DESIGN AND EVALUATION OF POCKET EDUCATION SYSTEM: AN SMS-BASED LEARNING FOR DISTANCE LEARNERS

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DESIGN AND EVALUATION OF POCKET EDUCATION SYSTEM: AN SMS-BASED LEARNING FOR DISTANCE LEARNERS

by

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LIST OF ABBREVIATIONS

ADDIE	Analysis, Design, Development, Implementation, and Evaluation
AECT	Association for Educational Communications and Technology
ASTD	American Society for Training and Development
API	Application Programming Interface
CASE	Computer-Aided Software Engineering
CD	Compact Disc
CSV	Comma Separated Values
DVD	Digital Video Disc
E-Learning	Electronic Learning
GPRS	General Packet Radio Service
GSM	Global System for Mobile communication
GUI	Graphical User Interface
HTTP	Hyper Text Transfer Protocol
ID	Instructional Design
ISD	Instructional System Design
ISDD	Instructional Systems Design and Development
IT	Information Technology
ICT	Information and Communication Technology
LMS	Learning Management System
M-Learning	Mobile learning
MCMC	Malaysian Communication and Multimedia Commission
MMS	Multimedia Message Service
MOHE	Malaysian Ministry of Higher Education

NKRA	National Key Results Areas
OUM	Open University Malaysia
PASW	Predictive Analytic Software
PC	Personal Computer
PDA	Personal Digital Assistant
PE	Pocket Education
PHP	Hypertext Preprocessor
QUIS	Questionnaire for User Interaction Satisfaction
SAT	Systems Approach to Training
SDE	School of Distance Education
SMS	Short Messaging Service
SQL	Structured Query Language
SRS	System Requirement Specification
UiTM	Universiti Teknologi MARA
UML	Unified Modeling Language
UPM	Universiti Putra Malaysia
USM	Universiti Sains Malaysia
WAP	Wireless Application Protocol

REKABENTUK DAN PENILAIAN SISTEM 'POCKET EDUCATION': SATU PEMBELAJARAN BERASASKAN SMS UNTUK PELAJAR-PELAJAR JARAK JAUH

ABSTRAK

Satu aliran terkini di kebanyakan universiti di seluruh dunia adalah penggunaan teknologi dalam menyokong proses pengajaran dan pembelajaran. Walaupun mod pembelajaran secara bersemuka masih kekal sebagai pilihan utama dalam kalangan pengamal pendidikan, masih terdapat keperluan terhadap penyelesaian berteknologi yang mampu dimiliki dan dicapai oleh semua orang untuk memperoleh pengetahuan pada bila-bila masa dan di mana-mana sahaja. Tujuan utama kajian ini adalah untuk mereka bentuk dan menilai sistem 'Pocket Education', iaitu satu aplikasi pembelajaran mudah alih (m-pembelajaran) yang memudahkan proses pengajaran dan pembelajaran melalui penggunaan teknologi khidmat pesanan ringkas (SMS). Kajian ini melibatkan pelajar jarak jauh yang mengikuti kursus pengurusan di Pusat Pengajian Pendidikan Jarak Jauh (PPPJJ), Universiti Sains Malaysia (USM). Ia menggunakan metodologi kajian berasaskan rekabentuk sebagai panduan proses rekabentuk pengajaran sistematik (ISD) dalam membangunkan sistem m-pembelajaran berasaskan SMS ini.Secara khusus, model ADDIE (Analisis, Rekabentuk, Pembangunan, Pelaksanaan dan Penilaian) telah dipilih sebagai pendekatan sistematik dalam merekabentuk dan menilai sistem dalam kajian ini. Oleh itu, terdapat lima peringkat pengumpulan data untuk mencapai tujuan kajian ini, iaitu: 1) soal selidik tentang kecenderungan pelajar, 2) gambarajah rekabentuk, 3) pembangunan portal dan kandungan pembelajaran

berasaskan teks, 4) menjalankan latihan untuk pelajar dan ‘system run’, serta 5) soal selidik tentang persepsi pelajar terhadap kebolehgunaan sistem ‘Pocket Education’. Berdasarkan dapatan kajian di fasa terakhir, didapati bahawa sistem m-pembelajaran berasaskan SMS tersebut dinilai secara positif oleh para responden di mana mereka secara umum berasa puas hati dalam hampir kesemua aspek kebolehgunaan sistem. Walaubagaimanapun, beberapa isu teknikal turut dikenalpasti yang menjelaskan bagaimana aspek-aspek tertentu dalam m-pembelajaran berasaskan SMS boleh dipertingkatkan lagi bagi menyediakan pengalaman pembelajaran yang lebih bermakna untuk pelajar jarak jauh. Oleh itu, dari sudut implikasi praktikal, kajian ini dapat memberi manfaat kepada pengamal dan sarjana pendidikan dalam bidang rekabentuk pengajaran dan pendidikan jarak jauh, khususnya dalam mempraktikkan dan menjalankan kajian lanjut tentang penggunaan teknologi SMS sebagai alat pedagogi pendidikan jarak jauh.

DESIGN AND EVALUATION OF POCKET EDUCATION SYSTEM: AN SMS-BASED LEARNING FOR DISTANCE LEARNERS

ABSTRACT

A current trend witnessed in most universities globally is the utilization of technology in supporting teaching and learning process. While face-to-face learning mode remains a favorite among educational practitioners, there is a need for a technological solution that is affordable and accessible for everyone in acquiring knowledge at anytime and anywhere. The primary purpose of this study was to present the design and evaluation of Pocket Education system, a mobile learning (m-learning) application which facilitates teaching-learning process via the short message service (SMS) technology. The study was conducted involving distance learners undertaking management courses in the School of Distance Education (SDE), Universiti Sains Malaysia (USM). The study employed the design-based research methodology to guide the instructional systematic design (ISD) process in developing the SMS-based m-learning system. In particular, ADDIE (Analysis, Design, Development, Implementation and Evaluation) instructional design model was adopted as a systematic approach to design and evaluate the system. Hence, there were five stages of data collection which were designed to achieve the purpose of the study, which are: 1) questionnaire on learners' preferences, 2) design diagrams, 3) development of portal and text-based learning content, 4) conducting participants' training and system run, and 5) questionnaire on learners' perception towards the usability of the Pocket Education system. Findings from the final phase revealed that the SMS-based m-learning system was perceived positively by

respondents in which they generally feel satisfied in almost all usability aspects. Nevertheless, findings derived from this study also indicate some technical concerns which lent further insight into how certain usability aspects of SMS-based m-learning can be further enhanced to provide more meaningful learning experiences for distance learners. Thus, practical implications of this study would be beneficial for educational practitioners and scholars in the field of instructional design and distance education, particularly for the practical aspect and further research on the use of SMS technology as a pedagogical tool for distance education.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This thesis focuses on the designing of an SMS-based mobile learning system, namely Pocket Education system and evaluating the usability of the system in assisting the distance learners who enrolled in distance learning programs in the School of Distance Education (SDE), Universiti Sains Malaysia (USM). Distance learners are the subject of this study since they are learning in an environment where majority of the instruction occurs while instructors and learners are at a distance from each other. Thus, it would be beneficial to see the applicability and usability of a mobile learning system in such learning environment. In order to actualize the system, this thesis applied the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) instructional design approach to design, develop and evaluate the Pocket Education system. The whole cycle of processes matters since it affects the quality of the learning tool which may in turn, affect the learning outcomes of the targeted users.

This chapter introduces the study, and provides the design framework and research rationale for conducting the study. The following describes the organization of this chapter:-

- Research Background
- Research Problems
- Objectives of the Study

- Research Questions
- Importance of the Study
- Theoretical Underpinning
- System (Conceptual) Framework
- Operational Definitions
- Summary

1.2 Research Background

For many centuries, face-to-face method remains the most dominant mode of teaching and learning in many countries all over the world. It offers real-time interaction between learners and instructors through many forms of teaching and learning activities, such as lectures, demonstration, tutoring, hands-on instruction and students' evaluation. Redmond (2011) explained that, in the traditional face-to-face approach, instructors and learners are in the same geographical place at the same time. Thus, face-to-face method is normally referred as traditional mode of education whereby instructors will present the learning material in a direct contact to a group of students (Georgiev, Georgieva, & Smrikarov, 2004; Redmond, 2011). Nowadays, with the evolution of technology and increasing diversity of learning strategies, face-to-face method is generally combined with technological tools to enhance the quality of teaching and learning.

The educational practice that combines face-to-face and technological approach is generally called as blended learning (Alonso, López, Manrique, & Viñes, 2005). Nowadays, blended learning is seen as the best pedagogical practice that spans both conventional and digital approaches to education. However, regardless of what technology or medium involved in the educational process, students must be

physically involved in the learning process and the technology depends mostly on the instructors (Georgiev et al., 2004). With the rapid technological and socio-economic changes, education providers nowadays have to endeavor in addressing the growing and cross-border educational demands of the learners. Thus, in response to such demand, numerous public and private learning institutions globally are introducing a flexible educational mode known as distance education which extends the access to education, especially to those who might have geographical and time constraint for fulltime class attendance.

Distance education presents a great opportunity for learners to access education, especially those who need to accommodate work or family commitment. Courses that are delivered distantly have a great appeal to those who do not have the ability to attend face-to-face classrooms. A growing body of literatures gradually discusses on the need of distance education nowadays. According to Hannay and Newvine (2006), distance learning programs are generally designed to fit the needs of off-campus students. They further added, distance education can also provide a cost-effective solution to educational providers wishing to serve a large number of students without the geographical limitations. Moreover, it is also to promote self-learning habits among distance learners. This is due to the fact that, students embarking on distance learning courses are expected to be more autonomous since most of the time, they are self-directed and unsupervised (Sampson, 2003).

Distance education is not a new style in instructional delivery system nowadays. Many universities around the world have long experimented with the distance approach to education to accommodate the ever-growing needs of the learners. As Sumner (2000) suggested, the history of distance education is well documented, especially in the 20th century. Historically, distance education was

introduced through correspondence program in the early 1700s (Jayroe, as cited in Gallogly, 2005). The correspondence program was the early generation of distance education in which it basically involves the use of printed course materials and the postal service (Sumner, 2000). Technology has started to gain presence in distance education courses in the early 1900s, whereby the use of multimedia has initiated the second generation of distance education. Until now, the form of distance education has evolved from correspondence-based to technological approach; from the utilization of audio-visual devices, to computer-mediated form and then to the use of the information age technology, i.e. the Internet (Gallogly, 2005).

Nowadays, the evolving digital information technology has changed the way students learn and the use of it is considered essential for an effective delivery of distance education. O'Lawrence (2006) defined distance learning as a teaching-learning medium that uses modern technology to connect instructors and learners. Thus, the delivery of distance education is always facilitated by technology (Ng, 2007). According to Beldarrain (2006), technology is the key factor that changes the concept of distance between learners and instructors, whereby learners are able to access education at anytime from anywhere. Technology-based teaching-learning mode has several advantages over face-to-face mode. According to Woo et al. (2008), utilization of technology will offer some flexibility for peer-to-peer and student-to lecturer interactions in distance education. Technology is also seen as a catalyst that can create stronger distance learning community with various expertise and enhanced problem-solving skills (Beldarrain, 2006). For instance, the emerging use of Internet technology has created the online mode of distance education which helps establish both synchronous and asynchronous distance learning network. The social network through Internet has also promoted a new dimension to collaborative

learning within constructivist environment among the distance learners (Beldarrain, 2006).

The trend of distance education development is also visible in Malaysia with the emergence of several distance learning providers, comprises of public higher learning institutions, such as Universiti Sains Malaysia (USM), Universiti Teknologi MARA (UiTM), Universiti Putra Malaysia (UPM) and private institutions, such as Open University of Malaysia (OUM), Multimedia University (MMU) and Wawasan Open University (WOU). This is due to the government's attempt to establish an information-rich society and a knowledge-based economy (Anuwar, 2006). Up until now, much progress has been made in higher learning institutions in Malaysia to incorporate technology in their distance education programs to offer a great deal of learning opportunities for the distance learners. In USM, for example, the delivery system of distance education in the School of Distance Education (SDE) has evolved from basic correspondence education packages to blended technological approach which combine face-to-face contacts in regional centers, audio and video conference, e-learning and other online tools of teaching and learning such as Learning Management System (LMS), web-based learning applications, and virtual multimedia (Hanafi, n.d.; Omar & Hanafi, 2012; Rozhan & Habibah, 2000).

The use of online tools in the delivery of distance education seems to be perceived quite well by distance learners in Malaysia as reported by some scholars (Yiong, Sam, & Wah, 2008; Sahin & Shelley, 2008; Ibrahim, Noraidah, Nor Azan, & Mutasem, 2010). For the case of USM, Hanafi, Zuraidah, and Rozhan (2004) reported that the distance learners were very receptive towards the need for online supplementary course articles. Siti Sarah and Issham (2011) also have found that most of the distance learners in SDE demonstrated positive perceptions towards the

effectiveness of e-learning portal for their learning process. In another related study, Mohd. Faiz, Shahrier and Yanti (2012) reported that the distance learners perceived the LMS provided by SDE USM as having a high level of service quality and ease-of-use. Thus, the prevalence of online tools in distance education courses in Malaysia are seen by learners as educational solutions that expand the delivery mechanism of distance education with greater possibility in their learning.

Despite the successes of online tools in terms of providing various learning opportunities to distance learners, the accessibility and flexibility of distance education in accommodating learners' needs is still an important factor to ponder. While reviewing the USM distance learners' perceptions on online distance education, Rozhan and Habibah (2000) revealed that, students are still focused on accessibility and presentation, rather than pedagogical techniques and interactivity of the online learning tools. Moreover, there are some urgency highlighted in literatures for distance learning programs to be able to provide more flexibility and convenience to accommodate the mobility needs of distance learners. In his study, Beldarrain (2006) agreed on the needs of a more mobile and technology-savvy learning platform among distance learners nowadays. As quoted from the study, "the 21st-century learner requires educational opportunities not bound by time or place, yet allow interaction with the instructor and peers" (p.139). In line with this need, mobile devices are seen as potential technologies to complete the missing puzzle in distance education.

The utilization of handheld and portable devices such as mobile phone, laptops, personal digital assistants (PDA) and smart phones for educational purposes is generally termed as mobile learning, or simplified as m-learning (Keegan, 2005). Over the past decade, m-learning has grown from a small research interest into some

significant projects in many educational institutions throughout the world. As a matter of fact, the increasing mobility of the society nowadays has influenced the way people live. Thus, educators and researchers need to consider the changing needs in designing any learning system (Rajasingham, 2011). Mobile learning is a new paradigm in electronic learning that meets learners' high demands on mobility (Leung & Chan, 2003). A study by Keegan (2005) described the parallelism between m-learning and distance learning in characterizing the just-in-time and life-long learning. Keegan (2005) further affirmed that mobile learning helps students to independently learn at any time and any place, with flexibility for work and family commitments. Thus, this mode of learning would mostly benefit the distance learners who are on the move and lacks of physical contacts with the lecturers and peers.

In promoting m-learning for distance education, mobile phone is seen as the most appropriate device to do such (Suki & Suki, 2010; Keegan et al., 2006; Prensky, 2005). By the same token, the Short Message Service (SMS) on mobile phones is considered as a great potential in offering dynamic delivery of distance education since it is the most ubiquitous and stable mobile technologies (Traxler, 2005). SMS-based learning would also benefit the distance learners who lack of competency in advancing technology. As claimed by Nyiri (2003), the usage of mobile phones as a tool for classroom teaching can be unobtrusive since the technology is basic and well-familiarized by the students. Therefore, this potential has ushered in a new paradigm in utilizing SMS technology as a tool to support the student-centric learning among distance learners.

In Malaysia, even though m-learning is considerably at its embryonic stage (Mohamed Amin & Norazah, 2013), several research reported in educational literature have suggested the potential of mobile learning in higher learning

institutions, particularly for distance education (Lim, Mansor, & Norziati, 2011; Zoraini Wati, Peng, & Norziati, 2009; Issham, Gunasegaran, Koh, & Rozhan, 2010a). For instance, m-learning is described by Supyan, Mohd Radzi, Zaini and Krish (2012) as a learning mode that definitely contributes to the flexibility of learning in open and distance learning institutions. M-learning is seen as the next evolution after e-learning which the government has identified in order to achieve one of the National Key Results Areas (NKRAs), which is to ensure that quality education is accessible to all Malaysians (Mohamed Amin & Norazah, 2013). Thus, m-learning's presence and its potential to gain ground in Malaysian higher learning institutions are widely recognized by the scholars.

In order to implement a mobile-based learning approach in distance education, m-learning via mobile phone is undoubtedly possible in Malaysia. This is due to the fact that, mobile phone is a technology that is always accessible among most people in this country. In a survey by the Statistics by Malaysian Communication and Multimedia Commission (MCMC, 2008), it was reported that mobile penetration in the last four years kept growing tremendously in most states in Malaysia. Even recently, MCMC (2013) reported that mobile phone ownerships per 100 inhabitants is approximately 143% while broadband is only 22%. MCMC (2008) also has reported that SMS usage in Malaysia is increasing from years to years, specifically, from 31.7% in year 2004 to 50.7% in year 2008. Students' familiarity and affordability with the technology can be a motivating factor for their learning (Hendrikz & Aluko, 2003). This suggests the potential of SMS-based m-learning as a solution to bridge the gap in distance education environment in Malaysia.

With such familiarity on the technology, SMS-based m-learning approach will be able to benefit a wide range of distance learners in Malaysia from diverse

backgrounds, particularly those who lacks opportunities and access to benefit from other advancing technological approach to learning. Thus, with the literature reports confirming the potential of SMS-based technology in distance learning environment, it is necessary to look into how this mobile technology can be designed and developed to match the learning mobility demands among distance learners in Malaysia.

1.3 Research Problems

For many centuries, the face-to-face teaching and learning mode remained to be the most widely used instructional strategy in universities throughout the world. Lecturer-to-students and students-to-lecturer communications have been perceived as the most important aspect through this traditional classroom setting. As a matter of fact, face-to-face classroom method has been found to promote synchronous face-to-face discussion by giving prompt feedback to students' questions and real-time problem-solving (Wray et al., 2008; Wang & Woo, 2007).

However, face-to-face classroom method does have some apparent limitations. For instance, one of the most critical problems which would arise in face-to-face classroom is students' silence, or in other words, passive participation in classroom (Tobin, 2001). Several institutional and situational barriers also may have arisen in face-to-face method, including inconvenient course schedule and location, lack of time and other constraints related to personal commitment (Ranganathan, Negash, & Wilcox, 2007). Thus, due to constraint of supports, flexibility, time and location, using this mode alone would appear less relevant and impractical, especially for learners undertaking distance learning programs.

Learning at a distant is gaining its popularity among learners since the past decades. Distance learning offers the learners many unique benefits which may not be available through face-to-face method, such as flexibility, convenience, and accessibility. A number of factors may have contributed to this evolutionary change in education. According to Raymond III (2000), economical needs is one of the factor, whereby the costs of education nowadays are increasing, while at the same time demanding these part-time learners to have work commitment. Moreover, the structure of distance learning itself which supports diverse and hard-to-reach student populations has provided the learners with capabilities to control their own time, place, and pace of the education without the boundaries of traditional classroom setting.

However, with the geographical limitation, distance learning may pose new challenges for the learners as the majority of them could not benefit the same learning satisfaction from face-to-face classes as on-campus students could have. Due to the low face-to-face contact with lecturers and peers, these learners might feel less motivated towards their learning (Dzakiria, 2004) and most probably would eventually drop out due to having fairly well-entrenched of support networks (Tobin, 2001). Consequently, distance learning educators and providers are tasked with responsibilities to decide how best to design the distance learning program so that it will benefit a broader range of distance learners. As distance learning is often conducted remotely, it requires advanced techniques of instructional design and delivery that properly meets the learners' needs, content requirements and lecturers' and faculty's constraint.

Therefore, for distance learning programs, it is safe to presume that the use of appropriate technology is a must to fulfill all those requirements in this information

age. Nowadays, technology is more than just a tool in education. It is seen as a catalyst that can enhance teaching and learning process, especially for distance learning programs. According to Schulte and Krämer (2008), "the development in technology globally has substantially changed the format of distance education from correspondence-style to technology-based courses". Thus, in this climate of change, many kinds of advancing learning supports have been incorporated in distance learning courses, such as multimedia software, Internet-based and Information and Communication Technology (ICT) tools. The burgeoning usage of the Internet and other digital technologies has shed new potential of distance learning in terms of access, quality and support (UNCTAD, 2004). Such technologies are transforming the landscape of distance education to becoming an online mode of learning. The online mode of learning or usually termed as online learning, has been promoted as the logical step in delivering education distantly. Several studies have identified that online learning has added a new dimension to the delivery of distance education (Wong, 2007; Ajadi et al., 2008; Eom et al., 2006). Overall, online learning provides both distance educators and learners an enriched learning experience that offers better accessibility, flexibility and independency in learning.

Notwithstanding its importance, online distance learning still faces similar issues regardless of any medium it uses. While the Internet offers enormous online learning resources, many distant educators and students may have problems in adopting the technological teaching and learning tools. Once they have signed up for the program, distance learners must be able to invest and master themselves in any technology that is employed within the distance learning program. According to Shelton and Saltsman (2006), an instructor might find lacks of satisfaction and preparation in online teaching. Some pitfalls of online learning were also highlighted

by Ranganathan et al. (2007), including lack of training on the system and improper use of emerging technologies. Other than that, they are still lacking of ubiquitous options which can assist learning in a more convenient and affordable way without any constraint on money, time and place. Tinio (2003) reported that using advancing technology in education might trigger issues since it does not work the same way for everyone at anywhere. As Beldarrain (2006) noted, learners in this 21st century are looking for educational solutions that not only allow them to interact with peers and instructors, but also are not bounded by time and place. While distance learning educators and providers are seeking for ways to improve the quality of online distance education, they also face challenges of meeting the diverse mobility needs of today's distance learners.

For the case of Malaysia, there are many issues surrounding the technology used in the teaching-learning practices in distance learning programs, such as lack of technological competency (Hisham, 2005), negative attitudes toward technology (Rugayah, Hashim, & Che Zainab, 2010), lack of infrastructure (Yiong et al., 2008), cost and accessibility (Kaur & Zoraini Wati, 2004), as well as technical and operational issues (Murugaiah & Thang, 2010). Concerns about online learning tools were also arisen, particularly regarding students' awareness, low adoption rate, bandwidth issue and connectivity, computer literacy and digital divide, lack of quality e-content, difficulty in engaging learners online and language barrier, as highlighted by Anuwar (2006). In addressing the issues, researchers suggested the needs for a more mobile, flexible, and accessible approach to distance education teaching-learning practices in Malaysia (Nik Mastura, Mohd Nor, & Posiah, 2011; Hisham, 2005; Rozhan & Habibah, 2000; Siti Sarah & Issham, 2011).

In this regard, distance learning programs nowadays have to consider the learners' technology-competency, accessibility, affordability, and familiarity in ensuring a successful integration of such technology within their physically-apart learning environment. Sampson (2003) agreed that any institution offering distance learning courses need to study on the needs of distance learners, including the constraints of cost, technologies and geography. Dewald, Scholz-Crane, Booth, and Levine (2000) also agreed that technological know-how and technological infrastructure are among four aspects that need to be considered when designing the instructional delivery of distance education, in which the technology does not only have to be well-familiar among the students, it also has to be accessible and affordable by them. Thus, mobile devices were seen by many scholars (Leung & Chan, 2003; Keegan, 2005; Beldarrain, 2006; Nyandara, 2012; Alexander, 2004; Mockus et al.,2011; Kennedy & Duffy, 2004) as such learning tool that can be used to bridge the gap in distance education. The utilization of mobile technology in supporting teaching and learning process in distance education, or m-learning, is a current trend witnessed in many distance education courses globally.

However, as the research literature appears to support the potentials of m-learning in distance education, m-learning via advanced mobile devices may introduce challenges to most learners in terms of affordability, accessibility, technical limitation and technology familiarity (Elias 2011; Wang & Higgins, 2005; Valk, Rashid, & Elder, 2010; Corbeil & Valdes-Corbeil, 2007). Despite the successes of m-learning in terms of increased access to education, quality issues are still much debated with regard to distance learning, especially when it involves advanced mobile devices, such as Personal Digital Assistants (PDAs), smartphones, laptops, tablet PCs, and portable media players. This is due to the fact that, the

advanced mobile devices are always costly and may require certain operating skills (Valk et al., 2010). As highlighted by Mockus et al. (2011), among the biggest issues with advanced mobile learning is the lack of industry standard and the need for multiple-platform development. Furthermore, the internet requirement of such devices is not widely available and accessible for many learners, especially in rural areas (Mockus et al., 2011). In this case, advanced m-learning would appear to be a hurdle in learning as not many students can afford and access such tools.

Meanwhile, m-learning in Malaysia is still considered by many scholars as in its embryonic stage (Mohamed Amin & Norazah, 2013; Shamsul Arrieya, 2011; Issham, Hanysah, & Rozhan, 2010b). Furthermore, there are some challenges highlighted by scholars pertaining to m-learning implementation via advanced mobile learning devices in Malaysian educational institutions, such as connectivity, cross-platform requirements (Nik Mastura et al., 2011), high cost of multimedia content development, limited device power and capability (Afendi, Mohamed Amin, & Haslinda, 2013), as well as financial issues (Supyan et al., 2012). It seems inevitable that m-learning has a promising future in the distance learning environment in Malaysia due to the increasing mobile device adoption among Malaysians (MCMC, 2008). However, amid the aforementioned issues, the implementation of m-learning via advanced mobile devices will definitely require an extensive infrastructure planning, development and management in order to widen the educational benefits of mobile devices among the distance learners.

In reality, every distance learner has his or her own expectation and capability in their learning environment. In fact, no one technology can deliver every type of learning experience that is needed by the distance learners. Finding the right combination of mobile learning tool and distance learning environment, at the same

time balancing with their technological competency and affordability, remains a great challenge. Without any effort to bridge such technology gap and address those mobility needs among distance learners, a successful student-centred learning in distance education might be harder to achieve. Considering the aforementioned issues, m-learning via SMS could offer some useful implications to provide learners with greater accessibility, flexibility, and affordability of learning tools in the distance learning environment. As commented by Kineo (2009), the most successful technology in education is the one that involves rich social practices, though built around rather simple, but reliable technology, and this includes the SMS technology. Therefore, it is worth to research on whether the SMS-based m-learning system is practical and usable to complete the missing puzzle in distance learning environment.

1.4 Objectives of the Study

The main focus of this research is to develop an SMS-based m-learning system which can support current modes of teaching-learning in higher learning institutions, specifically for distance learning courses in Malaysia. Thus, the specific objectives of this work are:

1) To identify what are the users' requirements needed of an SMS-based m-learning system for distance learners
2) To design the framework and architecture of an SMS-based m-learning system
3) To develop Pocket Education system as an SMS-based m-learning system
4) To implement the Pocket Education system within the distance learning environment

5) To evaluate the usability of Pocket Education system in assisting the learning process among the distance learners

1.5 Research Questions

1. What are the users' requirements of an SMS-based m-learning system?
2. What are the elements needed in designing an SMS-based m-learning system?
3. How the SMS-based m-learning system, namely Pocket Education can be developed to meet distance learners' requirements?
4. How can the Pocket Education system be implemented for distance learning programs?
5. To what extent is Pocket Education system usable for supporting the current modes of teaching and learning of distance learning programs?

1.6 Importance of the Study

This research is conducted to study whether the SMS-based m-learning application, i.e. the Pocket Education system is feasible in completing the current modes of teaching-learning in distance learning courses in Malaysian higher learning institutions.

Thus, the significance of the study is twofold. First, it is important to demonstrate the applicability of the systematic instructional design approach – the ADDIE model, in designing and developing a mobile learning system. In this research, the ADDIE instructional design approach was employed in order to develop the SMS-based m-learning system and evaluate its usability in bridging the educational divide among distance learners. The ADDIE model covers the whole

process of development of learning programs from “what does the system need to have” until “does the system accomplish its objectives or not?” (Zimnas, Kleftouris, & Valkanos, 2009).

Secondly, this research is also significant since it is a direct response to the needs for distance education to be able to serve diverse populations of learners in Malaysia, especially those with low income, as well as low ability and accessibility to afford costly devices and Internet access. Not only that it is in line with the current and future trends of educational technology in distance education, it also emphasizes the need for more than just flexibility and convenience in designing a mobile learning support for the distance learners. SMS-based m-learning is foreseen as a learning tool that complements the existing pedagogical approach in distance education courses by offering greater accessibility and affordability of such learning tool to the distance learners.

1.7 Theoretical Underpinning

This study is developed through reviews of prior works conducted on the utilization of Instructional System Design (ISD) as a systematic approach to develop the SMS-based m-learning system. ISD provides guidelines and procedures in developing an instructional material by breaking the complex tasks into several learning hierarchies, which consequently will provide a detailed prescription for the design of instructional programs (Mayes & De Freitas, 2004). ISD is considered as the combination of both a science and an art. It is “a science because it is rooted in learning theories which in turn draw their principles from psychology, sociology, philosophy and education; and an art because the designing of instructional materials is a highly creative process” (Moore, Bates, & Grundling, 2002, p.71).

ISD is actually closely related to the Instructional Design (ID) theory. ID theories are design-oriented in which the main target is to achieve the learning goals. According to Reigeluth (1999), ID theory is a set of design theories that relate to various aspects of instruction. Reigeluth (1999) listed six terms that represent the various design theories, which are given as: 1) Instructional-Event theory, 2) Instructional –Analysis theory, 3) Instructional-Planning theory, 4) Instructional-Building theory, 5) Instructional-Implementation theory, and 6) Instructional-Evaluation theory. Instructional-Event theory guides the nature of the instruction whereas the other five theories are inter-related, have input-output relationship and guide the ISD cyclical process (Reigeluth, 1999).

Thomas (2010a) explained that, the ISD models make practical of the ID theories and principles by embedding the theories in the instructional development process. Until now, more than 100 ISD models have emerged based on one or more learning theories (The Herridge Group, 2004). The fundamental ISD models normally cover five phases found in almost all ISD models, which are Analysis, Design, Development, Implementation and Evaluation. Examples of ISD models that are applicable for e-learning design are the Morrison, Ross, and Kemp model, the Seels and Glasgow model, the Dick and Carey model, and the classic ADDIE model (The Herridge Group, 2004). While there are many ISD models that are useful for the purpose of technology-supported learning, the ADDIE model is considered to be a classic that has stood the test of time (Colborn, 2011). According to Gustafson and Branch (2002), as cited in Thomas (2010a), many of the instructional design theories and models evolved from the core of ADDIE model with the five phases. The ADDIE model as distributed by the American Society for Training and Development (ASTD) is illustrated in Figure 1.1.

With the above discussed underpinning theories, the ADDIE model was chosen to guide the underlying conceptual framework of the SMS-based m-learning system to be developed in this study. As proposed by scholars in the related field, the ADDIE model provides specific strategies to guide the design and development of m-learning instructional materials whereby each of its interlinking phase has their own specific purposes and explicit functions (Sakina Sofia, 2013; Tsai, Young, & Liang, 2005; Fardoun, Villanueva, Garrido, Rivera, & Lopez, 2010). Furthermore, Berking, Archibald, Haag, and Birtwhistle (2012) suggested that the ADDIE model suits the conceptual framework of an m-learning system since it is the most generic, universal, and simple ISD model. It was believed by the researchers that, with the ADDIE approach, every aspect of ISD process can influence the development of an m-learning system.

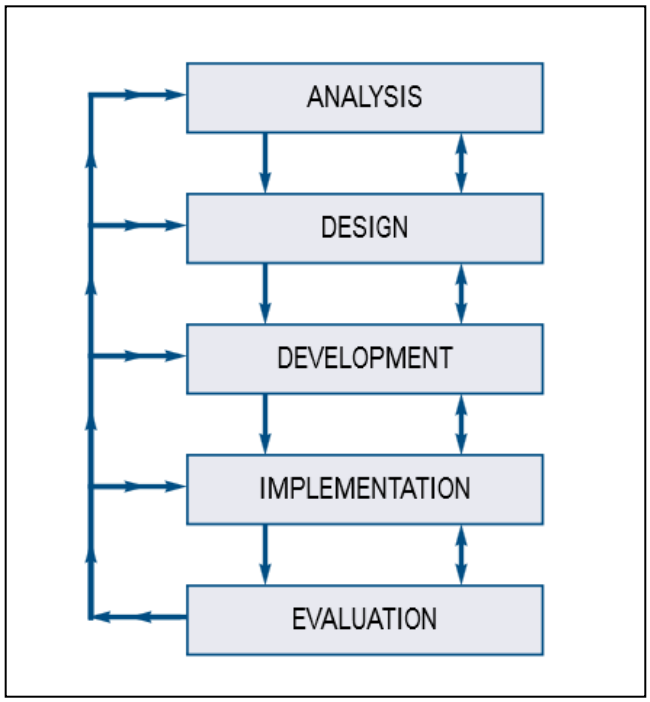

Figure 1.1: The ISD Model Featuring the ADDIE Processes (Grafinger, 1988, as cited in Molenda, 2003)

1.8 System (Conceptual) Framework

This research proposes an m-learning solution through the development of Pocket Education, a mobile-based learning system which facilitates teaching-learning process via SMS technology. For the scope of this study, it is designed as a convenient and ubiquitous learning solution for undergraduate students undertaking distance learning courses from the SDE, USM. This study is expected to give insights into the workings of SMS-based m-learning system as a complementary tool which completes the missing components of the current teaching-learning modes.

The Pocket Education system framework is illustrated in Figure 1.2. As described earlier, the ADDIE model was used as a generic guideline to develop the Pocket Education system framework. The ADDIE model injects the concepts, consideration, decisions, and guidelines specific to the development of Pocket Education system. The ADDIE model can be used as the interchange format to effectively map the steps required in designing and developing the Pocket Education system. Therefore, based on this rationale, the conceptual framework of this study could be diagrammatically expressed as in Figure 1.2.

As depicted in the Figure 1.2, the proposed framework of Pocket Education system comprises of five phases of instructional design, which are Analysis, Design, Development, Implementation, and Evaluation. Outputs from each of the phases vary by the objective of the phase and will be the inputs for the subsequent phase. Evaluation is performed after the system has been developed to evaluate the system's usability.

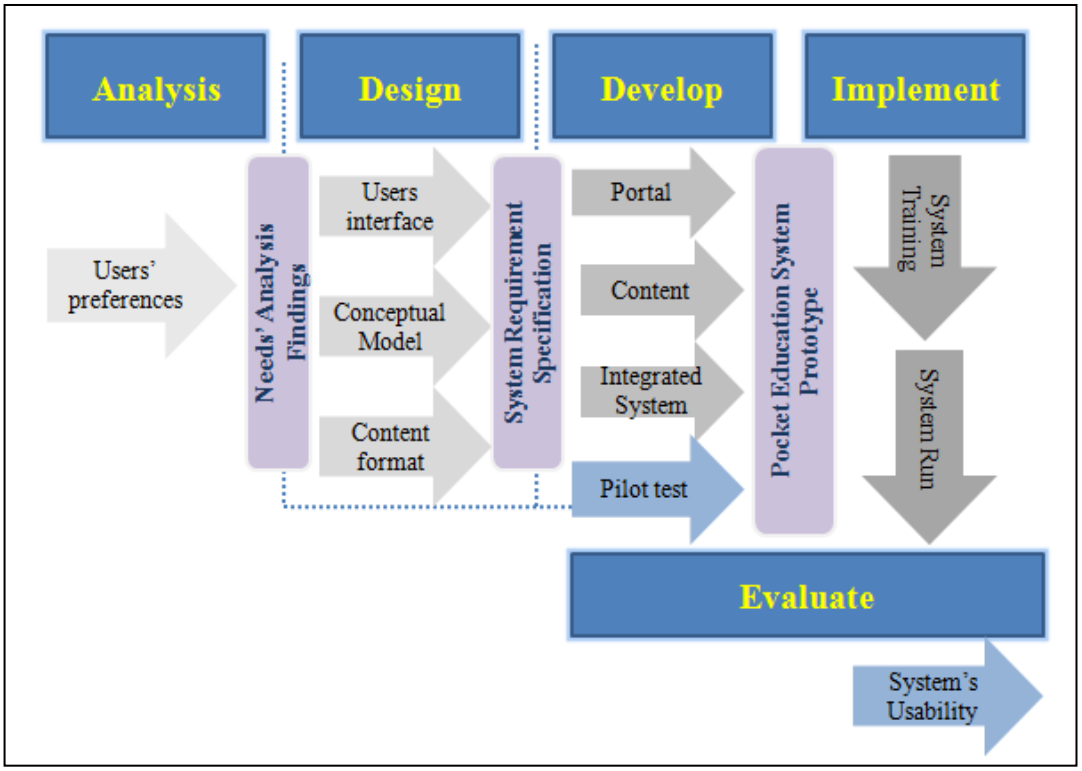

Figure 1.2: The Pocket Education System Framework

1.9 Operational Definitions

In this study, the following definitions are used to refer to the system development concepts used in achieving the research objectives.

(a) Distance Education

In line with the definition provided by Moore and Kearsley (2011), this study refers distance education as the educational process that occurs when students and instructors/lecturers are separated for most of the time, and by this, this mode of education would always require the technology-based communication.

(b) Distance Learners

In this study, distance learners are referred to as the individuals who are enrolling in a distance learning course with geographical limitations to access the on-

campus education. They may include adults with families, full-time and part-time employees, or even those who are self-employed or unemployed.

(c) M-learning

M-learning is used in this study as a simplified term of mobile learning whereby it refers to the utilization of mobile devices (such as PDAs, smartphones, and any mobile phone) in educational process; in line with the definition provided by Keegan (2005).

(d) SMS-based learning

This study refers SMS-based learning as a mode of learning that utilizes the most basic mobile phone technology, i.e. the Short Messaging Service (SMS). The learning content is presented in the forms of text-based chunked information, which may include notes, alerts, quiz, and query.

(e) Pocket Education

In this study, Pocket Education is referring to the system to be developed in this study, which is an SMS-based m-learning tool that delivers the learning contents, alerts, notification, and so forth to the distance learners' mobile phones in the forms of SMS.

(f) Instructional System Design (ISD)

ISD is defined in the study as the systematic approach to design, development, and deliver of any instructional material (McGriff, 2000). The instructional material may include program, training session, procedures, guidelines, curriculum, workshop and products for educational programs such as courseware and other forms of learning tool.

(g) ADDIE

In this study, ADDIE is referred as the generic ISD model and a systemic iterative methodology for designing instruction and instructional materials that represents the five phases of a systematic guideline in building an effective mobile learning tool.

1.9.1 Summary

Learning at a distant requires technological interventions for the delivery of education to become more effective to both learners and instructors. The SMS-based m-learning tool, namely Pocket Education system is to be shaped and realized for complementing the current face-to-face and blended learning modes in distance learning courses in SDE, USM. The ADDIE model is adopted as an instructional design in constructing the needed learning activities and instructional materials. It is hoped that this research will contribute to the studies in exploring the potential of m-learning to constitute a new paradigm of higher education, specifically within the distance learning environment.

This thesis is organized in five chapters. Chapter 1 gives the introduction and overview of the study. It also explains the research questions and objectives in details. Chapter 2 provides the literature review of educational technology, distance education, mobile learning, instructional design, and the formation of the study system framework based on the ADDIE model. Chapter 3 outlines the research methodology, research design, and data analysis procedures in this research. The instructional design approach and the methods employed in each of the five phases of ADDIE instructional design was described in this chapter. Chapter 4 presents detailed analyses and findings from the Analysis phase, the Design phase, the

Development phase, the Implementation phase, and finally, the Evaluation phase. Lastly, Chapter 5 presents the overall discussion whereby main findings obtained in this study are discussed in alignment with research objectives. It also highlights the core findings of this research and concludes the thesis with some limitations and suggestions for future research.