useful for sending administrative information. The immediacy of communication offered by SMS might have made the students believe that SMS would be useful to communicate time sensitive administrative information related to their classes. The findings regarding students' preferences for receiving administrative information by means of SMS aligned with the findings of similar research studies. For instance, Naismith (2007) suggested the types of administrative information that can be sent via SMS included: notices of changes and cancellations; reminders to submit assignments, reminders to collect assignments, and notices of relevant lectures/activities. In the second interviews, some participants believed that SMS would also be useful to send quizzes in order to encourage them to study more. Research has shown the usefulness of SMS for sending quizzes in higher education settings (Abu Ziden & Abdul Rahman, 2013). This finding suggests that participants started to think about other possible uses of SMS, and they believed that SMS would also be useful to send short quizzes that would motivate them to study.

The findings showed that students' perceptions of SMS as an educational tool were strongly related to their perceptions of SMS ease of use and usefulness as a communication tool. For instance, the reported difficulties of using SMS due to the limited number of

characters that can be sent in one SMS made the students believe that SMS is useful for sending simple educational content that depends on memorisation rather than comprehension, short administrative messages, or short quizzes. In addition, students' positive perceptions of the usefulness of SMS for convenient and direct communication made them believe that educational SMS would allow them to receive key points of the lectures and important short details of the lectures.

The findings have several implications for how institutions of higher education could implement SMS to support teaching and learning. The nature of the courses in which SMS can be used to support teaching and learning needs to be carefully considered. Course information should be carefully selected. For instance, the types of the educational content that can be sent via SMS would include the main concepts and the key points of the lectures. In addition, educational SMS can be used to deliver details related to the course that the students might fail to notice during the class. The educational content in these courses should suit SMS communication, as many aspects could be reduced to short messages (e.g. one programming statement) that could stand alone and retain meaning. Examples of such courses include foreign language and programming language courses, where foreign language tips or a code statement and its explanation can be sent in one SMS message. The educational content of the SMS should be carefully selected. The educational content of SMS should be simple and short, and should fit in one, clear, understandable message. However, the content of educational SMS should not be trivial and should include significant details related to the educational content.

The findings support the previous argument that suggest that institutions of higher education can profitably send important and time sensitive administrative information. On the university level SMS can be used to send students key dates for registration and enrolment. On a class level, SMS can be used to send students course management-related information such as assignment due dates and absentee rates. The findings suggest that besides the possible use of SMS in higher education to send educational and administrative content, SMS can also be used to send quizzes in the form of short questions for students. Institutions of higher education could use SMS to support face-to-face instruction rather than SMS being the main educational tool in the class. The integration of technology into

the educational process should be accompanied with showing the students the positive benefits of such integration on their learning.

6.5 Participants' Attitudes toward the Use of SMS as an educational tool

In the two rounds of interviews, most participants expressed positive attitudes toward the use of SMS as an educational tool. The interview participants explained the reasons for these positive perceptions. In line with the TAM model, students' reported reasons for positive attitudes toward the use of SMS as an educational tool were closely related with their perceptions of SMS ease of use and usefulness as an educational tool. For instance, participants who had positive feelings toward the use of SMS as an educational tool explained that these feelings were related to their positive perceptions of the usefulness of SMS as an educational tool.

Some participants liked the use of SMS as an educational tool because it allowed them convenient and easy access to important educational information through their phone. This finding is aligned with similar research studies that showed an association between students' attitudes toward SMS and their perceptions of SMS ease of access (Lu, 2008; Zhang et al., 2011). The other reported reasons for students' positive attitudes toward the use of SMS as an educational tool were related to the implications for their learning experience. The students believed that receiving SMS would remind them about the course and that they needed to study, thus increasing their thoughts about the course content outside of class. Some students ascribed their positive attitudes toward the use of SMS as an education tool to the benefit of SMS in allowing them to take advantage of their free time. Such results aligned with findings from Zhang et al.'s (2011) study. Zang et al. found that students appreciated educational SMS since they made them use their small fragments of time for study. Regarding receiving English vocabulary via SMS, one student in their study stated, "Reading words from text messages is really a time killer during meals, and it helped us make full use of fragmented time" (p. 208). Students said that they liked the use of SMS as an educational tool because it would motivate and encourage them to study. In addition, the content of educational SMS might motivate the students to look for more information. Related findings were described in Zhang et al.'s (2011) study. They found

that students highlighted the motivational role of receiving educational SMS for their language learning.

Another reason for students' positive attitudes toward the use of SMS was related to the positive perceptions of the usefulness of SMS in improving their connection to the class and to the instructor. In addition, some students ascribed their positive attitudes toward the use of SMS to the advantages of SMS in regulating their academic study time. A similar finding was reported in Lim et al.'s (2011) study. They reported that the students found educational SMS had helped them in managing the process of reviewing educational content. The students liked receiving information regarding the course content that helped them to review the course and to get through exams and homework. Such positive attitudes toward the use of SMS as an educational tool were expected after its actual use for one semester. This finding aligned with experimental research studies that showed the positive effects of educational SMS on students' learning (Cavus & Ibrahim, 2009; Zhang et al., 2011; Kert, 2011).

However, the participants reported some concerns related to their attitudes towards the use of SMS as an educational tool related to SMS ease of use and usefulness as an educational tool. In the first interviews, participants reported issues related to their attitudes toward the use of SMS as an educational tool were associated to the way SMS was used and the type of information sent. Participants expressed concerns regarding the type of content and the frequency of receiving it. For example, they said they would not like receiving too many SMS, or receiving SMS at inappropriate times. Educational content that needed to be memorised was viewed much more positively than information that needed to be comprehended, such as the main concepts of the class that did not need much explanation. Combining timing and content, they did not like the idea of receiving educational content before it was addressed in a lecture. This result aligns with the findings from other studies that show students preferred to receive a limited number of educational SMS at certain times (Hayati et al., 2013). The second issue was of phrasing the content of educational SMS. Since only text can be sent via SMS, the phrasing of the text was important to attract students' attention and make the use of SMS more fun. Participants also reported that they wanted SMS to be a tool for two-way communication between the

teacher and the students. This reflects their belief that SMS can increase the connection between teacher and students.

Overall, findings from the interviews showed that there were strong associations between students' attitudes toward the use of SMS as an educational tool and their perceptions of the usefulness of SMS as an educational tool. The reported beliefs that affected students' attitudes toward the use of SMS as an educational tool were similar to the ones that contributed to students' perceptions of the usefulness of SMS as an educational tool. In addition, there were associations between students' perceptions of SMS ease of use and their attitudes towards the use of SMS as an educational tool. For instance, students said they liked the use of SMS as an educational tool because it was an easy and convenient way to access educational content. Such relationships are aligned with TAM's (Davis, 1986) assumptions and the questionnaire results (see Section 6.1), which indicate that students' attitudes toward the use of SMS as an educational tool are strongly related to their perceptions of SMS ease of use and perceptions of the usefulness of SMS as an educational tool. Besides the effects of students' perceptions of SMS ease of use and usefulness on their attitudes toward the use of SMS as an educational tool. Participants reported that they liked the use of SMS as an educational tool because they liked using SMS in general, or because they liked the use of the technology in education. Therefore, students' positive perceptions of the usefulness of SMS as an educational tool, their positive perceptions of SMS ease of use, and their positive attitudes toward the use of technology in education contributed to their positive attitudes toward use of SMS as an educational tool.

Further, reported issues that would affect students' attitudes toward the use of SMS as an educational tool were related to the issues that contributed to students' perceptions of the usefulness of SMS as an educational tool. For instance, the reported difficulties of using SMS due to the limited number of characters that can be included in one message made the students like its use in particular ways (e.g., to send simple educational content and short administrative information). Some participants disliked the use of SMS as an educational tool because they did not like the application of technology in education, and preferred traditional educational approaches such as paper based ones and face-to-face educational settings. Studies that have examined students' attitudes toward the integration of different technologies have shown that there were always some students who had negative attitudes

toward the integration of technology in education (Dørup, 2004; Simsek, 2008; Kubiato, 2010; Safar, 2012). In addition, studies that have investigated students' attitudes toward the use of SMS as an educational tool have shown that there is always resistance to the use of mobile phone applications in education. For instance, Brett (2011) found that 32.2% out of 207 participants agreed that they did not like the use of mobile phones in their learning.

The association between students' perceptions of the usefulness of SMS and their attitudes suggests that it is important to inform student users of the specific useful aspects and consequences of integrating SMS in their learning. Institutions of higher education could make students aware of the usefulness of SMS as an educational tool through different ways such as seminars, brochures and presentations. Implementation of SMS as an educational tool should consider students' underlying reasons for their attitudes toward the use of SMS as an educational tool. For instance, the use of SMS as an educational tool would be most effective when aligned with students' preferences regarding the way SMS is used, its implications for their learning and type of educational content that would be sent via SMS. The findings regarding students' attitudes toward the use of SMS as an educational tool showed that in implementing SMS learning it was useful to understand students' reflections of such implementation. The integration of SMS, including educational SMS, should be accompanied with showing the students the potential benefits of using technology and SMS in education. The ways of integrating SMS in the educational process, as well as the types of educational content sent via SMS should align with students' beliefs regarding the implementation of SMS to support teaching and learning. The positive attitudes toward the use of SMS in education would suggest that students are expected to use SMS in their education once it becomes available to them.

6.6 Conclusion

The findings contribute to the knowledge of using the TAM to look at Kuwaiti students' use of SMS as an educational tool. The original TAM was valid for explaining students' acceptance of using SMS as an educational tool. The results of the regression analysis indicated the two predictors, students' perceptions of SMS ease of use and students' perceptions of the usefulness of SMS explained 75% of the attitude variance. Such a strong relationship between students' perceptions of the usefulness of SMS as an

educational tool and their attitudes toward its use as an educational tool was also evident in the qualitative data. In the process of the implementation of SMS as an educational tool, the findings suggest that institutions of higher education should consider positive and negative beliefs related to SMS ease of use and usefulness as an educational tool.

Kuwaiti students were more likely to have access to a mobile smartphone than a laptop, which suggests use of the mobile and SMS would be a strategy for more students to access learning outside of lectures and the university. Further, they had positive perceptions of SMS ease of use as a communication tool. The use of SMS in education does not require special expensive infrastructure for the students of the institutions of higher education, as the students have the required software and hardware in their hands all the time. This is critical in developing countries, in which students have often limited access to other expensive ICTs that might be used to support higher education.

Interview data confirmed this. The findings suggest that institutions of higher education can integrate SMS without training students. However, the integration of SMS for educational purposes should consider the nature of the courses in which SMS can be used to support teaching and learning. The educational content in these courses should align with affordances and limitations of SMS communication. Examples of such courses include foreign language and programming language courses, where foreign language tips or a code statement and its explanation can be sent in one SMS message. The educational content of SMS should be carefully selected, it should be short, fit in one message, and it should be clear and understandable. In addition, the use of SMS as an educational tool should avoid using the Arabizi alphabet, as not all students are familiar with the SMS abbreviations involved. Educational SMS can be used to send messages with a limited number of characters (e.g. one programming statement) that could stand alone and retain meaning.

Participants had positive perceptions of the usefulness of SMS as a communication tool. Students believed SMS was useful for sending important information, which could be related to educational content or possibly administrative and time sensitive information. Students felt SMS was convenient, quiet, available, one-to-many, and cheap. Given students' positive perceptions, institutions of higher education could use SMS as a communication and educational channel. The relation between students' perceptions of the usefulness of SMS as a communication tool and the usefulness of SMS as an educational

tool was evident in the findings. The results showed that students believed SMS was a useful way to promote learning through sending educational content. Students felt SMS helped them make the best or most effective use of their free time and motivated them to study, kept them connected to the class and instructor, regulated their academic study time, and helped them remember and understand educational content. However, they felt strongly that the content of the educational SMS needed to be carefully selected. The criteria for selecting educational content included sending important stand-alone educational content that supplemented face-to-face instruction, and simple educational content that needed to be memorised rather than complicated educational content that needed to be comprehended. However, the content of the educational SMS should not be trivial but should include significant details related to the educational content. Beside educational content, SMS can be used in higher education to send important administrative information and quizzes. SMS should be sent at appropriate times and frequencies and the SMS content should be synchronised with lectures content. In addition, SMS should be phrased in a way that captures students' attention such as starting with questions or indicating importance.

The findings regarding students' attitudes toward the use of SMS suggest positive beliefs and perceptions towards use of SMS for educational purposes, and that students would like to use SMS in their learning. Participants seemed to ascribe their attitudes toward educational SMS to their general attitudes about use of technology in education, as well as drawing on to their perceptions of SMS ease of use and usefulness as a communication and an educational tool. However, the results also showed that some students initially had negative perceptions of SMS as an educational tool. While their perceptions would be likely to change after positive experiences using SMS, this does highlight that students' attitudes were not uniform. This is an important consideration for the university, to understand that not all students would be prepared to adopt SMS as an educational tool. However, these beliefs can change. For instance, in the second interviews, students no longer complained about some aspects of using SMS as an educational tool (e.g., timing and frequency of using SMS). It is likely students will adopt more positive attitudes when they understand how SMS can be useful.

The findings showed that TAM can be used to understand Kuwaiti students' acceptance of using SMS as an educational tool. Students' perceptions of SMS ease of use

and usefulness would affect students' acceptance of its use as an educational tool. In order to improve students' acceptance of the use of SMS as an educational tool, several considerations in relation to the way of using SMS, the implications of SMS for learning, and the content of SMS should be decided in light of students' expectations and concerns.

Chapter 7: Conclusions and Recommendations

The aim of this study was to examine relations between Kuwaiti students' perceptions of ease of use, usefulness and attitudes toward the use of SMS to support teaching. Such relations were examined to better understand students' acceptance of educational SMS. Research had previously shown that use of SMS as an educational tool had some advantages (Lu, 2008; Cavus & Ibrahim, 2009; Zhang et al., 2011; Kert, 2011). Moreover, mobile phone and SMS usage is very popular among university students including Kuwaiti students (Ibahrine, 2008; ITU, 2012). To investigate this, the study examined students' perceptions of and attitudes about SMS before and after one semester of use in two university subjects. SMS technology was introduced in programming language-related classes and an English language class in Kuwait University to serve as a tool for education. The underpinning theoretical framework of the study was the original Technology Acceptance Model (TAM). The original TAM represents a simple model that has proven validity in explaining users' acceptance of different types of technologies in a number of domains.

The study employed a mixed methods research design with a mixed sequential procedure, including pre and post interviews and the SMS intervention, which had a one-group pre-test/post-test pre-experimental design. The participants included 171 university students from Kuwait University. Twelve students participated in two rounds of interviews. Results showed that students held positive beliefs about the use of SMS and its usefulness in communication. These beliefs were also evident in their beliefs about the use of SMS in education. Students felt that SMS was a useful tool to communicate in learning, to motivate and help regulate their study. However, they also felt educational content needed to be short and concise, and that messages needed to be sent at appropriate times and that they should be engaging. Findings suggest that, given students' positive perceptions and beliefs, SMS could usefully be integrated into higher education. The following sub-sections elaborate on these points and address each of the research questions.

7.1 Research Question 1: What are the perceptions of students at Kuwait University of the ease of use and usefulness of SMS?

Different aspects of students' perceptions of SMS were measured, including their perceptions of SMS ease of use and usefulness as a communication tool and their perceptions of the usefulness of SMS as an educational tool. Results showed that the participants believed that SMS was an easy-to-use and useful communication tool. Kuwaiti students' perceptions of SMS ease of use and usefulness as a communication tool ranged between slightly positive to moderately positive. Students' experiences of using SMS contributed to forming their positive perceptions of SMS ease of use and usefulness. The findings showed that almost all the participants (97.7%, $n=167$) reported using SMS and that they had been using SMS for approximately five years. The analysis of the students' responses regarding their use of SMS showed that they used SMS for mainly two purposes: social interaction and receiving information.

After the use of SMS as an educational tool for one semester, questionnaire results showed that students continued to perceive SMS as an easy-to-use and useful communication tool. At the end of the semester students also indicated that they now found it easier to retrieve old SMS messages on their phones. This may have been a result of students having more experience storing and retrieving old SMS in their phones during the use of SMS as an educational tool for one semester. The absence of significant changes in students' overall positive perceptions of SMS ease of use and usefulness as a communication tool can be ascribed to experiences using SMS before the use as an educational tool in the current study. Further, the results showed that the engineering major students perceived SMS to be easier and more useful as a communication tool than did the non-engineering students. There was also a significant relationship between frequency of receiving SMS and students' perceptions of the ease of use and usefulness of SMS as a communication tool.

The interviews provided a deeper explanation of questionnaire results regarding students' perceptions of SMS ease of use. All the interview participants reported that the use of SMS was easy. Participants believed that SMS was easy-to-use because it required simple steps to send or to receive messages. While they felt SMS was easy-to-use, some participants reported problems that limited the effectiveness of SMS use. These perceptions

most commonly related to specific communication-related issues of typing text using old mobile phones or new mobile phones and the limited number of characters that can be sent in one SMS. However, these also affected issues related to interpreting message content such as understanding the received SMS, use of SMS for long conversations and understanding the feelings of the sender of the SMS. In addition, the students had concerns regarding the use of Arabizi in SMS and the associated difficulties interpreting the received SMS. However, after the use of SMS for one semester, the students continued to mention the same negative issues except for the use Arabizi.

Interview data showed that participants believed SMS was a useful communication tool. In the first and second interviews, the repeated reasons for students' positive perceptions were primarily related to how SMS supported or enhanced the communication of content. Participants believed SMS was useful for convenient and direct communication. In the second round of interviews and after one semester of use, participants provided more explanations and information regarding the perceived usefulness of SMS. Some felt SMS was useful for informal learning and that it may be useful in overcoming some cultural communication issues.

Extending perceptions of the usefulness of SMS as a communication tool, participants also believed that SMS was useful as an educational tool. Perceptions of usefulness of SMS as an educational tool ranged between neutral and slightly positive. However, questionnaire results showed that participants' overall perceptions of the usefulness of SMS as an educational tool did not significantly change after its use for one semester. However, there was significant change in students' beliefs regarding the effect of educational SMS on their learning. The students had overly optimistic perceptions of SMS, and positive bias possibly resulting from personal experiences and positive beliefs about digital technologies, before its use as an educational tool. The students had positive perceptions of the effect of SMS on their learning performance when they learnt about how it would be used as an educational tool. However, after its use for one semester, such perceptions were lower than their original perceptions.

The engineering major students perceived SMS to be more useful as an educational tool than non-engineering students. This is possibly a result of having more experience using different technologies and/or general positive beliefs about technology use (e.g.

Margaryan et al., 2011). Furthermore, there was a significant relationship between frequency of receiving SMS and students' perceptions of the use of SMS as an educational tool. Most of the interview participants believed that SMS would be useful as an educational tool. The results show three categories relating to positive perceptions of SMS as an education tool: i) access to educational content; ii) implications for learning experience (e.g. allowing the students to utilise their short periods of free time, reminding and motivating the students to study, improving their connection to the class and instructor, regulating their study), ii) the role of SMS in reminding students of educational content and making them understand it; and iii) information type and learning, (e.g. allowing the students to receive key points of the lectures and allowing the students to pay attention of small details related to the course).

However, some participants expressed concerns. These concerns can be grouped into two main categories: i) information type and learning, (e.g. sending complicated information needing comprehension rather than memorisation, sending administrative information and sending quizzes, and use as a complementary tool rather than as an educational delivery tool); and ii) aspects of sending educational SMS, (e.g. inappropriate time and frequency of messages and phrasing SMS in a way that would gain students' attention). In the second interviews, students continued expressing their concerns regarding ways of using educational SMS in terms of phrasing messages in a way that would attract the students' attention and they reported some new concerns regarding the usefulness of SMS in programming courses, the lack of synchronisation between SMS and lectures; and the use of SMS as a two-way communication tool.

Overall, the questionnaire and interview results showed that students had positive perceptions of SMS ease of use and usefulness as a communication and education tool. However, the interview results showed that some students initially had negative perceptions of SMS as an educational tool. Their perceptions would be likely to change after positive experiences using SMS. Therefore, the reported affordances and limitations of SMS need to be considered when using SMS as an educational tool.

7.2 Research Question 2: What are the attitudes of students toward the use of SMS to support learning and teaching at Kuwait University?

Participants' attitudes toward the use of SMS as an educational tool ranged between neutral to slightly positive. Students' attitudes toward the use of SMS as an education tool did not significantly change after use over one semester. This was likely to be a result of the short timeframe of the intervention. Similar to their perceptions of the usefulness of SMS as an educational tool, the engineering major students expressed more positive attitudes toward the use of SMS as an educational tool when compared to non-engineering students. A possible explanation is that engineering students were more familiar and experienced with the application of technology in education and that this made them have positive attitudes towards its use as an educational tool (Margaryan et al., 2011).

However, in the first and second interviews, the majority of the participants expressed positive attitudes toward the use of SMS as an educational tool. The interview participants explained their reasons for this. The findings from the interviews showed that there were strong associations between students' attitudes toward the use of SMS as an educational tool and their perceptions of the usefulness of SMS as an educational tool. The reported beliefs that would affect students' attitudes toward the use of SMS as an educational tool were similar to the previously discussed ones that contributed to shaping students' perceptions of the usefulness of SMS as an educational tool. In addition, there were associations between students' perceptions of SMS ease of use and their attitudes towards the use of SMS as an educational tool. Such relationships aligned with a basic assumption of the TAM (Davis, 1986) that positive beliefs about use contribute to positive attitudes. Participants seemed to ascribe their attitude toward educational SMS to their general attitudes about use of technology in education, as well as drawing on to their perceptions of SMS ease of use and usefulness as a communication and an educational tool.

Besides the effects of students' perceptions regarding SMS ease of use and usefulness on their attitudes toward the use of SMS as an educational tool, there were associations between participants' attitudes towards the use of SMS as an educational tool and their beliefs and attitudes towards the use of the technology in education. Ultimately, the results showed that students' positive perceptions of SMS's usefulness as an educational tool, their positive perceptions of SMS ease of use, and their positive attitudes

toward the use of technology in education contributed to their positive attitudes toward the use of SMS as an educational tool. The findings regarding students' attitudes toward the use of SMS suggest positive beliefs and perceptions towards use of SMS for educational purposes, and that students liked using SMS and would like to use SMS in their future learning. It is likely students will adopt more positive attitudes when they understand how SMS can be useful.

7.3 Research Question 3: What is the relationship between students' attitudes toward using SMS and their perceptions of the usefulness and ease of use of SMS technology?

The TAM (Davis, 1986) argues that perceived usefulness and perceived ease of use factors can predict a user's attitude toward using a technology. The findings from the current study showed that TAM was valid for explaining the relationships between students' perceptions of SMS and their attitudes toward its use. The statistical analysis showed that students' attitudes toward the use of SMS as an educational tool strongly correlated with their perceptions of SMS ease of use as well as their perceptions of its usefulness as an educational tool. The results of the regression analysis indicated the two predictors, students' perceptions of SMS ease of use and students' perceptions of the usefulness of SMS explained 75% of the attitude variance ($R=.867$, $F(2,168)=254.66$, $p<.05$). In addition, it was found that students' perceptions of SMS ease of use significantly predicted their attitudes toward the use of SMS ($\beta = .11$, $p<.05$), as did students' perceptions of the usefulness of SMS ($\beta = .81$, $p<.05$). The statistical analysis showed that the relationships between participants' perceptions of the usefulness of SMS and their attitudes toward its use as an educational tool were stronger than the relationships between students' perceptions of SMS ease of use and their attitudes toward the use of SMS as an educational tool.

The strong relationship between students' perceptions of the usefulness of SMS as an educational tool and their attitudes toward its use as an educational tool was also clear in students' responses to the interviews' questions. The interviewed students who reported negative perceptions regarding the usefulness of SMS as an educational tool were the same students who reported negative attitudes toward the use of SMS as an educational tool. The students explained their feelings about the use of SMS in education through their beliefs

about the use of SMS as an educational tool. There were overlaps in the participants' comments on the usefulness of SMS and their attitudes toward the use of SMS as an educational tool.

The findings from the questionnaire and interviews showed that students' attitudes toward the use of SMS as an educational tool was sufficiently related to their perceptions of SMS ease of use and the usefulness of SMS as an educational tool. The relationship between students' attitudes and their perceptions of the usefulness of SMS was stronger than the relationship between students' attitudes and their perceptions of SMS ease of use. In order to improve students' acceptance of educational SMS, students' reported affordances and limitations of SMS need to be considered when using SMS as an educational tool.

7.4 Recommendations for Practice

Based on the findings of the current study, several recommendations can be offered for policy and practice in relation to the use of SMS messages or similar technologies in the field of higher education. These recommendations relate directly to strategies that can be implemented by policy makers and practitioners to ensure the success of SMS integration and to ensure that the students get benefits from the use of SMS as an educational tool. The recommendations, in relation the integration of SMS to support teaching and learning, relate to three categories: the type of content that is sent to the university students, the way in which educational SMS is used, and the implication of SMS for students learning.

Regarding the content of the educational SMS, SMS can be used to support university students' formal learning, for example to send important key points of lectures or critical small details of the lectures that students need to remember and understand. In addition, SMS can also be used to send quizzes in the form of short questions. The courses, in which SMS would be used to support educational processes should be carefully selected. The educational content in these courses should suit the limitations of SMS communication, as many aspects could be reduced to small messages (e.g. one programming statement) that could stand alone and retain meaning. The educational content of SMS should be short, and should fit into one message, and they should be clear and understandable. In addition, the educational content of SMS messages should be simple

facts which need to be memorised rather than complicated educational content that needs to be comprehended. Besides selecting appropriate educational content, the findings suggest students felt SMS should be written in ways that motivate them to pay attention, for example by starting with questions or indicating importance – for example, “*do you remember ...*”, “*do you know ...*”, or “*do not forget ...*”. Furthermore, the educational content of SMS should avoid confusing acronyms. In addition, to the educational content, SMS can be used to communicate time-sensitive administrative information (e.g., key dates for registration and enrolments and assignments due dates). In view of students’ positive perceptions regarding the quietness of SMS, institutions of higher education can take advantage of such perceptions by using SMS to send different types of private information that students may not wish to share with other people (e.g., exam results or absentee rates). Universities could take advantage of students’ positive perceptions of the usefulness of SMS in saving their time and effort in accessing information and administrative (e.g., using SMS to register for classes, to inform students about cancellation of classes, or to inform students about instructor absence). Since students are used to using SMS for coordinating events and sending social greetings, SMS could be used in higher education institutions for publicising key social functions (e.g., to invite students to attend events and to send holiday greetings to them).

The findings suggest different ways of using SMS to support teaching and learning. Similar to its use in the current study, SMS could be used as an out-of-class educational tool. In such use, the findings suggest that the timing and the frequency of educational messages should be appropriate and they should appropriately synchronised with lectures, but that SMS could be used as supplements to face-to-face instruction. While students were accepting of receiving educational SMS outside of lectures, they were quite specific about the appropriate timing of messages. They felt SMS should be sent on weekdays rather than weekends. SMS should not be sent too early or too late and so they should be sent in the afternoon. The number of SMS should be one to two a week. All SMS should be sent from one particular phone number in order to make it easier for the students to review the entire received SMS from the university at once. In addition to the use of SMS as an out-of-classroom educational tool, the findings regarding the convenience of receiving educational SMS imply that that SMS could also be used as an in-class educational tool. In addition,

since it is very cheap to send SMS, institutions of higher education could use SMS for two-way communication and as an educational tool, where the students could use SMS to request information and the university could reply via SMS. Institutions of higher education could use SMS as an optional communication channel for students with limited internet access or for communication with those who are not present on campus.

Regarding the implications of SMS for students' learning experiences, participants found SMS helped them to keep connected to their classes and instructors, helped them to keep thinking about educational content, allowed them to take advantage of their short periods of free time, and kept them in touch with their classes. Students' beliefs that SMS motivated them and improved their learning were very positive perceptions. Institutions of higher education can take advantage of the motivational benefits of educational SMS to help students organise and manage their study time. This suggests that institutions of higher education could usefully implement educational SMS to promote learning, to develop and maintain a feeling of connection throughout the academic semester, and to provide social and academic support for first year university students to improve transition from school to university. In addition, educational SMS could be used to support students who might be at risk in certain classes. Therefore, it is possible that SMS could be used to encourage them to attend lectures, tutorials and workshops, as well as to complete assignments. The findings suggest that to improve students' academic study time during the semester, educational SMS should be sent over the whole semester regularly and at specific times. This would help students organise their study time.

7.5 Recommendations for Theory and Future Studies

The findings contribute to the body of knowledge on using the TAM to look at Kuwaiti students' use of SMS as an educational tool. This research included a new population to be examined regarding SMS use, using the original TAM, where the study involved university students from different majors at Kuwait University. The original TAM was shown to be valid for explaining Kuwaiti university students' acceptance of using SMS as an educational tool. The findings suggest that the original TAM was valid, in that results were in agreement with previous studies using the TAM, and could be used in other higher education settings in Arab cultures. However, to confirm the validity of the TAM, the study

would need to be replicated. In order to better understand Kuwaiti students' acceptance of the use of SMS as an educational tool, future research studies could build on the current study by utilising extended versions of TAM to examine other factors affecting students' attitudes toward the use of SMS as an educational tool and their intentions to use SMS as an educational tool. Examining other factors that affect students' attitudes toward the use of SMS as an educational tool would help in the design and implementation of strategies for using SMS in higher education.

There is certainly scope for further studies to investigate students' acceptance of the use of SMS as an educational tool. Based on the findings of the current study, further studies might be developed to enhance knowledge in the investigated area. Since the current study was one of the first in the Kuwaiti educational system that investigated the integration of SMS as an educational tool, additional studies are required to enhance knowledge on this topic. The findings of the current research showed that the use of SMS as an educational tool in Kuwait University would be accepted by the students. However, future studies might be conducted in different study settings, disciplines, research samples, sampling procedures, data collection methods and ways of using SMS.

The recent development of internet messaging applications and their popularity among higher education students might suggest that upcoming studies should examine the use of such technologies in combination with SMS technology in the higher education field and students' reactions to such integration. Further investigation of the use of SMS among Kuwaiti students and the digital divide would provide a clearer vision of the differences in the use of SMS and other technologies based on students' socio-economic status. Students' attitudes were measured at the beginning and at the end of the semester in which SMS was used as an educational tool. Future research needs to consider attitude change over a longer period of time, where students' attitudes toward technology are a function of time.

In the current study the sample size was 171 students, with the majority of participants coming from the engineering department. Future research studies should consider having a large sample of students across a range of disciplines in order to improve generalisability of the findings. Further validation of the questionnaire and interview instruments is recommended for future research studies. The current research study collected data from students in only one university; future research should replicate the

current study across several universities. Besides studies that investigate students' perceptions and attitudes toward the use of SMS as an educational tool, there is a need to carry out studies that examine university faculty members' and administrators' attitudes toward the use of SMS as an educational tool in order to have a more comprehensive understanding of the acceptance of SMS from different sources.

Besides the role of SMS in direct support to students' learning, students reported that educational SMS had a positive effect on their motivation, self-regulation in study, and their connection to the class and the instructor. Such affordances of educational SMS should be investigated through future research studies. Unlike other electronic communication tools, SMS can only be used to send text. Text might not capture students' attention as well as other types of media such as pictures, audio or video. Therefore, the ways in which educational SMS messages are phrased should be carefully considered. Students emphasised that educational SMS should use attention-getting introductory phrases. Future research should examine ways of phrasing educational SMS to capture students' attention and to make them more engaging. Furthermore, some students pointed out the importance of using SMS to promote interactions between instructors and students. They said that SMS should be used as a two-way communication tool between students and their instructors. The current study was limited to examining the use of SMS as a one-way educational tool. Future studies should examine other uses of SMS which support teaching and learning, for example in two-way communication between the students and their instructors. The examination of the use of SMS in different ways would show the benefits and limitations of such use, and this information could be used to inform policy and practice in relation to the use of SMS in higher education.

7.6 Conclusions

The results of this study showed that students' had positive perceptions of SMS ease of use and usefulness as a communication and education tool. Students would like to use SMS in their learning. Participants seemed to ascribe their attitude toward educational SMS to their general attitudes toward the use of technology in education, as well to their perceptions of SMS ease of use and usefulness as a communication and an educational tool. However, the interview results showed that it is likely students will adopt more positive

perceptions and attitudes when they understand how SMS can be useful. The findings aligned with TAM (Davis. 1986). The findings contribute to the knowledge of using the TAM to look at Kuwaiti students' use of SMS as an educational tool, where the original TAM was valid for explaining students' acceptance of using SMS as an educational tool. Indeed, Kuwaiti students participating in the study had more access to mobile phones than laptop computers, suggesting that the use of mobiles and SMS to support learning would increase students' access to learning outside of lectures and the university.

The empirical findings of this research should guide higher education practitioners' efforts to enhance the adoption of technology in education, particularly SMS technology. The findings of the current study have practical value for faculty members who wish to use SMS to support face-to-face teaching. The key message is for faculty to pay particular attention to: the selection of the content of SMS, ways of using SMS and the implications of SMS for learning.

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Appendices

Appendix A: Student Consent Form

A Study of Students' Perceptions and Attitudes toward the Use of SMS to Support Learning and Teaching at the Kuwait University.

Researchers: Budour AlMisad (Faculty of Education, University of Wollongong),

I have been given information about *a study of students' perceptions and attitudes toward the use of SMS to support learning and teaching at the Kuwait University* conducted by **Budour AlMisad**. I have had an opportunity to ask any questions I may have about the research and my participation.

I understand that, as part of this research, I will be invited to participate in two questionnaires. Also, give my consent I may be asked to participate in two interviews, one at the beginning of the semester and the other at the end of it. Both the questionnaire and interview questions will ask for my experience SMS as educational tool, my attitudes toward using SMS as tool of education, and my perceptions of educational SMS technology's ease of use and usefulness. I understand I can participate in the questionnaires and choose not to participate in two interviews.

I understand that by completing the questionnaire that I have given my tacit consent to participate in that portion of the research. I understand that my written consent, by way of this consent form, is necessary to confirm my participation in the interviews. By ticking the box below, I am indicating whether I would participate in the interviews:

I agree to be interviewed by the researcher ☐ Yes ☐ No

I agree to allow the interview to be audio-taped ☐ Yes ☐ No

I agree to make myself available for a further interview if required ☐ Yes ☐ No

I understand that if I choose to participate, the following methods will be used to protect my privacy:

- identifying details, such as names and phone numbers, will not be directly linked to my responses, research ID numbers will be used to identify participants,
- data collected will be stored securely in a locked filing cabinet or password protected computer, and will only be accessed by the researchers,
- only general findings and anonymous data will be used in publications arising from this study.

I understand that my participation in this research is voluntary. I am free to refuse to participate and I am free to withdraw from the research at any time. I understand that a research ID number will be used to identify my interview responses, but that all responses will be kept confidential and only available to the researcher. If there are any questions in the interviews that I do not want to answer because I feel uncomfortable about doing so then I can choose to skip the question. My refusal to participate or my withdrawal of consent will not affect my participation or performance in the courses I am taking, nor will it affect my relationship with the Kuwait University. I understand that if I withdraw after completing the questionnaire or the interviews I can request to have my data removed from analysis and reporting.

If I have any enquiries about the research, I can contact Dr. Sarah Howard by phone on +61 (0)2 4221 3664 or

by email at sahoward@uow.edu.au or Budour AlMisad, by phone on +96566424253 or by email at ba622@uowmail.edu.au. If I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 02 4221 4457 or by email at rso-ethics@uow.edu.au.

By signing below I am indicating my consent to participate in the research as it has been described to me in the information sheet. I understand that the data collected from my participation will be used anonymously for thesis, conference, and journal publications, and I consent for it to be used in that manner outlined above.

Signed

Date

.....

...../...../.....

Name (please print)

.....

Appendix B: Students Information Sheet

TITLE: A Study of Students' Perceptions and Attitudes toward the Use of SMS to Support Learning and Teaching at the Kuwait University.

PURPOSE OF THE RESEARCH

This is an invitation to participate in a study conducted by researchers at the University of Wollongong. The main goal of this study research is to investigate the effects of using Short Message Service (SMS) technology as an educational tool on the Kuwaiti students' attitudes towards and perceptions of using SMS to support learning and teaching.

INVESTIGATORS

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METHOD AND DEMANDS ON PARTICIPANTS

For the purpose of this research study students enrolled in courses at the College of Computer Science and Engineering of Kuwait University in Kuwait were selected in order to use the SMS in their classes as an educational tool, where educational SMS will be sent to them regularly over one semester long. The content of these SMS will be small pieces of educational content e.g. short programming code and its explanation to help students invest short pockets of their free time to learning or reviewing course content within the day.

If you consent to participation, you will be asked to complete two paper-based questionnaires, one at the beginning of the semester and the other at the end of it. The first questionnaire, completed at the beginning of the course, will ask for your experience with technology in general and SMS in particular, your attitudes toward using SMS as tool of education, and your perceptions of educational SMS technology's ease of use and usefulness. In addition, questionnaire you will be given the option to provide your mobile number, to receive SMS messages. The second questionnaire, to be completed at the end of the course, will ask for similar information. Each questionnaire will take approximately 10-15 minutes.

Some questions you might be asked in the questionnaire are:

- What type of ICT use regularly for personal purposes?
- What type of ICT use regularly for educational purposes?
- In average, how often do you receive SMS?

In addition, the researcher will invite 12 students to participate in two interviews, one at the beginning of the semester and the other at the end of it. The interviews' questions will ask for your experience SMS in particular as educational tool, your attitudes toward using SMS as tool of education, and your perceptions of educational SMS technology's ease of use and usefulness. Each interview will last approximately 30-40 minutes.

Some questions you might be asked in the interviews are:

- Do you find SMS easy or difficult to use?
- Do you think the use of SMS as an educational tool (e.g., to receive small bite of educational content such as Code Snippets) will be useful or not useful for your learning? Why?
- Do or do not you like using SMS?

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Apart from the 10-15 minutes of your time for the questionnaire and 30-40 minutes for the interview, we can foresee no risks for you. Your involvement in the study is voluntary and you may withdraw your participation from the study at any time and withdraw any data that you have provided to that point. Your refusal to participate or withdrawal of consent will in no way affect your participation or performance in the courses that you are taking, nor will it affect your relationship with the Kuwait University. Information about who chooses to participate in the study and who does not, and data collected about participants is only available to the researchers.

FUNDING AND BENEFITS OF THE RESEARCH

This study is funded by from Kuwaiti government. The results of the study will provide a better understanding of students' experience of using SMS as an educational tool and how their experiences may impact on future study and teaching. These outcomes will be used to improve technology integration in for educational purposes. The results of this research will be used to improve technology integration in education at the university. Findings will also be reported in publications and in conference presentations so others can also benefit from the findings.

A research ID number will be used to identify your questionnaire responses. All responses will be kept confidential and only available to the researcher. If there are any questions you not want to answer on the paper-based questionnaire or in the interviews because you feel uncomfortable about doing so then you can choose to skip the question and leave the response blank. You understand that by completing the questionnaire, you have given tacit consent to participate in this part of the research.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Social Sciences Human Research Ethics Committee of the University of Wollongong. If you have any enquiries about the research, you can contact the either Dr. Sarah Howard by phone on +61 (0)2 4221 3664 or by email at sahoward@uow.edu.au or Budour AlMisad, by phone on +96566424253 or by email at ba622@uowmail.edu.au. If you have any concerns or complaints regarding the way the research is or has been conducted, you can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 02 4221 4457 or by email at rso-ethics@uow.edu.au.

Thank you for your interest in this study

Appendix C: In Class Verbal Presentation

Hello all,

In this subject we will introduce the SMS to support your learning. SMS will be sent to you over the semester. SMS will contain small piece of educational content e.g. programming code and its explanation over the semester. The SMS would help you investing short pockets of your free time to learning or reviewing course content within the day. To participate, you will be asked to provide your mobile number, to receive the SMS messages. It is integral to the research study that you will receive educational SMS messages. Your phone number will be kept confidential and will not be available to anyone except the researcher.

In order to measure how using SMSs supports your learning, we will invite you to participate in two paper-based questionnaires, one at the beginning of the semester and the other at the end of it. These will be handed out and collected in your tutorial classes. The first questionnaire will ask for your experience with technology in general and SMS in particular, your attitudes toward using SMS as tool of learning, and your perceptions of educational SMS technology's ease of use and usefulness. In addition, questionnaire will be used collect your phone number. The second questionnaire, to be completed at the end of the course, will ask for similar information. Each questionnaire will take approximately 10-15 minutes.

In addition, the researcher will invite 12 students to participate in two interviews, one at the beginning of the semester and the other at the end of it. The interviews' questions will ask for your experience SMS in general and as an educational tool in particular, your attitudes toward using SMS as tool of education, and your perceptions of educational SMS technology's ease of use and usefulness. Each interview will last approximately 30-40 minutes.

Participation in this research is voluntary, you are free to refuse consent of participation and you can withdraw from the research at any time

If I have any enquiries about the research, you can contact either Dr. Sarah Howard by phone on +61 (0)2 4221 3664 or by email at sahoward@uow.edu.au or Budour AlMisad, by phone on +96566424253 or by email at ba622@uowmail.edu.au . If you have any concerns or complaints regarding the way the research is or has been conducted, you can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 02 4221 4457 or by email at rso-ethics@uow.edu.au.

Appendix D: Questionnaire Instrument (First Round)

Section 1: Demographic data and ICT use

1. Gender

- Male
- Female

2. Age

- 18-20
- 20-25
- 26-30
- 31-35
- 36-40
- above 40

3. What is your major?

- Information technology
- Electrical Engineering
- Computer Engineering
- Civil Engineering
- Mechanical Engineering
- Chemical Engineering
- Petroleum and Industrial & Management System engineering,
- Architecture
- Mathematics
- Computer science
- Chemistry
- Physics
- Biological sciences
- Earth and Environmental Sciences
- Statistics and Operations Research
- Social Science
- Law
- Business
- Curricula and teaching methods,
- Educational psychology,
- Educational foundations,
- Educational administration& planning
- Islamic Studies
- Arts
- Medicine
- Pharmacy
- Other, please specify
- Preparatory Year

4. In which academic year you are in?

1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. Other, please specify

5. What type of ICT use regularly for personal purposes? Please check all that apply.

1. Mobile phone (That used for phone calls and SMS), e.g. Nokia, LG, Samsung, Sony, Motorola, Alcatel, etc
2. Smart phone (That used for phone calls, SMS, downloading application, and accessing the internet),

e.g. iPhone, Samsung Galaxy, HTC, Motorola Droid, LG Optimus, Nokia Lumia, BlackBerry, etc.

3. Desktop computer
4. Laptop computer
5. Games console
6. Digital camera
7. MP3 player (iPod)
8. Memory stick
9. Electronic organizer (PDA)
- 6. Do you use the internet?**
 - Yes
 - No
- 7. If yes, how frequently do you use the internet for personal purposes?**
 1. Many times a day,
 2. 2-3 times a day,
 3. Once a day,
 4. 2-6 times a week,
 5. Once a week,
 6. 2-3 times a month
 7. Once a month
 8. Never
- 8. If yes, how frequently do you use the internet for educational purposes?**
 - Many times a day,
 - 2-3 times a day,
 - Once a day,
 - 2 to 6 times a week,
 - Once a week,
 - 2-3 times a month
 - Once a month
 - Never
- 9. What type of ICT use regularly for educational purposes? Please check all that apply.**
 1. Mobile phone (That used for phone calls and SMS), e.g. Nokia, LG, Samsung, Sony, Motorola, Alcatel, etc
 2. Smart phone (That used for phone calls, SMS, downloading application, and accessing the internet), e.g. iPhone, Samsung Galaxy, HTC, Motorola Droid, LG Optimus, Nokia Lumia, BlackBerry, etc.
 3. Desktop computer
 4. Laptop computer
 5. Games console
 6. Digital camera
 7. MP3 player (iPod)
 8. Memory stick
 9. Electronic organizer (PDA)

Section 2: SMS Use

- 1. Do you own mobile phone or smart phone?**
 - Yes
 - No
- 2. What kind?**
 - Apple iPhone 5
 - Apple iPhone 4S
 - Apple iPhone 4
 - Nokia Lumia 920
 - Nokia Lumia 620
 - Nokia Asha 311
 - Samsung Galaxy S III LTE
 - Samsung Galaxy Note 2

- Samsung Galaxy Note 10.1
 - Samsung Ace
 - BlackBerry Z10
 - BlackBerry 9900
 - HTC One X
 - HTC 8X
 - Others, please specify.....
- 3. How many Mobile phones or smart phones do you have?**
- 1
 - 2
 - 3
 - 4
 - 5
 - More than 5
- 4. Do you use SMS?**
- Yes
 - No
- 5. If yes, how old were you when you started using SMS?**
- 6. In average, how often do you receive SMS?**
1. Many times a day,
 2. 2-3 times a day,
 3. Once a day,
 4. 2 to six times a week,
 5. Once a week,
 6. 2-3 times a month
 7. Once a month
 8. Never
- 7. In average, how often do you send SMS?**
1. Many times a day,
 2. 2-3 times a day,
 3. Once a day,
 4. 2 to 6 times a week,
 5. Once a week,
 6. 2-3 times a month
 7. Once a month
 8. Never
- 8. For what purposes you usually use SMS? Please circle all that apply?**
- To send and receive greetings
 - To chat with family and friends
 - Banking
 - Advertising
 - To vote in TV and Radio programs
- Others, please specify.....

Section3: students' perceptions and attitudes toward SMS

- The following items ask you to indicate your agreements with use of SMS
 - Please tell us about the ease of using SMS and its usefulness as a communication tool
-

SMS Perceived Ease of Use and usefulness as a communication tool Scale		Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	I think the SMS is an easy way to communicate	1	2	3	4	5	6	7
2	Retrieving old received or sent messages on my phones is easy.	1	2	3	4	5	6	7
3	I think interaction with SMS is clear and understandable.	1	2	3	4	5	6	7
4	It took me a long time to learn how to send and receive SMS.	1	2	3	4	5	6	7
5	Overall, I think the SMS easy-to-use.	1	2	3	4	5	6	7
6	I think SMS is an effective communication tool.	1	2	3	4	5	6	7
7	My communication is improved with the use of SMS.	1	2	3	4	5	6	7
8	SMS is a useful way to communicate.	1	2	3	4	5	6	7

- Please tell us about the usefulness of SMS -as an educational tool e.g., to receive small bite of educational content such as Code Snippets

SMS Perceived Usefulness as an Educational tool Scale		Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	My learning would be more effective if I use SMS as an educational tool.	1	2	3	4	5	6	7
2	My course performance would be improved if I use SMS as educational tool.	1	2	3	4	5	6	7
3	I think using the SMS as an educational tool would increase my productivity in my	1	2	3	4	5	6	7

	coursework.							
4	I can accomplish tasks more quickly, if I use SMS as educational tool.	1	2	3	4	5	6	7
5	I would do better in my course if I use SMS as educational tool.							
6	Overall, I think using the SMS as an educational tool would be useful.	1	2	3	4	5	6	7
<ul style="list-style-type: none"> Please tell us about your attitudes toward the use of SMS - as an educational tool e.g., to receive small bite of educational content such as Code Snippets 								

Attitudes Scale		Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	I believe it would be a good idea to use SMS as an educational tool.	1	2	3	4	5	6	7
2	I think using the SMS technology as an educational tool would provide me with a lot of enjoyment.	1	2	3	4	5	6	7
3	Using the SMS as an educational tool is not a good idea.	1	2	3	4	5	6	7
4	If it was made available, I would use SMS to receive educational content	1	2	3	4	5	6	7
5	Overall, I would like to use SMS as educational tool.	1	2	3	4	5	6	7

Thank you for your participation. If you are willing to participate in this study, SMS will be sent to you over the semester. SMS will contain small piece of educational content e.g. programming code and its explanation over the semester. The SMS would help you investing short pockets of your free time to learning or reviewing course content within the day. To participate, you will be asked to provide your mobile number, to receive the SMSs. Your phone number will be kept confidential and will not be available to anyone except the researcher.

Participation in this research is voluntary, you are free to refuse consent of participation and you can withdraw from the research at any time. It is integral to the research study that you will receive educational SMS messages.

If you want to participate, please provide your phone number:.....

Note: the SMS will be sent to you in afternoon 2PM-6PM

Would you like to participate in follow up interview regarding the use of SMS in your education?

- Yes
- No

Appendix E: Questionnaire Instrument (Second Round)

- The following items ask you to indicate your agreements with use of SMS
- Please tell us about the ease of using SMS and its usefulness as communication tool

SMS Perceived Ease of Use and usefulness as a communication tool Scale		Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	SMS is an easy way to communicate.	1	2	3	4	5	6	7
2	Retrieving old received or sent messages on my phones was easy.	1	2	3	4	5	6	7
3	The interaction with SMS was clear and understandable.	1	2	3	4	5	6	7
4	It took me a long time to learn how to send and receive SMS.	1	2	3	4	5	6	7
5	Overall, I think SMS is easy-to-use.	1	2	3	4	5	6	7
6	I think SMS is an effective communication tool	1	2	3	4	5	6	7
7	My communication is improved with the use of SMS.	1	2	3	4	5	6	7
8	SMS is a useful way to communicate	1	2	3	4	5	6	7

- Please tell us about the usefulness of SMS -as an educational tool e.g., to receive small bite of educational content such as Code Snippets

SMS Perceived Usefulness as an Educational tool Scale		Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	My learning was more effective because I used SMS as an educational tool.	1	2	3	4	5	6	7
2	My course performance was improved because I used SMS as an educational tool.	1	2	3	4	5	6	7

3	Using the SMS as an educational tool increased my productivity in my coursework.	1	2	3	4	5	6	7
4	I accomplished tasks more quickly because I used SMS as an educational tool.	1	2	3	4	5	6	7
5	I did better in my course because I used SMS as an educational tool.							
6	Overall, I found using the SMS technology as an educational tool was useful.	1	2	3	4	5	6	7

- Please tell us about your attitudes toward the use of SMS - as an educational tool e.g., to receive small bite of educational content such as Code Snippets

Attitudes Scale		Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	I believed it was a good idea to use SMS as an educational tool.	1	2	3	4	5	6	7
2	Using the SMS technology as an educational tool provided me with a lot of enjoyment.	1	2	3	4	5	6	7
3	Using the SMS as an educational tool was not a good idea.	1	2	3	4	5	6	7
4	If it was made available, I would use SMS to receive educational content	1	2	3	4	5	6	7
5	Overall, I would like to use SMS as educational tool.	1	2	3	4	5	6	7

Appendix F: Interview Instrument (First Round)

• Interview questions: Perceived Ease of Use and Usefulness Scale of SMS as a communication tool

Sometime, SMS is easy-to- use and some other time SMS is difficult to use.

1. (REF) Do you find SMS easy or difficult to use?
 (TYP) What kinds of things do you find easy to do through SMS?

 (TYP) What kinds of things do you find difficult to do through SMS?

 (CRT) Could you describe a specific incident when you found the use of SMS easy?

 (CRT) Could you describe a specific incident when you found the use of SMS clear and understandable?

 (CRT) Could you describe a specific incident when you found the use of SMS difficult?

 (CRT) Could you describe a specific incident when you found the use of SMS rigid or inflexible to interact with?
2. (REF) was it easy or difficult to learn how to use SMS?

 (TYP) What kinds of things do you find easy to learn regarding the use of SMS?

 (TYP) What kinds of things do you find difficult to learn regarding the use of SMS?

 (CRT) Could you describe specific incidents when learning how to use SMS was easy?
 (CRT) Could you describe specific incidents when learning how to use SMS was difficult?
3. (REF) Do you find the SMS as a communication tool useful or not useful?

 (TYP) What are the tasks you find SMS as a communication tool useful for?

 (TYP) What are the tasks you find SMS as a communication tool not useful for?

 (CRT) Could you describe a specific incident when you found SMS as a communication tool to be particularly useful?

 (CRT) Could you describe a specific incident when you found SMS as a communication tool to be particularly not useful?

• Interview questions: Perceived Usefulness Scale of SMS as educational tool. In this subject you will be asked to use SMS -as an educational tool e.g., to receive small bite of educational content such as Code Snippets

1. Do you think the use of SMS as an educational tool (e.g., to receive small bite of educational content such as Code Snippets) will be useful or not useful for your learning? Why?

• Interview questions: Attitudes toward SMS

1. (REF) Do or do not you like using SMS?

(TYP) what is something you dislike about SMS?

(TYP) what is something you like about SMS?

(CRT) Could you give a specific example of the kinds of things you use SMS for?

(CRT) What you like the most in regard to the use of SMS?

(CRT) What you dislike the most in regard to the use of SMS?

2. (REF) Do you like or do not like the use of SMS as an educational tool?

(TYP) What do you like best and least about the use of SMS as an educational tool?

(CRT) Could you give specific examples of advantages of using SMS as an educational tool?

(CRT) Could you give specific examples of disadvantages of using SMS as an educational tool?

3. Do you think using SMS as an educational tool is favourable or unfavourable? Why?
4. Will you sign in for future educational SMS services? Why? Why not?

Appendix G: Interview Instrument (Second Round)**• Interview questions: Perceived Ease of Use and Usefulness Scale of SMS as a communication tool**

1. (REF) Do you find SMS easy or difficult to use?

(TYP) What kinds of things do you find easy to do through SMS?

(TYP) What kinds of things do you find difficult to do through SMS?

(CRT) Could you describe a specific incident when you found the use of SMS easy?

(CRT) Could you describe a specific incident when you found the use of SMS clear and understandable?

(CRT) Could you describe a specific incident when you found the use of SMS difficult?

(CRT) Could you describe a specific incident when you found the use of SMS rigid or inflexible to interact with?

2. (REF) was it easy or difficult to learn how to use SMS as an educational tool?

(TYP) What kinds of things do you find easy to learn regarding the use of SMS as an educational tool?

(TYP) What kinds of things do you find difficult to learn regarding the use of SMS as an educational tool?

(CRT) Could you describe specific incidents when learning how to use SMS as an educational tool was easy?

(CRT) Could you describe specific incidents when learning how to use SMS as an educational tool was difficult?

3. (REF) Do you find the SMS useful or not useful?

(TYP) What are the tasks you find SMS useful for?

(TYP) What are the tasks you find SMS not useful for?

(CRT) Could you describe a specific incident when you found SMS to be particularly useful?

(CRT) Could you describe a specific incident when you found SMS to be particularly not useful?

- **Interview questions: Perceived Usefulness Scale of SMS as an educational tool**

1. (REF) Do you find the SMS useful or un-useful to your learning?

(TYP) In which ways do you find SMS useful or un-useful for learning?

(CRT) Could you describe a specific incident when you found the use of SMS useful or un-useful for your learning?

2. (REF) Do you find the SMS useful or un-useful to your learning performance?

(TYP) In which ways do you find SMS useful or un-useful for your learning performance?

(CRT) Could you describe a specific incident when you found the use of SMS positively or negatively impacted your learning performance?

3. (REF) Do you find the SMS useful or un-useful for your learning productivity?

(TYP) In which ways do you find SMS useful or un-useful for your learning productivity?

(CRT) Could you describe a specific incident when you found the use of SMS impacted your learning productivity?

4. (REF) Does the SMS make your learning easier or more difficult?

(TYP) In which ways the SMS has made your learning easier?

(TYP) In which ways the SMS has made your learning more difficult?

(CRT) Could you describe a specific incident when you SMS has made your learning easier?

(CRT) Could you describe a specific incident when you SMS has made your more difficult?

Interview questions: Attitudes toward SMS

1. (REF) Do or do not you like using SMS?

(TYP) what is something you dislike about SMS?

(TYP) what is something you like about SMS?

(CRT) Could you give a specific example of the kinds of things you use SMS for?

(CRT) What you like the most in regard to the use of SMS?

(CRT) What you dislike the most in regard to the use of SMS?

2. (REF) Do you like or do not like the use of SMS as an educational tool?

(TYP) What do you like best and least about the use of SMS as an educational tool?

(CRT) Could you give specific examples of advantages of using SMS as an educational tool?

(CRT) Could you give specific examples of disadvantages of using SMS as an educational tool?

3. Do you think using SMS as an educational tool is favorable or unfavorable? Why?

4. Will you sign in for future educational SMS services? Why? Why not?

Appendix H: List of Instruments' Reviewers

Name	Major
Dr.A.A	Curriculum and instruction
Dr. M.A	Curriculum and instruction/ Instructional Technology
Dr.A.F	Curriculum, Instruction /Media Technology

Appendix I: List of Participated Faculty Members Initials, Courses and Frequency of Sending SMS

Instructor	Course Name	Number of Students who received SMS	Time of sending SMS	Number of SMS
Dr.K.S	Computer Programming for Engineers	69	Every Monday and Wednesday	1794
Dr.A.A	Computer Programming for Engineers	29	Every Sunday	348
Dr.M.A	Computer Programming for Engineers	23	Every Monday and Wednesday	598
Dr.S.A	Computer Programming for Engineers	33	Every Thursday	429
Dr.S.A	Advanced English Course	17	Every Tuesday	187
Total: 171				

Appendix J: List of the Sent Educational SMS

• Dr. A. A class

SMS Number	Date	Content
1	September 15	<ul style="list-style-type: none"> Welcome to Computer Programming for Engineers class. We will send you educational SMS throughout the semester
2	September 22	<ul style="list-style-type: none"> Every variable has name, type, size and value When new value placed into variable, overwrites previous value
3	September 29	<ul style="list-style-type: none"> if (a = 3) is ALWAYS true. The condition a = 3 is an assignment statement and assignments are always consider to be true. Whereas: if (a == 3) is true ONLY if the value stored in a is the number 3.
4	October 6	<ul style="list-style-type: none"> The unary operator static_cast<double>() creates a temporary floating point copy of its operand.
5	October13	<ul style="list-style-type: none"> Happy Eid holiday
6	October20	<ul style="list-style-type: none"> The continue statement used in while, for, do/while skips remainder of loop body and proceeds with next iteration of loop The break statement causes immediate exit from while, for, do/while, switch. The Program continues with first statement after structure.
7	October 27	<ul style="list-style-type: none"> The general equation for scaling and shifting a random number is Number = shiftingValue + rand() % scalingFactor
8	November 3	<ul style="list-style-type: none"> Call by reference: <ul style="list-style-type: none"> - Function can directly access data and changes will affect original. - Use & after data type in prototype for example: void myFunction(int &data)
9	November 10	<ul style="list-style-type: none"> An array is a collection of data storage locations, each of which holds the same type of data. Arrays are static entities (same size throughout program).
10	November 17	<ul style="list-style-type: none"> Arrays are passed-by-reference where as individual array elements are passed-by-value
11	November 24	<ul style="list-style-type: none"> A pointer is a variable that holds an address. With pointers, the & symbol is called the address operator and the * is called the dereferencing (indirection) operator.
12	December 1	<ul style="list-style-type: none"> Class functions are used to access an object of that class. Functions in main() file are used to create the required program.
13	December8	<ul style="list-style-type: none"> The type of function a client would use to check the balance of his

bank account would be an access function.

• **Dr. S.A class**

SMS Number	Date	Content
1	September 17	• Welcome message
2	September 24	• "The use of idioms in a presentation might create problems. Explain how/why."
3	October 1	• There are two approaches to organizing a presentation. Can you name them? Try naming the internal methods of organizing presentations too.
4	October 8	• Impromptu presentations are those presentations where you are asked to think on your feet and talk spontaneously. Are you ready for your presentation next week?
5	October 15	• Eid mubarak to all.
6	October 22	• Good luck in your presentations
7	October 29	• Welcome back. I hope you have enjoyed your Eid holiday. Get ready for the informative presentations next week
8	November 5	• Determining the required steps, the duration of the presentation, and practising are key factors to the success of the demonstration presentation.
9	November 12	• Demonstration presentations end this week. Get ready for the persuasive presentations next.
10	November 19	• Successful persuasive presentations are based on two types of appeals. Remember what they are?
11	November 26	• Prepare well and good luck to you all.
12	December 3	• -
13	December 11	• -

• **Dr. S.A class**

SMS Number	Date	Content
1	September 19	• Welcome to Computer Programming for Engineers class. We will send you educational SMS throughout the semester

2	September 26	<ul style="list-style-type: none"> Functions are blocks that do specific tasks. A function can return only one value. Write the complete program in Fig 3-4 and play with it.
3	October 3	<ul style="list-style-type: none"> When we pass an array to a function, it is always pass by reference. When we pass an element, it is passed like any other variable: by value or reference.
4	October 10	<ul style="list-style-type: none"> For array of integers, we must send the array and its size when calling a function. However, no need to send a string size since null is always at the end.
5	October 17	<ul style="list-style-type: none"> Happy Eid holiday
6	October 24	<ul style="list-style-type: none"> Global variables should never be used except when defining rows and columns for two dimensional arrays.
7	October 31	<ul style="list-style-type: none"> If stream and of stream cannot deal with improved strings. They only handle strings which are defined as arrays of characters.
8	November 7	The main() function cannot access private data members. Private data members can be changed using their set functions, and read using get functions.
9	November 14	<ul style="list-style-type: none"> By analyzing the input file, we can build the needed class and its functions. By studying the required program, we can build main() and its functions.
10	November 21	<ul style="list-style-type: none"> Coming Exam on Saturday from 1:00 - 2:30 at the same room of first exam. Exam will be on chapters 3 and 4. In order to get a good grade, you should solve all homeworks and notes examples.
11	November 28	<ul style="list-style-type: none"> Class on Monday at 12:30 in 9kh lab. Class on Wednesday at 12:30 in 14kh room 102. Read & solve hw 12. Ideal solution online already.
12	December 5	<ul style="list-style-type: none"> Class functions are used to access an object of that class. Functions in main() file are used to create the required program.
13	December 12	<ul style="list-style-type: none"> The type of function a client would use to check the balance of his bank account would be an access function.

• **Dr.K. A and Dr.M. A classes**

SMS Number	Date	Content
1	September 16	<ul style="list-style-type: none"> Welcome to Computer Programming for Engineers class. We will send you educational SMS throughout the semester
	September 18	<ul style="list-style-type: none"> The central processing unit (CPU) supervises the operation of the other sections.
2	September 23	<ul style="list-style-type: none"> Every statement in C++ must end with a semicolon (;)
	September 26	<ul style="list-style-type: none"> do/while is a repetition structure

3	September 30	<ul style="list-style-type: none"> • An uninitialized local variable contains the value last stored in the memory location reserved for that variable
	October 2	<ul style="list-style-type: none"> • If a variable is declared in the initialization expression of a for structure, then the scope of the variable is restricted to that particular for loop
4	October 7	<ul style="list-style-type: none"> • A switch statement should be used as a multiple-selection structure
	October 9	<ul style="list-style-type: none"> • If a do/while structure is used, the body of the loop will execute at least once
5	October 14	<ul style="list-style-type: none"> • Happy Eid holiday
	October 16	
6	October 21	<ul style="list-style-type: none"> • All math library functions return the double data type
	October 23	<ul style="list-style-type: none"> • A variable that can only have values in the range 0 to 65535 is a two-byte unsigned int
7	October 28	<ul style="list-style-type: none"> • An identifier's storage class determines the period during which that identifier exists in memory
	October 30	<ul style="list-style-type: none"> • A recursive function is a function that calls itself
8	November 4	<ul style="list-style-type: none"> • The following statement would be used to declare a 10 element integer array <code>c int c[10];</code>
	November 6	<ul style="list-style-type: none"> • Constant variables can be used to specify array sizes, thereby making programs more scalable
9	November 11	<ul style="list-style-type: none"> • Strings cannot grow or shrink dynamically
	November 13	<ul style="list-style-type: none"> • Unless otherwise specified, entire arrays are passed call-by-reference and individual array elements are passed call-by-value.
10	November 18	<ul style="list-style-type: none"> • To prevent modification of array values in a function the array parameter can be preceded by the <code>const</code> qualifier
	November 20	<ul style="list-style-type: none"> • The binary search technique can only be used on a sorted array
11	November 25	<ul style="list-style-type: none"> • Pointers cannot be used to reference values directly
	November 27	<ul style="list-style-type: none"> • A function that prints a string should have a parameter that is a non constant pointer to constant data
12	December 2	<ul style="list-style-type: none"> • A pointer can not be assigned to a pointer of a type other than its own type and void
	December 4	<ul style="list-style-type: none"> • <code>(*max)(num1, num2, num3);</code> is a call to the function pointed to by <code>max</code>

13	December9	• Object-oriented programming primarily focuses on classes.
	December 11	• By default, structures are passed call-by-value

Appendix K: Summary of Specific Majors of the Participants

		Frequency	Percent
Major	Petroleum, Industrial & Management System Engineering	37	21.6
	Electrical Engineering	32	18.7
	Civil Engineering	28	16.4
	Mechanical Engineering	22	12.9
	Chemical Engineering	17	9.9
	Computer Engineering	17	9.9
	Preparatory Year Program	7	4.1
	Nutrition	2	1.2
	Architecture	1	.6
	English language	1	.6
	Art	1	.6
	Information technology	1	.6
	Communication	1	.6
	Earth and Environmental Sciences	1	.6
	Psychology	1	.6
	Engineering	153	89.5
	Others	16	9.4

Appendix L: Summary of the Percentages of Participants' Use of ICT for Personal Purposes based on their Use of Smart Phone and Laptop

	Mobile phone	Smart- phone	Desktop computer	Laptop computer	Games console	Digital camera	MP3 player	Memory stick	Electronic organizer
Smart phone	3.3%	100%	6.6%	35.5%	7.2%	5.3%	7.9%	7.9%	.7%
Laptop	11.9%	91.5%	13.6%	100%	18.6%	11.9%	16.9%	18.6%	.6%

Appendix M: Summary of the Percentages of Participants' Use of ICT for Educational Purposes based on their Use of Smart Phone and Laptop

	Mobile phone	Smartphone	Desktop computer	Laptop computer	Games console	Digital camera	MP3 player	Memory stick	Electronic organizer
Smartphone	3.8%	100%	6.7%	60%	1%	1.9%	2.9%	1.9%	1.9%
Laptop	3.3%	52.5%	5.8%	100%	0%	1.7%	2.5%	4.2%	.6%

Appendix N: Summary of the statistical analysis of the relationships between students' perceptions of SMS ease of use, usefulness and attitudes with some of their demographic characteristics and ICT use variables

- Results of t-tests and Descriptive Statistics SMS Ease of Use, Usefulness and Attitudes by Gender

Outcome	Group						95% CI for Mean Difference	t	df
	Female			Male					
	M	SD	n	M	SD	n			
Ease of Use and usefulness s communication tool	5.31	1.49	86	5.51	1.04	85	-.58, .19	-.99	169
Usefulness as educational tool	4.46	1.63	86	4.33	1.41	85	-.32, .60	.58	169
Attitudes	4.63	1.70	86	4.69	1.33	85	-.52, .40	-.26	169

* $p < .05$

- One-Way ANOVA- students' responses to the SMS ease of use, usefulness and attitudes scales for frequency of sending SMS.

Outcome	df	F	p
Ease of Use and usefulness s communication tool	3	2.74	.04
Usefulness as educational tool	3	1.75	.16
Attitudes	3	1.45	.23

Note. 1= 'Frequent', 2= 'Often', 3= 'Rarely', 4= 'Never'.

* $p < .05$

- One-Way ANOVA- students' responses to the SMS ease of use, usefulness and attitudes scales for academic year.

Outcome	df	F	p
Ease of Use and usefulness s communication tool	2	.64	.53

Usefulness as educational tool	2	1.39	.25
Attitudes	2	1.04	.36

* $p < .05$

- One-Way ANOVA- students' responses to the SMS ease of use, usefulness and attitudes scales for frequency of using the internet for personal purposes.

Outcome	<i>df</i>	<i>F</i>	<i>p</i>
Ease of Use and usefulness s communication tool	2	1.79	.17
Usefulness as educational tool	2	.15	.86
Attitudes	2	.80	.45

Note. 1 = 'Frequent', 2= 'Often', 3= 'Rarely or Never'.

* $p < .05$

- One-Way ANOVA- students' responses to the SMS ease of use, usefulness and attitudes scales for frequency of using the internet for educational purposes.

Outcome	<i>df</i>	<i>F</i>	<i>p</i>
Ease of Use and usefulness s communication tool	3	1.58	.20
Usefulness as educational tool	3	1.66	.18
Attitudes	3	1.22	.30

Note. 1 = 'Frequent', 2= 'Often', 3= 'Rarely', 4= 'Never'.

* $p < .05$

- Results of t-tests and Descriptive Statistics SMS Ease of Use, Usefulness and Attitudes by their use of Smartphone for Personal and Educational Purposes.

Outcome	Group						95% CI for Mean Difference	t	df
	Non users			Users					
	M	SD	n	M	SD	n			

Ease of Use and usefulness s communication tool	5.05	1.83	19	5.45	1.20	152	-1.02, .21	-1.30	169
Usefulness as educational tool	4.24	1.60	19	4.42	1.52	152	-.91, .56	-.47	169
Attitudes	4.35	1.76	19	4.70	1.47	152	-1.08, .38	-.95	169
Ease of Use and usefulness s communication tool	5.51	1.23	66	5.34	1.32	105	-.23, .57	.85	169
Usefulness as educational tool	4.39	1.53	66	4.40	1.52	105	-.49, .46	-.07	169
Attitudes	4.59	1.59	66	4.71	1.48	105	-.59, .35	-.49	169

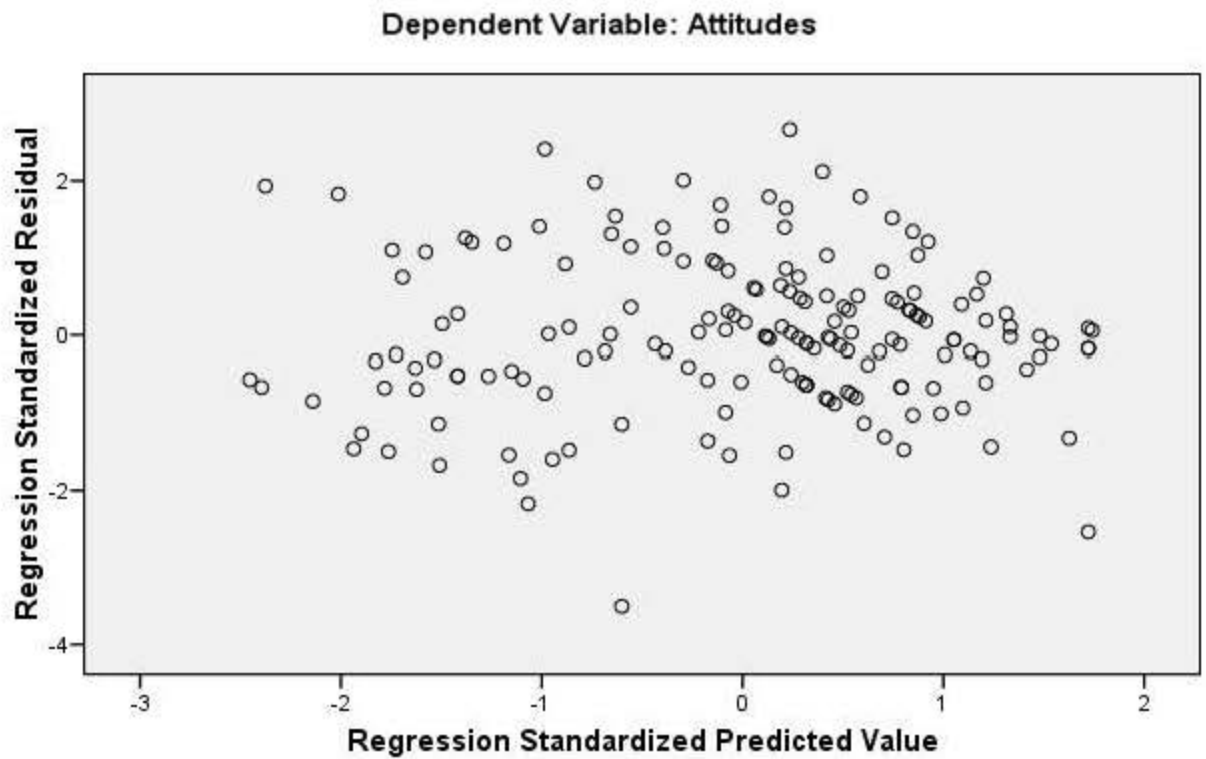
* $p < .05$

- Results of t-tests and Descriptive Statistics SMS Ease of Use, Usefulness and Attitudes by their use of laptop computer for personal purposes and Educational Purposes.

Outcome	Non users			Users			95% CI for Mean Difference	t	df
	M	SD	n	M	SD	n			
Ease of Use and usefulness s communication tool	5.34	1.30	112	5.53	1.27	59	-.59, .23	-.88	169
Usefulness as educational tool	4.45	1.50	112	4.30	1.58	59	-.34, .63	.59	169
Attitudes	4.74	1.57	112	4.51	1.42	59	-.25, .71	.93	169
Ease of Use and usefulness s communication tool	5.24	1.30	51	5.48	1.28	120	-.66, .19	-1.08	169
Usefulness as educational tool	4.23	1.61	51	4.47	1.48	120	-.74, .27	-.92	169
Attitudes	4.59	1.56	51	4.69	1.51	120	-.61, .40	-.41	169

* $p < .05$

Appendix O: Scatter Plot of Regression Standardized Predicted Values Against Regression Standardized Residuals.



Appendix P: Results of Paired t-tests for Significance Differences of Participants' Perceptions of and Attitudes towards SMS before and after Using SMS as an Educational Tool

- Descriptive statistics and results of paired t-tests for significance differences of participants' perceptions of SMS ease of use and usefulness as a communication tool before and after using SMS as educational tool

Outcome	Pre-test		Post-test		N	95% CI for Mean Difference	t	df
	M	SD	M	SD				
SMS is an easy way to communicate.	5.55	1.64	5.63	1.65	132	-.41,.24	-.49	131
Retrieving old received or sent messages on my phones was easy.	4.81	1.79	5.25	1.65	132	-.82,-.05	-2.2*	131
The interaction with SMS was clear and understandable.	5.33	1.59	5.34	1.65	132	-.37,.35	-.06	131
It took me a long time to learn how to send and receive SMS.	6.05	1.59	5.94	1.53	132	-.27,.47	.52	131
Overall, I think the SMS easy-to-use.	6.03	1.52	5.84	1.43	132	-.16,.52	1.04	131
I think SMS is an effective communication tool	5.48	1.68	5.44	1.58	132	-.33,.39	.16	131
My communication is improved with the use of SMS	5.05	1.80	4.90	1.66	132	-.21,.50	.79	131
SMS is a useful way to communicate	5.55	1.58	5.43	1.61	132	-.26,.48	.59	131
Overall	5.48	1.21	5.48	1.21	132	-.27, .26	-.03	131

* $p < .05$.

- Descriptive statistics and results of paired t-tests for differences of participants' perceptions of the usefulness of SMS before and after using SMS as educational tool

Outcome	Pre-test		Post-test		N	95% CI for Mean Difference	t	df
	M	SD	M	SD				

My learning was more effective because I used SMS as an educational tool.	4.40	1.68	4.42	1.79	132	-.40, .35	-.12	131
My course performance was improved because I used SMS as educational tool.	4.43	1.53	4.28	1.73	132	-.18, .48	.88	131
Using the SMS as an educational tool increased my productivity in my coursework.	4.41	1.63	4.09	1.70	132	-.01, .66	1.9	131
I accomplished tasks more quickly because I used SMS as educational tool.	4.52	1.72	4.37	1.68	132	-.20, .50	.82	131
I did better in my course because I used SMS as educational tool.	4.51	1.65	4.14	1.70	132	.02, .70	2.11*	131
Overall, I found using the SMS technology as an educational tool was useful.	4.79	1.82	4.85	1.74	132	-.43, .30	-.36	131
Overall	4.51	1.49	4.36	1.54	132	-.45, .15	-.97	131

* $p < .05$.

- Descriptive statistics and results of paired t-tests for significance differences of participants' SMS attitudes before and after using SMS as educational tool

Outcome	Pre-test		Post-test		N	95% CI for Mean Difference	t	df
	M	SD	M	SD				
I believed it was a good idea to use SMS as an educational tool.	4.92	1.66	5.02	1.82	132	-.44, .25	-.55	131
Using the SMS technology as an educational tool provided me with a lot of enjoyment.	4.62	1.68	4.59	1.81	132	-.35, .39	.10	131
Using the SMS as an educational tool was not a good idea.	4.66	1.88	4.81	1.81	132	-.52, .21	-.85	131
If it was made available, I would use SMS to receive educational content	4.89	1.69	4.72	1.83	132	-.25, .57	.76	131
Overall, I would like to use SMS as educational tool.	4.91	1.83	4.66	1.92	132	-.15, .64	1.20	131

Overall	4.80	1.51	4.77	1.58	132	-.35,28	-.20	131
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* $p < .05$.