

**DESIGNING MOBILE LEARNING
ACTIVITIES IN THE MALAYSIAN HE
CONTEXT: A SOCIAL
CONSTRUCTIVIST APPROACH**

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**Designing Mobile Learning Activities in
the Malaysian HE Context: A Social
Constructivist Approach**

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List of Abbreviations and Terms

Bluetooth	a wireless technology in the form of a short-range radio technology. Bluetooth makes it possible to transmit signals over short distances between telephones, computers and other devices, and thereby simplify communication and synchronization between devices (Georgiev, Georgieva, & Smrikarov, 2004). Caudill (2007) describe it as device-to-device data transfer technology.
Delivery platform/ mechanism	is the method being used to deliver the course to the targeted students. These platforms take many forms from face-to-face lectures to delivery by the web.
Digital learner	students who are familiar with using digital technologies in their daily life
eBook	a text-based publication in digital format which can be read through various digital devices
HE	higher education
HEI	higher education institution
Hotspot	Wi-Fi in public places (Caudill, 2007)
ICT	information communication technology, a term used widely in education to refer to the variety of technological equipment used in schools and HEIs to support student learning, or to the policy and curriculum for implementation in order to manage, create, store and propagate learning with computer technology. Pelgrum & Law (2003) and Naidu (2003) assert that ICT in education will widen the possibilities for learning and educators will need to re-think their educational practices. In this study, I perceive that ICT in education is defined as the use of computer and technological tools to engage students in their learning.
JPEG file	JPEG stands for Joint Photographic Experts Group. JPEG File Interchange Format is a minimal file format which enables JPEG bitstreams to be exchanged between a wide variety of platforms and applications (Hamilton, 1992). It is a standard method of compressing photographic images.
Learning designer	a person to adopt, adapt, test and improve design learning for technological initiatives. This person needs to translate instructional needs and articulate pedagogy.
Learning management system (LMS)	also known as virtual learning environment (VLE). It is a software application for the administration, documentation, tracking, and reporting of virtual classroom and online events.
Learning principles	similar to goals of learning. It emphasises certain learning activities and these activities support certain learning aims usually based on a learning theory.
Microblogging	is a new form of communication in which users can describe their current status in short posts distributed by instant messages, mobile phones, email or the Web. Microblogging can also be described as “asynchronous, and

	collaborative communication technology” (Cochrane & Bateman, 2010, p.6). More specifically it is “a variant of blogging which allows users to quickly post short messages on the web for others to access” (Costa et al., 2008).
Moblog	a blend of the words mobile and weblogging (Mielo, 2005). Moblogs are actually blogs but are designed to be specifically accessed via a mobile device. Just like web blogs, moblogs allow students to make instant comments on the mobile web pages. Blogs are posts and not pages of a book, hence moblogs usually holds micro-content (Wilén-Daugenti, 2009).
Mobile broadband	implies the establishment of a universal system architecture, capable of cost effectively handling a wide range of equipment with diverse service attributes, in a wide range of applications, involving high data-rates and mobile terminals. This approach allows mobile communications (Fernandes, 1995). Generally it is noted as internet access to mobile phone through a wireless mobile network (Caudill, 2007).
Mobile phone applications	also known as mobile app, is a term used to describe software that runs on smartphones and mobile phones. Mobile applications are designed to educate, entertain, or assist consumers in their daily lives. In some countries the mobile phone is known as cell phones or handphones.
MP3 file	digital audio that encodes format which uses a form of data compression. It is a common audio format for audio storage, as well as a standard of digital audio compression for the transfer and playback of music on most digital audio players.
Notebook	also known as laptops. This is a mobile personal computer that easily be transported and conveniently used in temporary spaces.
Ordinary phone	a basic mobile phone with usually the call function and the texting function
PDA	Personal Digital Assistant. PDA combines computing capability, Internet access, and networking features in one system with a calendar, notepad, address book, and productivity tools. It is a programmable, Bluetooth-enabled, Wi-Fi-equipped device with a pen/stylus input interface (Corbeil & Valdez-Corbeil, 2007).
PDF file	Portable Document Format (PDF) is the global standard for capturing and reviewing rich information from almost any application on any computer system and sharing it with virtually anyone, anywhere (About Adobe PDF, 2012).
Pedagogical Guidelines	guidelines within educational sector vary in purpose from those produced to guide and inform development to those that evaluate the nature of existing resources (Beck, 1997). Guidelines for pedagogy recommends integrating a mix of educational experiences and strategies to meet a variety of learning

	outcomes.
Podcast	is a digital media file which could either be an audio file that could be downloaded through the web.
Podcasting	is the process of capturing audio then posting the digital file on a website or a blog from which students can download the files onto their computers or devices to listen to them at anytime and anywhere they want.
Small bite notes	chunks of information or content of a course delivered to the students.
Smartphone	hybrid devices which combine the abilities of the mobile phones and PDA. Typically they do not have full sized keyboard and can recognise handwritten text. They use Symbian, Windows Mobile or other operating system. As they have Internet browsers they have the potentiality to be successfully in the mobile multimedia education (Georgiev, Georgieva, & Smrikarov, 2004). A smart phone combines telephone capability with a PDA, camera, video, mass storage, MP3 player, Internet access, and networking features in one compact system. (Corbeil & Valdez-Corbeil, 2007).
SMS	short messaging system or at times also known as text messages (Peters, 2009).
SMS blast	short messaging system that is delivered simultaneously to many intended receivers
Widget	a software system for small applications that can be embedded on the web or a mobile phone. A widget also means the small programme that is written in order to describe how it behaves, and how it interacts in response to user actions. Most operating systems include a set of ready-to-tailor widgets can incorporate in an application. New widgets can be created without skill of computer programming language.
Wi-Fi	is wireless fidelity. It is a series of access points which are transmitter/receiver stations that wireless devices can connect to via a mobile device Wi-Fi networking card to the internet (Caudill, 2007). It is used for certain types of wireless local area network (WLAN). Wi-Fi has gained acceptance in many businesses, schools, institutions and homes as an alternative to a wired LAN. Many charge a daily or hourly rate for access, but some are free.
3G/4G Web Service	all smartphones can access the web, but not all can do so at the same speed. 3G broadband networks can offer speeds of 3.1 megabits per second (Mbps) or more. (Cassavoy, 2012). 4G wireless is the term used to describe the fourth-generation of wireless service. 4G is a step up from 3G, which is currently the most widespread, high-speed wireless service. 4G is only available in limited areas. (Cassavoy, 2012).

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This is indeed a journey of many perils and triumphs. The experience teaches me not only about the mechanics of research but also about people, culture and politics in general. I started to want to learn in depth about research, but I ended up learning about myself too.

Dedication

This tribute is to my dad, Lt. Col. (R) Baharom Bin Sukon, the embodiment of an educator. He only saw me half way through this journey, but I know this is what he wanted as he did not manage to finish his own journey.

So daddy, I finished this for us.

Abstract

The introduction of mobile learning in higher education institutions (HEIs) in Malaysia is an instinctive course of action in response to the high increase in rates of mobile phone ownership amongst higher education (HE) students. Mobile learning encapsulates learning opportunities undertaken with the usage of the students' mobile phones. This study aims to explore how mobile learning activities, developed using social constructivist learning principles, can support undergraduate students learning in the context of the study. It identifies the learning opportunities that the different mobile learning activities provide as well as exploring issues and challenges in implementing these mobile learning activities. The results derived from this research are used to inform the development of pedagogical design guidelines for engaging Malaysian HE students via mobile learning activities to support a specific course.

As depicted by interpretive paradigm upon which this study is founded, the students' voices are emphasised as it is justified that the students' participation is essential to move the technology in directions that they prefer. The methodology is design-based research (DBR) which emphasises the need for cyclic intervention and analysis as part of the research process. Hence, there were two stages of data collection which were designed to explore the students' perspective on the mobile learning activities. The methods of data collection include a questionnaire (145), students' blog posts (145) and online interviews (9). The study was implemented with two cohorts of student teachers over a period of two years.

The findings of this study indicate that Malaysian HE students are prepared to accept mobile learning to support their study. However, educators must also be wary of issues such as the students' familiarity in using the selected mobile application. There are several types of mobile learning activities which could be offered namely; contextual, reflective, collaborative, multiple-medium, communication and learning-management. This study contributes to the body of knowledge by providing a) conceptual benchmarks for future studies in the area of mobile learning and learning design, b) a rich insight into the mobile learning development in Malaysian HEIs, c) social constructivist pedagogical guideline considerations, and d) tactical advice for HE practitioners in considering mobile learning.

Chapter 1 : Introduction

Overview

This chapter provides the background to this study. Firstly, it provides the general landscape on which this study is based. Key concepts are provided in order to present a guide to terms used in the study. It then proceeds to explain the research rationale. The research aims and research questions are also discussed, followed by the scope and the significance of the study. Finally, the thesis guide is presented in order to provide a general overview of the study's evolution.

1.1 Background of the Study

The International Telecommunications Union (ITU) (2011) reported that there are 5.9 billion subscriptions to mobile-cellular network worldwide with a penetration of 79% of the population who had subscribed to a mobile-cellular network in developing countries by the end of 2011. This trend is mirrored in most nations, including Malaysia, where subscriptions for mobile phones have reached 119.2 for every 100 people in the country for the year 2011 (MCMC, 2012). Greater than 100% penetration is due to the fact that consumers are subscribing to more than one mobile-cellular network. MCMC, the government's Communication and Multimedia Commission also predicted that these multiple subscriptions will continue onwards with a likely penetration of 121% by the first quarter of 2012 (MCMC, 2012). This large subscriptions difference compared to broadband subscriptions of only 17.3 per 100 people for the last quarter of 2011, which indicates that mobile phones have surpassed the number of conventional computers with internet access. A large number of Malaysians, be it in rural or urban areas of the country, own a mobile phone.

Studies as early as 2004 (Colley & Stead) indicated that mobile phones are a common communication tool for young adults aged 16-24 in United States of America (USA). Mobile phones are also relatively inexpensive as compared with laptop computers. Similar to trends in other countries, it is common for Malaysian students in higher education institutions (HEIs) to own a mobile device. Mobile phones have the potential to be used as part and parcel of students learning, as their "technologies are familiar, personal, universal, non-intrusive, lightweight and cheap, to be woven into every waking moment, among a

myriad of other activities and in all manner of social settings and groups” (Traxler, 2008, p.18). In other words, mobile phones are omnipresent as compared to the internet-able desktop personal computer (PC).

The 2012 NMC Horizon Report (Johnson et al., 2012) rated mobile learning as a ‘technology to watch’ in HEIs. It has become popular for some HEIs to deliver content and services via a mobile device throughout the campus. In the United States, Duke University equipped each new student with an iPod (Menzies, 2005) while Abilene Christian University provided iPhones to incoming students as part of their Connected Campus project (Terpstra, 2009). Other American universities such as George Fox, Duke (Brookshire, 2007, and Raths, 2010), and Georgia State (Sellers, 2003, and Brookshire, 2007) are using audio podcasts to disseminate audio notes or recorded lectures. Some universities have developed mobile applications for the campus community, such as a campus directory and maps, real-time current events and other campus-related information. This trend is also mirrored in university-wide initiatives being implemented by Oxford University (Mobile Oxford, 2011) and the Open University (Kukulka-Hulme, 2007) in The United Kingdom (UK). In Australia, Curtin Technology University (Oliver, 2005) and Queensland University of Technology (Cobcroft et al., 2006) have reported implementations of mobile learning initiatives. Athabasca University, Canada (McGreal et al., 2005, and Coa et al., 2006), has also begun implementing campus-wide mobile applications with their library information system. Common to all of these examples is the use of the mobile phone as a means of information delivery in order to support and manage learning for the courses offered.

Some argue that 80% of people reported to be accessing the internet around the world will do so with a mobile device (Johnson, Adams & Cummins, 2012). This suggests that mobile phones can be used to support learning ranging from learning materials to campus services to specialised applications for specific courses. Amongst the key trends reported in the Horizon 2012 Higher Education Preview is that students expect to be able to study whenever and wherever they want (Johnson, Adams & Cummins, 2012). Students are reported to want faster and more timely access because they want access not only to information but also for collaboration in their social networks. The latter is reported to help them to interpret and maximise the value of a particular course content.

The idea of using computerised mobile devices to support learning was formally conceptualised a few decades ago. Sharples (2003), in a keynote paper, 'Disruptive Devices: Mobile Technology for Conversational Learning', identifies Alan Kay's Dynabook, conceived in the early 1970s, as the first attempt to design a computer-mediated mobile learning platform. However, the concept of mobile learning could be found further back with the invention of the printed press by Johannes Gutenberg in 1445, which brought about the ability for books to be portable to be read anywhere and anytime. The history of mobile phones can also be mapped to the history of mobile learning, as easier communications were formed through mobile radio telephony. Regardless of this, today's concept of mobile learning is still in evolution and different types of research are needed in order to generate more development and understanding in the field (Kukulka-Hulme & Traxler, 2005; Sharples, Taylor, & Vavoula, 2005; Cobcroft, 2006; Kukulka-Hulme, 2009; Ally, 2009; and Vavoula, Pachler, & Kukulka-Hulme, 2009).

In introducing the background of this research, it is also appropriate to explain the key concepts of the research. The understanding of definitions of key concepts is essential in order to provide the backdrop of the research.

1.2 Key Concepts Definitions

There are many interpretations of the term **elearning** which mainly describe the explicit association between students' learning by means of a digital environment. Digital environment can mean using computer applications for both pedagogical and learning management purposes. Pollard & Hillage (2001) posit that elearning "involves the delivery and administration of learning opportunities and support via computer, networked and web-based technology, to help individual performance and development" (p.20). Rosenberg (2001) defined it as "the use of internet technologies to deliver a broad array of solutions that enhance knowledge and performance" (p.28). Zoraini, Kaur, & Hairudin (2004) in a study on elearning readiness in Malaysia, define elearning as "the use of the network and multimedia technologies to improve the quality of learning by enabling access to knowledge and remote resources for the development of a K-society" (p.2). This definition could also include web-based learning and online learning. In this study, elearning means delivering

learning activities in the form of a virtual environment, for example, by placing course content online or using an online discussion forum.

Mobile learning, on the other hand, is a relatively new field and needs to be clearly defined. Kukulska-Hulme (2009) discusses the diversity of mobile learning through several concepts of mobility that can be translated into mobility of learners, content and learning, and which transcend context and time.

There are attempts to define mobile learning focused on the novelty or the functionality of the device. Wang, Wiesemes & Gibssons (2012) define it simply as “learning through mobile devices” (p.570). However, as discussed by Frohberg (2006), Traxler (2007) and Balasundram & Ramadoss (2007), if mobile learning is defined based on applications than it is technology-dependent and could fall into the trap of becoming obsolete. Traxler (2009) further argued that there is a need to move away from a techno-centric definition as it constrains the field of mobile learning. The focus of this study is not on mobile technology but rather on learning activities that can be offered through the device; hence this type of definition is not suitable for this study.

There are also definitions that relate mobile learning to elearning such as that of Milrad (2003) who defines mobile learning as “elearning using mobile devices and wireless transmission” (p.151). Brown’s (2005) definition of mobile learning is a form of elearning that specifically employs wireless communication devices to deliver content and learning support, while the definition presented by Wilen-Daugenti (2009) is that it is an “intersection of mobile computing with elearning, learning enabled by the use of PDAs, mobile phones, and other personal and portable devices” (p.185). However, mobile learning, due to its compact nature, particularly in terms of its technical limitations and concise delivery, cannot possibly deliver the full range of elearning materials in my opinion. The term elearning for this research is explained later in this section. Whilst mobile devices are ubiquitous, they are limited by size and cannot support a full range of learning activities, nor will all learners find them accessible (Zhang & Adipat, 2005 and Goundar, 2011). Mobile learning has the capacity to enable learning to occur across locations, contexts and times (Kakihara & Sorensen, 2002; Thomas, 2005; and Ryu & Parsons, 2008). These descriptions which position mobile learning as a subset of elearning appear simplistic (Traxler, 2007 and Ally, 2009), and are therefore deemed inapplicable to this study.

Throughout the short period of time that mobile devices have been available, we are beginning to understand more about the nature of mobility (devices and users) and how this type of learning plays on the strengths of context, location, and immediate presentation of relevant information. Mobile learning definitions have developed to encapsulate the use of mobile devices in the curriculum to create learning spaces which can facilitate active learning and create meaning that overcome the limitations of time and space (Torrissi-Steele, 2006). These learning spaces are where learning activities take place. O'Malley et al. (2003) define **mobile learning** as “any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies” (p.6). This is the definition that is employed throughout this research, in which **the learner is placed in the centre and directs his or her own learning within learning activities with the use of a mobile phone**. This definition is deemed suitable for this research as central to the learning activities are the students using their own mobile phones.

Learning support is a mechanism to assist students with meeting the course's learning outcomes (Chin & Williams, 2006). In this study, there are basically two categories of learning support. The first is the management support that entails assistance for students to manage their learning, for example reminders and notifications of datelines through short messaging system (SMS). The second, on which the study focuses, is course support in the form of activities for students to engage further with the course content. There may also be other types of support such as pastoral support specifically for personal challenges or technical support to address technical issues. Nevertheless, these two types of support (personal challenges and technical support) are not covered in this study which focuses only on supporting learning for HE students. Meanwhile Nor Aziah & Nik Suryani (2012) describe learning support elements as “elements in a learning environment that aid development of new knowledge, skills and attitudes when the individual interacts with information and the environment” (p.4). This is the description used for this study.

Social constructivist learning principles refer to learning principles based on social constructivist theory. These learning principles found the basis of the learning activities for this study. A key part of HE students' experience must relate to how they are taught and how they can be encouraged to reflect, to collaborate, and to experience multiple viewpoints

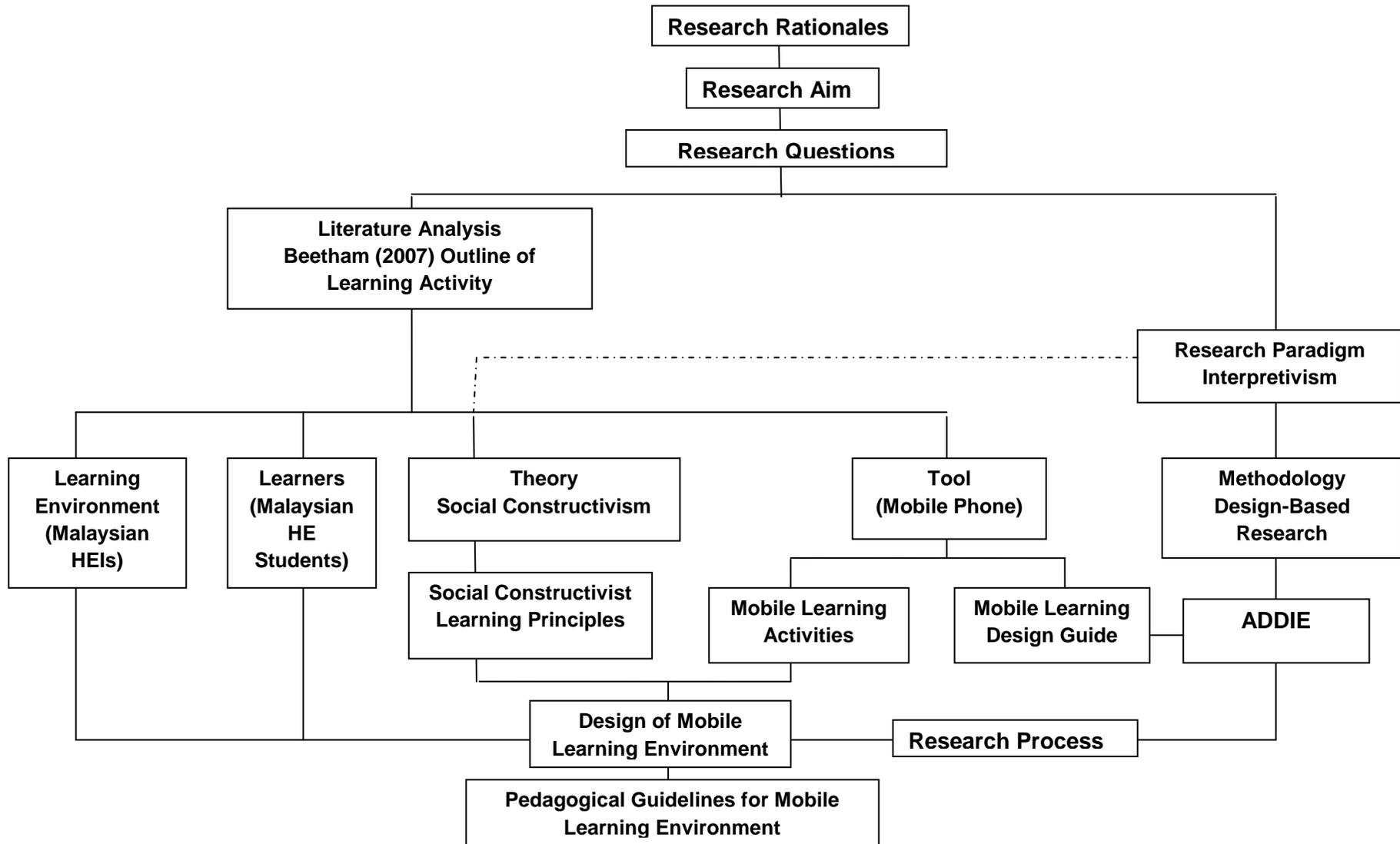
on the contexts of their studies, as proposed by social constructivist theory. The creation of these learning principles is discussed in detail in Section 3.4.

The term **mobile learning activities** have been developed for this study. It means activities that involve use of a particular mobile phone application by HE students in constructing their learning. For example, students collaborating together to complete a project using SMS to communicate with each other. **Mobile learning environment** is another term used in this study. The design of mobile learning environment through social constructivist learning principles and mobile learning activities is elaborated in Chapter 4. This refers to the deployment of students' own mobile phones as a learning support mechanism in the designated course. This environment is supported by learning principles based on theory. This deployment is in the form of learning activities designed to use selected mobile phone applications such as SMS, moblogs, and others.

The **mobile learning design guide** term refers to a design framework for a mobile learning environment. The guide is to provide step-by-step direction in order to develop and implement mobile learning initiatives.

These concepts used in this thesis are illustrated in Diagram 1 in a concept map. The map shows the interconnectivity of the main concepts to each other. The literature is based on learning design which is discussed in Chapter 2. Through social constructivist learning principles and proposed mobile learning activities, the design of mobile learning environment can be created. This process is explained in Chapter 3 of the thesis. The design process for this research and gave birth to the pedagogical guidelines for the mobile learning environment. The research process comes in the form of the interpretivist paradigm and also Design-based Research (DBR) as the research methodology. Diagram 1 also indicates the framework of this research. The research commences with several research rationales which are discussed in Section 1.3 of this chapter. Through the motivation of the research, the aims and research questions are derived.

Diagram 1: Concepts Map of the Thesis



1.3 Research Rationales

There are several justifications for this research. It was based on my personal motivation, and the need for student-focused studies within HEIs. It was also justified by the lack of research on mobile learning activities in HEIs, insufficient research information about mobile learning in Malaysian HEIs, and also the need for learning design research for HEI courses.

1.3.1 Personal Motivations

In my years of having many roles in the first private university in Malaysia, I have developed a deep interest in ICT in education after being part of the initial instructional design team for the deployment of the university's elearning initiative. This compliments my academic background in the field of education in which I had gained a Bachelor of Education (B.Ed) in Teaching English as a Second Language (TESL) and also a Masters in Instructional Technology (MIT). I have found that students have taken up studying with the support of the internet very easily. It is my own observation that students are generally exposed to the internet in Malaysian schools during the weekly computer class, which is subject to the availability of facilities in schools. However, when we introduced elearning into the university, most students did not have issues with the implementation, and some even formed expectations in relation to this service. Therefore I believed that HE students would also be ready to accept mobile learning. Not only are the students familiar with the devices and the various applications offered by mobile phones, but they have also been found to grasp digital concepts easily. This assumption is supported by the Digital Youth project report (Ito et al., 2008). This 3-year ethnographic research project by the University of Southern California and the University of California, Berkeley found that social network and video-sharing sites, online games, and gadgets such as iPods and mobile phones are now fixtures of youth culture. In addition, these devices were used as avenues for extending social worlds, personalised learning, and independence. Although this study was based in the USA, the situation is similar to Malaysia's context. Malaysian are seen to be exposed to digital devices and the ICT culture which will be discussed further in Section 2.3.3 and 2.4.3.

I have many roles in this research. Not only I am a single researcher, but I am also the designer of the learning activities. To the participants I was introduced as a volunteer tutor. This means I was part of the group of instructors for their course, but I was not involved in assessing them. The participants were also informed of my role as a researcher. In playing different roles in research I needed to be constantly aware of my priorities in the various contexts of the research. Furthermore, being ethnically Malay and religiously Muslim, provided me an insider perspective in the context of the research that will be further discussed in Section 2.4.2. According to Wang & Hannafin (2005) "researchers need to balance their roles as designers and researcher to ensure the practical constraints are considered, alternative perspectives are provided, and discipline in the inquiry is ensured" (p.10).

1.3.2 The Need for Student-Focused Research on Adoption of ICT in HEIs

Technology has moved forward rapidly in terms of functionality and speed of the internet with broadband connectivity; the internet is now part of everyday life in most developed countries. Developing countries like Malaysia have followed suit. Therefore as discussed by Somekh (2006) "human beings now use ICT tools routinely, so designing an education system that includes their use by students is increasingly important" (p.36), particularly in the higher education landscape, which is seen as the producer of knowledge workers for our knowledge society. This means technology-enhanced learning studies should include the use of familiar daily tools such as the mobile phone applications used by the students in this study in order to gauge how these tools can support students' learning. It is the students' voices that should be the focal point as they are the recipients of this type of delivery mechanism. For example, issues and challenges of this type of learning should be studied from the students' perspectives in order to gauge their level of acceptance of it.

According to Boud & Prosser (2002) many research projects using new technologies in HEIs teaching and learning adopt a teacher-focused rather than student-focused perspective in the process of converting the teaching and learning practices into a new form. The argument is that there is a need to "utilize knowledge of how students experience learning through the technologies" (Boud & Prosser, 2002, p.237). Hence in this research the focus is on formative evaluation of how the students perceived the deployed mobile learning activities to support their learning. Furthermore, Kennedy et al. (2008) stress that "students

may have particular ideas about how their mobile phones could be used to support their learning (e.g. texting marks or cancelled classes), and these may well be different from those of University staff (e.g. texting pre-tutorial questions)” (p.13).

According to Laurillard (2007a) “M-learning, being the digital support of adaptive, investigative, communicative, collaborative, and productive learning activities in remote locations, proposes a wide variety of environments in which the teacher can operate” (p.172). This places importance on teacher input through good pedagogical design. However, teachers can lead but not direct towards more student-centred learning. Herrington & Herrington (2007) recognise that “despite the significant potential of mobile technologies to be used as powerful learning tools in higher education, their current use appears to be predominantly within a didactic, teacher-centred paradigm, rather than a more constructivist environment” (p.4). This needs to change for a more student-centred type of learning because there is a need for further research on how mobile learning works for learners through the learning tasks and experiences that students most benefit from (Ryu & Parsons, 2008). Parsons & Ryu (2006) suggest that learning activities using mobile phones are ubiquitous part of life; the focus of the design should study the users’ experience in order to get students’ buy-in for the use of mobile phones for learning. Kukulska-Hulme, Traxler & Pettit (2007) suggest that learners should lead the design of mobile learning as they are already creating mobile learning experiences for themselves.

1.3.3 The Need for Research on Mobile Learning to Support Learning in HEIs

Zawacki-Richter, Brown & Delpont (2007) reported on a survey of 88 HEIs from 27 countries on their expectations of mobile learning. One of the main concerns of these institutions was the impact of mobile technologies on teaching and learning. Of the 83 respondents, 64 believe that mobile learning will “be very helpful in enhancing teaching and learning independent of time and space” (p.3). However, they do not suggest how.

Litchfield et al. (2007) have identified gaps within the mobile learning literature and proposed that further mobile learning research is much needed. Amongst these gaps it was discovered that most mobile learning studies are concerned with a single-focused attribute, for example, in fieldwork purposes and focused on a single technology (Kukulska-Hulme, 2008, and Clough et al., 2009). Most mobile learning studies are solely based on a single

mobile application be it SMS, podcasts or a classroom response system. Hence, it is believed that “a body of knowledge of learning and teaching principles and strategies is urgently needed to inform teachers wishing to utilize innovative mobile technologies and also to inform the development of national policy and pedagogical approaches about emerging mobile devices” (Litchfield et al., 2007, p.591). This is the essence of the proposed research study. It aims to derive a better understanding of effective implementation of mobile learning support for HE students through exploration of a series of mobile applications that the students select themselves and to provide a holistic framework for the development of these mobile learning activities within a course based on practical and theoretical principles.

Roschelle (2003) proposes research that critically reviews the “economic plausibility of a ubiquitous, mobile, personal teacher and learning platform that will run all the best pedagogical applications” (p.270). Meanwhile Ryu & Parsons (2008) highlight the need for greater understanding of mobile learning designs founded on pedagogical requirements. This means that research should integrate the use of mobile technologies into a comprehensive pedagogical platform.

According to Alexander (2004) the influence of mobile learning in HEIs is “the physical vs the digital, the sedentary vs the nomadic – the wireless, mobile, student-owned learning impulse cuts across our institutional sectors, silos, and expertise-propagation structures” (p.34). This means that advanced technology has an impact on the practice of teaching and may change the way students experience learning. Hence, Alexander (2004) emphasises the need to explore new approaches to learning with technology.

Therefore this study aims to explore a group of mobile phone applications chosen by the students based on their familiarity and their perceived learning value. Through them mobile learning activities were designed. These activities were then implemented to gauge the students’ perceptions on their usefulness in supporting their learning. The outcome of the research is a set of pedagogical guidelines that can help those teaching in HEIs to map out potential mobile learning activities to support HE students’ learning. The need for pedagogical guidelines for a mobile learning environment had been emphasised by Cobcroft et al. (2006). Through the development of these guidelines, theoretical development for the design of mobile learning activities could be derived.

1.3.4 The Need for Mobile Learning Research in Malaysia

This research identified a gap in knowledge in the area of mobile learning in the context of Malaysian HEIs. Studies in this area are scarce, and the few to which I had access are small projects reportedly being carried out in the Malaysian HEIs. For example, mobile services being used to deliver library services at a public university (Shahriza, Karim, Darus, & Hussin, 2006) and a study that examines the differences in mobile learning use between heavy and light mobile phone users in Malaysian HEIs (Norbayah & Norazah, 2007). There was also Shamsul's (2011) study that discusses the need to include cultural perspectives in the design of mobile learning for HE students in Malaysia.

In Malaysia mobile learning in HEIs focuses mainly on the use of SMS. The Open University of Malaysia (OUM) has begun to introduce their version of mobile learning into a few of their courses (Zoraini, Peng, & Norziati, 2008). The initiative was intended to complement face-to-face tutorials and online discussions, which highlighted the usefulness of SMS (Zoraini, Lim & Woo, 2009). The largest known study of mobile learning is reported by OUM in which 13,200 students were surveyed on the use of SMS to support distance learners (Lim, Mansor & Norziati, 2011). The findings reported that Malaysian HE students generally are receptive to the initiative. Aznarahayu, Issham & Rozhan (2010) reported transfer of learning occurs with the use of SMS for distance learners in University Science Malaysia (USM). However, it appears that studies - which combine several mobile phone applications in a more holistic manner to support the delivery of learning for Malaysian HE (higher education) students - are under researched. There is a need to introduce mobile learning in Malaysian HEIs beyond the use of SMS.

It was also not known whether Malaysian HE students, who are familiar with the mobile phone and its various applications, would also embrace the device as part of their learning. The problems that arise in designing and implementing mobile learning activities in Malaysia were not truly understood. Moreover, Malaysian HE students' perceptions of adding another learning platform and how it could be best designed was not understood. This study attempts to address these gaps; in particular, to explore whether mobile learning activities are acceptable to Malaysian HE students. Through this study the first step towards a more holistic understanding of the implementation of mobile learning for Malaysian HE students can be determined.

The discussion on mobile learning centres around more developed countries and Traxler (2009) rightly states that there is a need for a conception of mobile learning that is based on the culture of a developing country like Malaysia. Ford & Leinonen (2009) recognise that mobile phones are an “important networked knowledge-exchange technology used in a developing world” (p.196). According to them, from the viewpoints of those in developing countries, “features such as limited or no dependence on permanent electricity supply, easy maintenance, easy-to-use audio and text interfaces, affordability and accessibility are the most important considerations for using mobile phones as potential learning tools” (p.196). Thus, research into the use of mobile phones to support learning in a country like Malaysia will produce understanding for any mobile learning initiatives embedded in a real-world context.

1.3.5 The Need for Learning Design Research for HEIs

Alexander (1999a) stresses the need for appropriate learning design in order to use technology to improve or enhance students’ learning experiences. This is because a planned and evaluated design would lead to more successful implementation of interventions with technology. There is a need to plan learning environments based on relevant learning activities and tools (Oliver & Herrington, 2003). It was acknowledged a few years ago that there is “little empirical work that can guide the design of learning settings that support knowledge construction” (Oliver et al., 2002, p.498), and this issue remains relevant to date. This means that more research on learning design is needed in order to foster technology implementation as echoed in Hannafin (1992) and Edelson’s (2002) suggestion that we need to broaden our understanding of the design of emerging technologies. Ravenscroft (2008) emphasises this need to design what he calls “new and powerful technology-mediated process and practice” (p.4) that could revolutionise the way learning is embraced by today’s learners.

According to Barab & Squire (2004), educational design research is “a series of introduction approaches, with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings” (p.2). Currently there is a need to design a learning environment whereby HE students can construct their knowledge by providing a range of tools and resources to navigate and manipulate to support their learning. However, the challenge at the moment is to link the practice of

technology enhanced learning and ground it in a learning theory. It is noted that design studies are expected to be able to make a theoretical contribution as they can address the gap between theory and practice (Mor & Winters, 2007, and Puroo et al., 2008), and learning design is effective if it is based on sound underlying learning theory (Hannafin et al., 1997). There had been many criticisms on educational research especially the link between theory and practice, and design research can contribute to this need (Edelson, 2002, and van den Akker et al., 2006). This study is a step to fill this gap between theory and practice.

A major challenge for technology-enhanced learning research is to communicate the potential of the tools in a pedagogical manner (Mor & Winters, 2007). Pedagogical foundations emphasise how an environment is designed and how the affordances of the chosen tools are made available in order to empower the learners with a wide choice of learning tasks with which to support their learning (Hannafin & Land, 1997, p.174). It is the focus of this research to explore the possibility of the affordances of mobile phones to support HE students' learning and map it into a pedagogical framework. Hannafin & Land (1997) suggest that through design research, a researcher is able to produce "improved understanding of the foundations and assumptions of such systems" (p.172). Hence, through design research, I am also able to understand the learning environment of Malaysian HE students in order to be able to improve future technology interventions. Puroo et al. (2008) state that learning design is a research approach that "values research outcomes that focus on improvement of a phenomenon as the primary research concern, and seek understanding of the phenomenon as a secondary outcome via the process of designing" (p.5). Thus, through this type of research not only do I achieve improvement in mobile learning interventions as a means to support HE students' learning, but I am also able to comprehend the Malaysian HE students' learning with technology.

1.4 Research Aims

Through the justification of the research rationales, the aims of this research were derived. In summary, it was noted that there was a need to explore the possibility of introducing mobile learning activities for Malaysian HE students, and through that gained an understanding of how mobile phone applications could support students' learning in HEIs. Through this exploration, the preparedness of HE students to accept mobile learning as a

supportive mechanism and to identify issues in implementing a mobile learning environment could also be achieved.

The main focus of the study is on the types of mobile learning activities, using available applications of mobile phones which can support HE students' learning. The research capitalised on and deployed applications in the form of a series of organised activities to reinforce learning outside the classroom. These activities are conceptualised using social constructivist theory as explained further in Section 3.5. Recommendations for mobile learning applications and activities were derived from iterative cycles of design and development. The outcome of the research has been to produce pedagogical guidelines on which mobile learning activities could be designed and delivered via students' mobile phones in a Malaysian HEI context.

The research was conducted in the oldest university in Kuala Lumpur, Malaysia specifically in the Education faculty. The course in which the mobile learning environment was implemented was the Technology in Primary Education (PKEY3101) for B.Ed Teaching English as Second Language (TESL) students in the Faculty of Education. These students were third year pre-service teacher trainees who were training to teach English language in primary schools. The course aims to introduce the use of educational technology in the classroom. A more detailed illustration of the participants and the course is presented in Section 4.6 and 4.7 respectively of this thesis.

1.5 Research Questions

According to van t'Hooft (2009) mobile learning "is characterized by an active process, interaction with others, and transfer of learning to/learning in real-world situations" (p.171). Therefore research questions should be adjusted to accommodate this complexity. Van t'Hooft (2009) also emphasised that the priority for research questions in mobile learning should be the process of implementing mobile learning. Meanwhile Laurillard (2007b) points out the importance of mobile learning research questions that centre on the pedagogical aspect as a means to support the learning process and to exploit the richness of a ubiquitous environment. These factors were taken into account in developing the study's research questions, which are:

1. How prepared are HE students in a Malaysian university to accept mobile learning activities as part of their course?
2. How can social constructivism be applied to the design of mobile learning in a Malaysian HEI course?
3. What are the issues and challenges in implementing mobile learning activities in a Malaysian HEI course?

1.6 Scope and Significance of the Study

The main focus of this study is the implementation of mobile learning activities for which the design and development of the activities are part of a research process. The design is based on available mobile phone applications such as SMS and podcasts that are made possible through the use of students' mobile phones and are also considered suitable to support a HEI course. The applications were chosen on the basis of the comfort levels of the students targeted along with the perception of usefulness of the students themselves in the initial stage of the study. Besides that, preparedness of the participants along with issues that arise in implementing the learning activities in a mobile environment were also explored.

The role of mobile phones in this study is as a supporting delivery tool intended to bring about a greater sense of 'always-on' learning and a wider context for learning opportunities. This means that learning is not restricted to the four walls of the lecture hall but it can be reflected and reconstructed anywhere (Naismith et al., 2001; Klopfer, Squire, & Jenkins, 2002; Kim, Mims, Holmes, 2006; Park, 2005; Thomas, 2005; Maag, 2006; Caudill, 2007; McConatha, Praul & Lynch, 2008; Goundar, 2011; and Hashemi et al., 2011).

This research did not seek to measure the effectiveness of the applications that were selected to be embedded within a learning activity that uses mobile phones; however, it covers students' perceptions of the usefulness of these applications in supporting mobile learning activities. The main focus was to establish pedagogical guidelines for mobile learning activities based on social constructivist theory deemed suitable for HE students in Malaysia to support their learning.

The study did not narrowly focus on a single mobile phone application, but on several applications in combination. Ehrmann (1995) further adds that research should not only involve creating strategies for teaching and learning with technology, but also finding which technologies are best to support these strategies for appropriate educational technology research. These mobile applications were chosen by the students in terms of their familiarity and their perceived usefulness to support their study. As noted in the research rationale, it is essential for student-focused research. The study presents the students' points of view on the extent to which a specific learning activity using a specific mobile application or a combination thereof could help them to learn.

Going beyond the practical design aspect of mobile learning activities, this research potentially extends and refines social constructivism as the theory underpinning the design of the activities. This research could shed new light on theoretical development as it bridges the gap between theory and practice. Furthermore this study is conducted in a specific context, thus it brings about further revelation to the field of mobile learning in Malaysia.

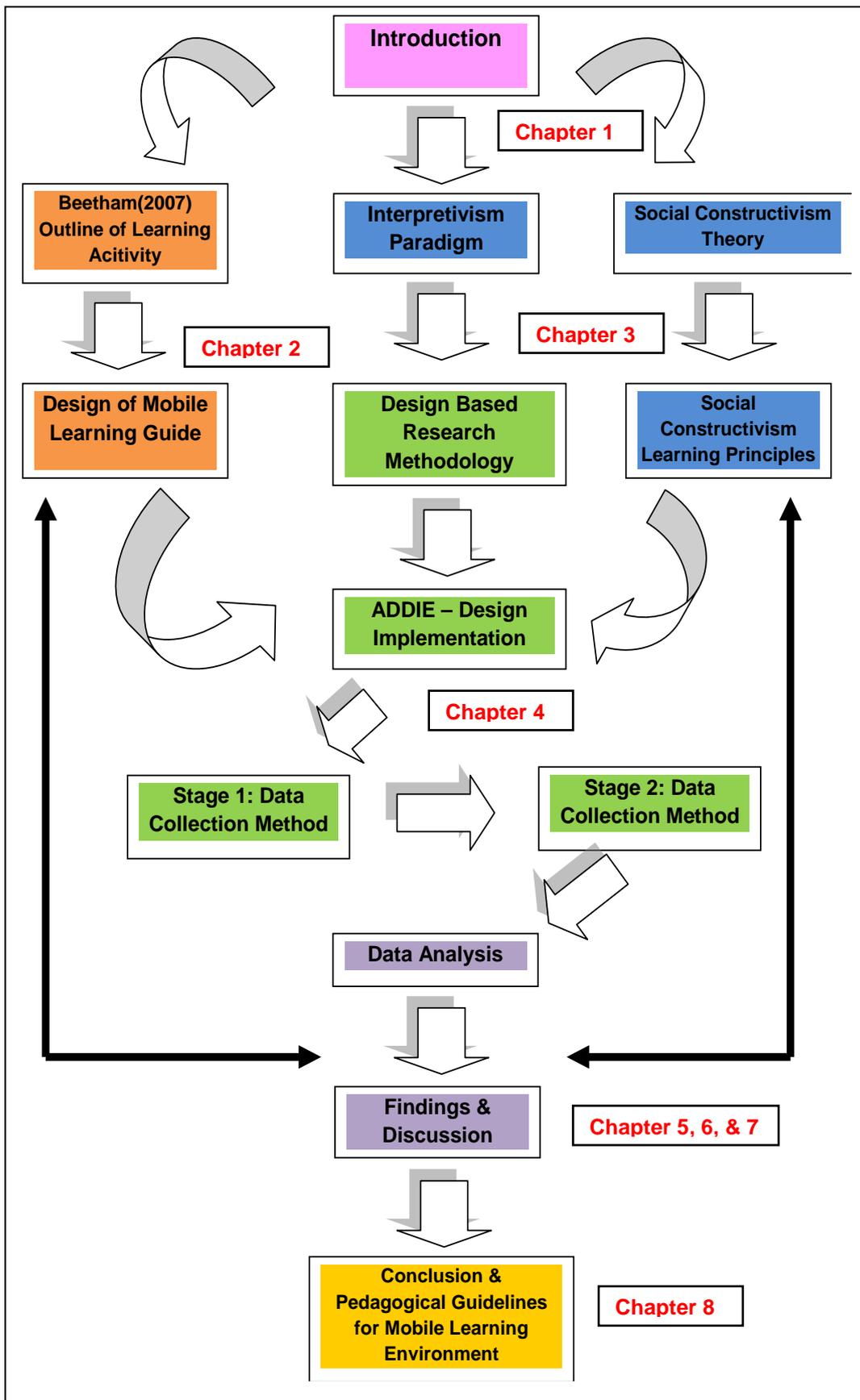
This study is timely as Malaysia aims to become a developed nation through the Vision 2020 policy (National Higher Education Strategic Plan 2020, Ministry of Higher Education, 2007). HEIs have to keep abreast of development in order to produce graduates who are skilled in using ICTs. There is also an absence of studies on ICT-led research in the area of higher education in developing nations such as Malaysia, especially in relation to the use of specific tools such as mobile phones. Even though this study is based on a single Malaysian context, it also contributes to research on understanding HE students' use of mobile phone applications to support their learning globally, particularly in other developing countries.

The research contributes to the limited body of knowledge concerned with the use by HE students of mobile phones to support their learning. In the study, learning activities for mobile learning environment were developed and implemented. The findings of this study provide insights into implementation issues, particularly in terms of the types of mobile phone applications that could be used and the type of activities that could be designed based on these applications. Challenges and issues are also highlighted in order to provide a reality check on the complexity of designing and implementing a new delivery mechanism such as mobile learning in HEIs.

1.7 Thesis Guide

This section presents a guide to this thesis. The guide presents a map that not only navigates the reader through the research process, but also provides a pathway for the remaining chapters of this study. The thesis guide is as illustrated as Diagram 2, and the detailed explanation follows.

Diagram 2: Structure of Thesis for Designing Mobile Learning Activities for HE Students



Vrasidas (2001) states that interpretive research, as in this study, needs to provide a rough guide in order to communicate the purpose of the study to the reader of the thesis. Therefore, this thesis guide aims to show the inter-connectivity of the chapters with the aims of the research. The research background and rationale are discussed in this chapter (Chapter 1) as an introduction to this research. The research aims and research questions are also introduced to provide the direction of the research. The structure of the thesis through the thesis guide in Diagram 1 is further explained. The summary of the chapters and sections of the thesis guide discussed are explained as follows:

Chapter 2 Literature Review: Learning Design for Mobile Learning Activities

The first section of the chapter explores the concept of learning design specifically in terms of factors relating to and design requirements for mobile learning activities. The chapter then reviews three aspects of learning design which are: learning environment, the students and mobile learning. The learning environment of Malaysian HE students is explored through a review of HEIs and ICTs, the Malaysian HEI context and Malaysian HEIs and ICTs. The participants in the course, who constitute the Malaysian HE students' context are also scrutinised in aspects of them as digital learners in HEIs, Malaysian HE students and Malaysian HE students' use of ICT. Finally, mobile learning characteristics, its possibilities in offering learning support, and its challenges are also discussed. Through the literature, structure for designing mobile learning activities are elicited, along with issues that could be faced during the implementation at different stages of the research.

Chapter 2 is linked to the chapter about the research process (Chapter 4) because the design of mobile learning activities was derived from the literature and also guided the implementation of the activities. Furthermore, the literature in Chapter 2 is reflected in the data analysis and discussion of the findings for this study.

Chapter 3 **Research Paradigm and Theoretical Perspective**

My research is founded on the interpretive paradigm. This chapter justifies this approach. Furthermore, the theory utilised in this research, social constructivism, is discussed. This chapter presents the way in which social constructivist theory is interpreted to form learning principles. These learning principles were adopted as the foundation for the mobile learning activities.

Chapter 4 **Research Process and Research Design**

Design Based Research (DBR) is the methodology used in this research. The ADDIE (Analysis, Design, Development, Implementation and Evaluation) Model is the instructional tool used to implement DBR. While the mobile learning design guide is also used in the two stage research process as part of the research's design process. Data collection methods and ethical issues in the research are also explained. Finally, a description of the way in which data were analysed is presented in this chapter.

Chapter 5 **Stage 1 Results and Findings**

A rich description of the Stage 1 findings from the research process is provided in this chapter. The findings illustrate the data collection methods which were designed for the respective ADDIE phases of both stages. Stage 1 findings influenced the Stage 2 design of mobile learning activities.

Chapter 6 **Stage 2 Results and Findings**

The findings from Stage 2 are described in this chapter. The presentation is similar to Chapter 5. A summary at the end of the chapter provides a reflection on the mobile learning activities' implementation.

Chapter 7 **Discussion**

This chapter ties the two stages together with the literature in

Chapter 2 and the theory (social constructivist learning principles) from Chapter 3. The discussion is guided by the research questions.

Chapter 8 **Conclusions, Limitations and Recommendations**

In this chapter the focus is on conclusions derived from the findings in which the mobile learning pedagogical design guidelines are produced. It then evaluates the design process and also the research process of the study. The limitations of the study are discussed and further directions for research in this field are also proposed. The summary wraps up the thesis.

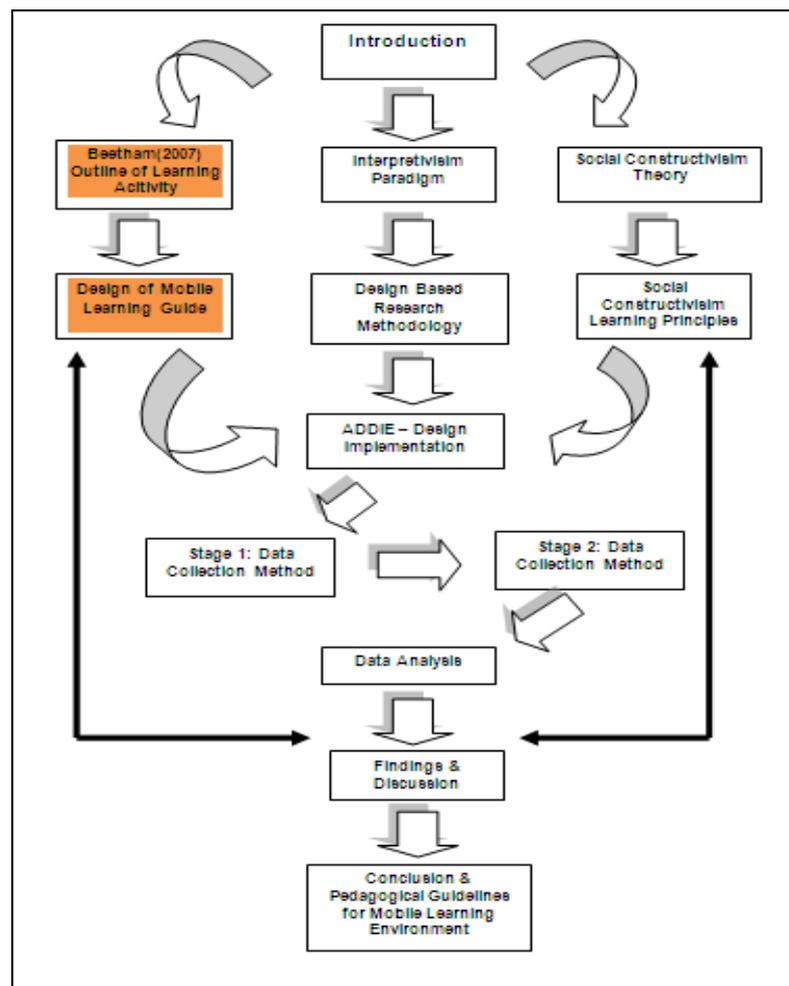
Readers will be shown the thesis guide in the following chapters of the thesis in order to provide a better illustration of where the research presentation is at and how the concepts are interconnected in the research process.

Chapter 2: Literature Review: Learning Design for Mobile Learning Activities

Overview

This chapter reviews literature that provides the groundwork for the design of mobile learning activities to support Malaysian Higher Education (HE) students. The chapter is part of the thesis structure shown in the diagram below:

Diagram 2: Structure of Thesis for Designing Mobile Learning Activities for HE Students



The sections in this chapter aim to provide an understanding of, and act as building blocks for, the architecture of learning activities using the mobile phone in a Malaysian Higher Education Institutions (HEI) course. The first section is on the concept of learning design followed by discussion of the concept of learning activities to be designed as part of the foundation for this research. Through the literature on learning design activities there are four main factors identified as the basis of learning design. Three of the factors are

discussed in this chapter, namely the learning environment, the learners and the tool. The fourth factor, theoretical principles, is discussed in Chapter 3.

For each of the respective factors there are sub-sections which constitute the various aspects. For learning environment the discussion is about HEI and ICT, the Malaysian HEI context and Malaysian HEI and ICT. For learners' factor, aspects of digital learners in HEIs, Malaysian HE students and Malaysian HE students' use of ICT are discussed. Finally, for the tool factor the sub-sections are on mobile learning affordances, potential of mobile learning in HEIs, possible mobile learning activities in HEIs, issues and challenges of mobile learning in HEIs, and also the design of mobile learning environments.

2.1 Learning Design

Learning design is defined by Boud & Prosser (2002) as “a variety of structures using new technologies that support student learning experiences. Learning designs may be at the level of a whole subject, subject component or learning resources” (p.238). Whereas MacLean & Scott (2007) define it as “the process of designing effective learning experiences for a variety of contexts: in the classroom or laboratory, in the field, online and via standalone packages using a range of media” (p.187). This means that learning design is the design of structures for learning experiences in a targeted context while using various media or technology.

Furthermore, Conole & Fill (2005) describe learning design as “a pedagogical model for a specific learning objective, target group and a specific context or knowledge domain. The learning design specifies the teaching and learning process, along with the conditions under which it occurs and the activities performed by the teachers and learners in order to achieve their required learning objectives” (p.5). In 2009, Cross & Conole depict learning design as “a range of activities associated with better describing, understanding, supporting and guiding pedagogic design practices and processes” (p.1). Learning design is also portrayed as the art of creating and sequencing learning activities in order to guide learners' efforts to produce effective learning through selecting the best tools (JISC, 2004a). These descriptions of learning design resemble Koper & Olivier's (2004) description that learning design is a pedagogical approach that positioned the learning process as central to its design. Learning design is also based on a complex real-world context in which a learning designer must be

mindful of the relationship between learner, learning environment and intended outcomes. (JISC, 2004a). Beetham & Sharpe (2007) take the discussion further by stating that design for learning is “the process by which teachers – and others involved in the support of learning – arrive at a plan or structure or design for a learning situation. The situation may be as small as a single task or a large as a degree course” (p.7). This means that design for learning is intentional and systematic. It also appears that there must be discussion between learners with cycles of practices, evaluation and reflection that will help to develop effective learning design. Learning design involves not only the learner but also the learning environment to produce learning situations or in this study noted as learning activities.

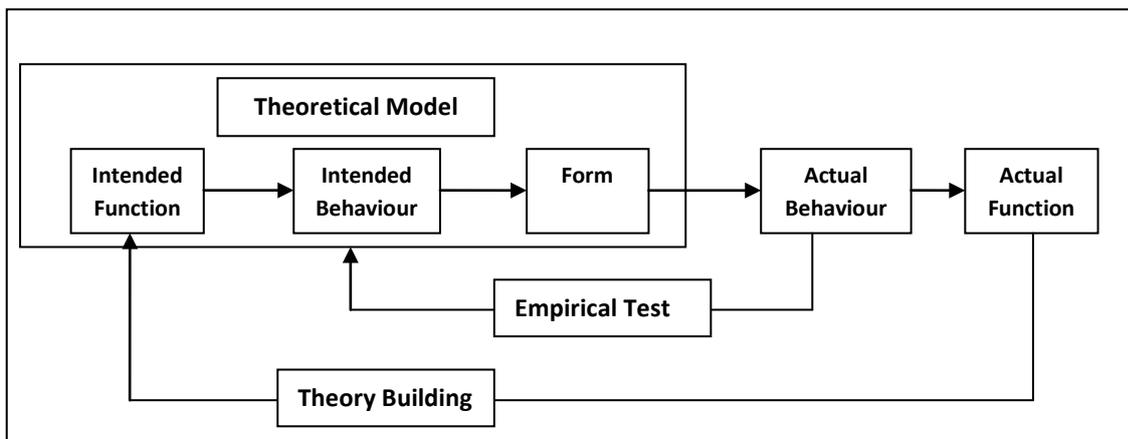
Cross & Conole (2009) and Falconer, Finlay & Fincher (2011) noted that there are different approaches to designing learning in the field of technology-enhanced learning. The first is a more specific technical approach which focuses on building computer systems that can synthesize the delivery of learning resources and activities for computer-assisted learning (Falconer, Finlay & Fincher, 2011). An example of this is adopted by IMS Learning Design which aims to provide a framework of elements that can describe any design of a teaching-learning process (Caeiro, Anido & Llamas, 2003). The second approach focuses on pedagogy and student activity rather than learning content. This approach stresses the design process including the structure of design, learning situation, support, resources and so on in order to find effective ways of sharing innovative practice in technology-enhanced learning. This second approach is also recognised by Beetham (2007) as a way of understanding the components and relationships within a learning experience. This is because the focus of research in the implementation of technology is on activities by the learners and also how learners engage with them as active participants. This research adopts the second approach, focussing on the design of pedagogy-based mobile learning activities that support HE students’ learning.

There are a few methods for designing learning. Conole et al. (2004) propose that pertinent stages to designing learning are: (1) reviewing learning theories; (2) identifying common characteristics across different learning theories; (3) building a model from these characteristics; (4) mapping learning theories to the model and identifying theory clusters; and (5) applying and testing the model to develop a learning design toolkit. An additional suggestion from Gorard & Taylor (2004) is that design activity is a creative process and that it involves continuous modifications as feedback is received, and designers reflect upon it.

This means that designing learning is a continuous iterative cycle (Purao et al., 2008, and Cross & Conole, 2009). These are some of the structures for learning design.

In this study a more general model of design research as proposed by Gorard & Taylor (2004), illustrated in Diagram 3, shows an iterative design cycle is adopted. This cycle is essential to transform the ‘form’ of the artefact to conform to the pragmatic demands of the situation. The artefact is the affordance of the tool used for intervention process of the learning environment and in this research; the tool is the mobile phone. The diagram shows that the intended function and behaviour through ‘form’ determines the actual function and behaviour which bring forth the outcome of the research either as empirical findings or theory-building. This learning model design was adapted in this research because the exploration of actual behaviour of participants in this research and also the actual function of the mobile phones to support their learning are being reviewed after the theoretical model is shaped and implemented. The model was chosen because it is suitable for the exploration of mobile learning activities as it caters for iterative processes.

Diagram 3: Design Learning Model Gorard & Taylor (2004)



Purao et al. (2008) explain further, Gorard & Taylor’s (2004) iterative model by stating that each cycle of the design represents a coherent theory about the nature of learning and instruction, and also the design process itself. This is because the initial stage of design is exploratory as it seeks to understand possibilities that emerge as a result of the participants interacting with the tool. The relationship between learning activities and actual in-use situations is important in design research (Fowler & Mayes, 2000). This differs from traditional educational research in which well-defined hypotheses are declared and tested. In design research, the actual situation of implementation is focused. Hence, traditional

education studies “do not include rich descriptions of designed interventions as they only provide the means to a larger goal of testing existing hypotheses” (Purao et al., 2008, p.15). This Gorard & Taylor (2004) design learning model is reflected in the presentation of findings of this research (Chapter 7) which partly focuses on the need to understand actual behaviour of the participants upon the implementation of mobile learning activities.

Learning design features key elements which are comprised of the different types of tasks or activities, the content or resources and support mechanisms that can support learners to engage with the task (Agostinho et al., 2002; Oliver & Herrington, 2003; and Bennet et al., 2007). Boud & Prosser (2002) state that it is essential to identify the elements of learning designs which can enhance the possibility of the activity inducing a deep learning experience for learners. Thus it is understood that the main component of learning design is the learning activities.

Rich hands-on experience through personal connections among ideas, contexts and perspectives produces learning that is meaningful (Wilemsky, 1991; Hannafin & Land, 1997, and Bennett et al., 2007). Activities maximise learning experiences, thus the learning environment should provide a structured context that is rich in enabling experience and opportunities to engage in knowledge construction. Agostinho et al. (2002) describe the design of these learning activities as “a variety of ways of designing student learning experiences, which is the sequence of types of activities and interactions” (p.30). The next section discusses learning activities further, as the focus of this research.

2.2 Learning Activity Design

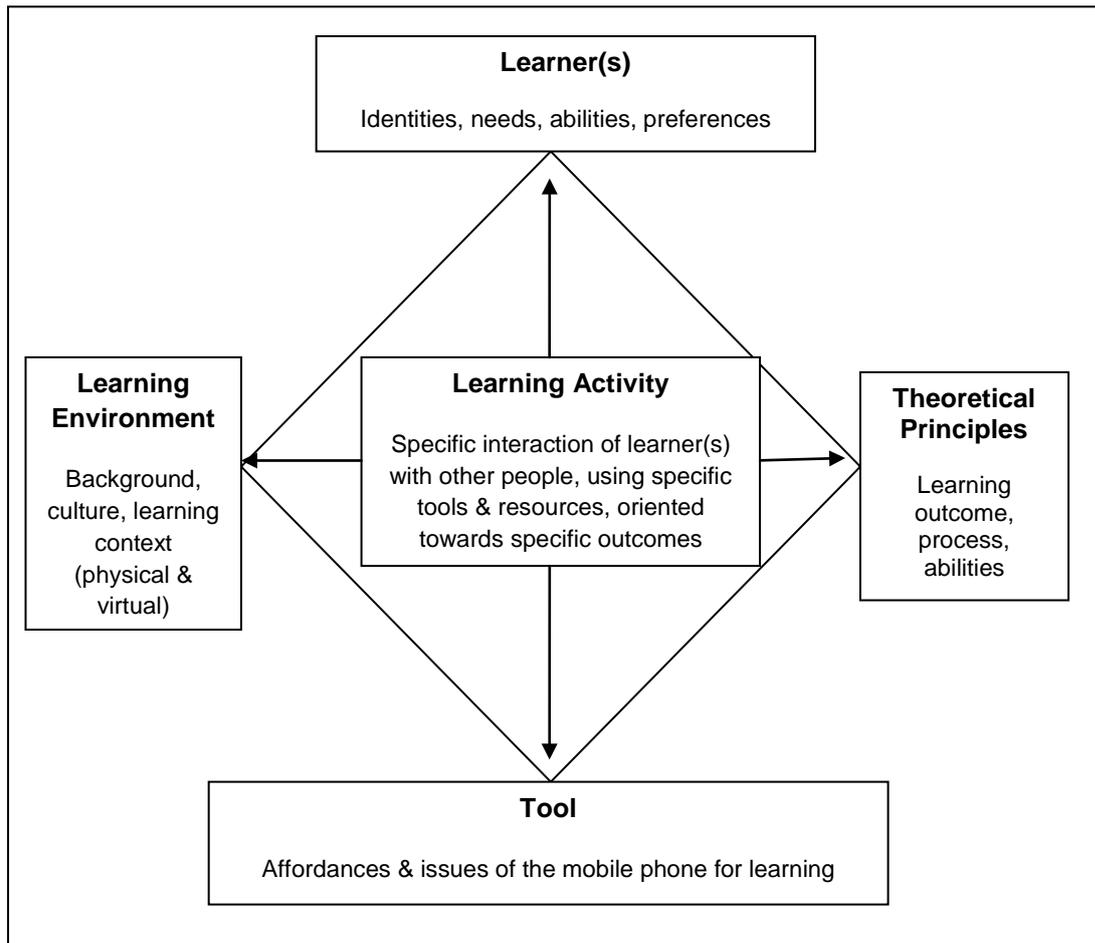
Learning is developed through activity (Papert, 1990). According to Oliver et al. (2007) learning activities are a “deliberately planned set of experiences that are intended to help them (learners) to learn” (p.65). Qiao, Sun & Wang (2009) describe learning activity as “an interaction between a learner and an environment (optionally involving other learners, practitioners, resources, tools and services) to achieve a planned learning outcome” (p.127). This definition is also supported by Beetham (2007) who states that a learning activity is an interaction between learners and the environment or others using selected tools and resources targeted towards an outcome. It is noted that in some research ‘learning activity’ is expressed as ‘learning scenarios’.

Hannafin (1992) posits that learning is not achieved by “mastery of formal knowledge per se, but by activities that progressively refine and qualify relationships among connected elements” (p.54). While Gagne (1985) and Hannafin & Land (1997) emphasise learning activities as the engineering of external conditions which are believed to activate the internal processes needed for effective learning. Learning activities should also engage learners in meaningful and relevant tasks so that they can see the direct implications of their actions and can further apply the knowledge gained in their context (Wilson & Cole, 1996, and Dabbagh, 2005). This means that the design of learning activities could take into account context and create opportunities for learners to make meaning within their context. As proposed by Oliver et al. (2002) learning “is achieved by the active construction of knowledge supported by multiple perspectives within a meaningful context” (p.496). There is further discussion on learning in Section 3.3, which explains the use of social constructivism as the theoretical framework.

Hannafin & Land (1997) take the perspective that technology enhanced learning can “provide interactive, complimentary activities that enable individuals to address unique interests and needs, study multiple levels of complexity, and deepen understanding” (p.168). Beetham (2007) on the other hand states that learning design should focus first on activities and only then on the tools or resources to support them. She believes that if learners engage in an activity then they are also responding to the task afforded by the tools. Nevertheless, tools that afford learning are an essential part of the learning design.

Beetham (2007) has positioned learning activity as central to the design process, which also includes factors on which design decisions are based. She proposed four factors which support design decisions, which are the learning environment, the learners, learning outcomes and ‘others’. I have adapted Beetham’s (2007) Outline of Learning Activity to make it suitable for this research as in Diagram 4.

Diagram 4: Outline of Learning Activity (Adapted from Beetham, 2007)



In Beetham's (2007) Outline of Learning Activity, she includes 'learning outcomes' as a factor; however, I have changed this factor to 'theoretical principles' as it was more relevant to this research. Theoretical principles focus more on theory building aspects of Gorard & Taylor Design Learning Model (2004) as in Diagram 3 explained earlier. Thus, theoretical principles fit more in this research. Theoretical principles are also an element in the design of mobile learning activities as discussed further in Chapter 3. I have also changed 'others' into 'tool' in order to concentrate more on the affordance of mobile phone for learning rather than a general 'others'. Therefore for this study, the factors in the design of the learning activity are the theoretical principles, learning environment, the learners, and tool.

The learning environment and learners are two factors in the Outline of Learning Activity (Diagram 4) that describe the background aspects of the context in which the design of learning activities for this research is based. Passey (2010) recognises that the design of mobile learning activities must consider tasks, technical issues, the political and cultural

context of the learning environment. These are represented in the factors of learning environment and also the learners in the Outline of Learning Activity (Diagram 4). There are many decisions that underpin the design for mobile learning in a particular context. Effective practice for learning design is based on a range of approaches for learning activities, perceptions of learners' needs, the nature of the learning environment, and the intended outcomes based on theoretical principles. Most importantly, learning using ICT should be directed towards extending learning potential and not just use ICT for its own sake (JISC, 2004b).

Hannafin & Land (1997) call for cultural foundations to be reflected in the design process because the values and roles of the individual in society are linked to the acceptance of learning. This is being reviewed through the section on learning environment and learners. The learning environment element in this research comprises ICT in HEIs, the Malaysian HEIs context and usage of ICT in Malaysian HEIs. Guralnich (2008) stressed the importance of the learner's environment as a factor in the design of mobile learning activities. The challenge of designing for learners is that they "have different priorities, preferences and approaches to learning, and different requirements for support" (Beetham, 2007, p.31). Malaysian HE students are also discussed in the following sections of this chapter. This provides understanding of cultural background of the learning environment and the participants of this study.

The last element from the model of learning activities design in Diagram 4 is the 'tool' and in this research, the tool is represented as the mobile phone. According to Beetham (2007), available technologies and how learners use them for specific activities are essential aspects of learning design. The way that learners use technology is referred to as 'affordances' or learning meditation, and it is noted that tools can have different meanings in different contexts (Beetham, 2007). The affordances of the mobile phone for learning in HEIs, possible mobile learning activities, and the challenges of mobile learning implementation are also discussed in this chapter.

Hannafin (1992) posits that learning activities are "substantially less explicit, identifiable, and singular, while being substantially more complex, individual, and internally centred" (p.52). Dunlap & Grabinger (1996) and Passey (2010) propose that meaningful learning can be achieved through the provision of a variety of learning activities. It is noted that design

for learning is intricate and does not progress in a linear way from theory to principle to practice, rather it iterates between the two. Passey (2010) stresses the need for mobile learning activities within a learning context that encompasses a wider system that includes both formal and informal elements. The most important aspect of designing learning activities in this research is the engagement of learners in these activities. The outcome of the activity needs also to be significant to learners' learning and based on their context.

The sections that follow are reviews of the factors in the learning activity model: the learning environment (an HEI in a Malaysian context and the use of ICT in this context), the learners (Malaysian HE students as digital learners) and the tools (affordances of the mobile phone to support learning within an HEI course).

2.3 Learning Environment

A learning environment is “the totality of the surroundings and conditions in which something or someone lives or functions” (Warger & Dobbin, 2009, p.6). Oliver et al. (2002) describe learning environments as “learning settings that support knowledge construction, the emphasis is placed on learning as a process of personal understanding and the development of meaning in ways which are active and interpretative” (p.497). As posited by Hannafin & Land (1997), a learning environment is “ultimately shaped by its foundations and assumptions about learning, pedagogy, and the learner” (p.197), which is similar to Kember, Leung, & McNaught's (2008) argument that approaches to learning are greatly influenced by the teaching and learning environment. This means that understanding the context of the learning environment is part of designing the intended learning activities because context can influence the design.

According to McRobbie & Tobin (1997) learning environments should be about the extent to which a social setting encourages or constrains learning. A rich learning environment places emphasis on the learners' social or cultural settings in order for the learning environment to be tailored to them (Reeves, 1992). Buckley et al. (2010) postulate that the learning environment should be based on learning experiences that are founded on “understanding of the context in which students operate, including their multiple needs, approaches to study and different conceptions of learning” (p.63). Only through

understanding of the learning environment context can the goal to “generate empirically referenced design guidelines and heuristics” (Hannafin, 1992, p.61) be achieved.

In order to describe the learning environment in the context of Malaysian HE students, it is believed that an understanding of ICT in HEIs, the context of Malaysian HEIs and Malaysian HEIs’ usage of ICT are pertinent. It is essential to evaluate the values of Malaysian HE students in a multicultural society, and also to understand relevant government policies related to ICT in education which would colour the general context for the design of mobile learning in a Malaysian HEI.

2.3.1 HEI and ICT

The main role of ICT in HEIs is to enable HEIs to assist with the delivery of traditional education, as students are expecting “to use ICT to complement their more restricted access to teachers, and academic staff” while support staff such as librarians are starting to use “different strategies towards dissemination of knowledge and the development of intellectual skills” (Shuller, 2001, p.82). However, it does not mean that any new technology can be adopted or adapted straight away for teaching and learning without understanding the nature of the technology and investigating the best methods suitable for the context where it is to be implemented. In the words of the former VC of Brown University, Vartan Gregorian, “the new technology per se is not a revolution – the revolution is the difference that technology makes in how we organize, structure, and empower our lives” (Gregorian, Hamwkins, & Taylor, 1992, p.7). Hence, ICT can be exploited as a delivery mechanism for a HEI course, but it is also essential to learn and recognize the ways in which the selected technology can be employed and deployed for teaching and learning.

One of the most extensive HEI surveys is the National Survey of Student Engagement (NSSE) that aims to gauge how American HE students spend their time and how their educational experiences are shaped. In the latest NSSE report of 2011 for Fostering Student Engagement on Campus, it was stressed that providing opportunities, activities and environments supportive of learning influenced student success in their studies. There were five indicators for effective educational practice in HEIs: (1) level of academic challenge; (2) active and collaborative learning; (3) student-faculty interaction; (4) enriching

educational experiences; and (5) a supportive campus environment. ICT has a part to play in these factors as a means to improve HE students' engagement in their learning. These indicators are also echoed in the Australasian Survey of Student Engagement Report (2009) and the New Zealand Survey of Student Engagement (2011). The concept of student engagement is based on the premise that learning is influenced by how an individual participates in educationally purposeful activities. While students are seen to be responsible for constructing their knowledge, learning is also seen to depend on institutions and staff generating conditions that stimulate and encourage involvement (Australasian Survey of Student Engagement Report, 2009). These findings of the surveys indicated that possible exploitation of ICT is needed for further engagement of HE students' learning.

There are a few reports on the extent of ICT usage to support HE students' learning. In the United States of America (USA) Educause produces the annual ECAR National Study on Undergraduate Students and Information Technology report (Dahlstrom et al., 2011). A nationally representative sample of 3,000 students in 1,179 colleges and universities were surveyed in the 2011 ECAR report about their opinions and their use of ICT in their learning. It indicated that 33% of participants 'strongly agreed' that ICT made learning more creative and applicable in real life and therefore ICT could enhance learning by making it more engaging and providing relevant experience. Participants also disclosed that they did not like the way ICT was used in lectures, but when technology was used, they felt that it had a positive impact on their learning. The majority of students felt that ICT was about access to and efficiency in their learning. Apparently, they owned a variety of technology devices but they had a preference for small mobile devices that they could take with them everywhere. An extensive study of 2,000 first year Australian students on the usage of ICT found that the majority of students were positive about the use of ICT for their learning (Kennedy et al., 2006). The learning activities that they identified were: using the computer for general study purposes; searching for information; course administration and communicating via SMS or instant message.

In 2010, the National Union of Student (NUS) report for the Higher Education Funding Council for England (HEFCE) on Student Perspectives on Technology was part of the Online Learning Task Force initiative in United Kingdom (UK). The main findings were: (1) the need for effective use of technology and not merely using technology for technology's sake; (2) staff need for ICT skills enhancement and (3) ICT can benefit

teaching but reaching its potential is a challenge. It appears that students would like to be given the choice on how to learn and ICT is seen as a tool to provide this possibility. The students also stated that they value using ICT for learning but request a variety of learning activities using ICT, and different types of ICT used on the course.

In the NUS/HSBC Student Experience report of 2009, it was found that 96% of HE UK students use the internet as an information source and that 69% of them use it on a daily basis as part of their studies. The NUS Student Experience Report for 2010-11 showed that ICT is extensively used by students but only 20% of students are positive about gaining more from sessions when ICT is integrated into teaching, and only 10% want more teaching presented online. This seems to suggest that ICT is not being used well by lecturers and also that there is an underlying fear that ICT will replace face-to-face contact with staff, which students value highly. Another report, Joint Information System Committee (JISC) Great Expectations of ICT study (Ipsos MORI, 2008), found that in the use of ICT for learning, students requested not for more technological tools but for the tool to be fully utilized. Students were also reported to be open to new ways to enhance their learning. It appeared that a majority of students use technologies between those being provided formally offered by their HEIs, and those that they informally choose for themselves. These are some of the challenges in implementing ICT in HEIs that need to be considered in the design of mobile learning.

The reports highlighted above revealed the integration of ICT with the teaching and learning process in HEI. These reports were mainly derived on the experience from developed countries. The Malaysian context will be discussed later in this chapter in Section 2.3.3 Different technologies can become tools that students choose as a means to engage with their peers and tutors in constructing their learning. However, on the perception of the HEIs themselves, the Economist Intelligence Unit (Glenn, 2008) reported findings on the future of higher education specifically on the role of technology in HEIs. It was found that ICT has had and will continuously have a significant teaching and learning impact in HEIs. Two-thirds of the survey respondents consisting of various HEIs in USA stated that ICT will have a major influence on teaching over the coming five years from the date of the survey. Hence it seems that both HEIs and HE students concurred that ICT does have an impact on an effective teaching and learning process.

Bonk & Cummings (1998) believe that face-to-face instruction may not fulfil all the needs of learners. Evans & Abbot (1998) also support this view and promote various delivery strategies that could be used to engage HE students. In their study based on the HE students' perspective, they found that "the 'new look' teaching and learning culture which universities are being encouraged to adopt, veers more towards individualised, participatory, active learning" (p.46). Collis & Moonen (2001) stress the need for HE students to move away from the idea of HE as a knowledge-acquisition process to one which sees knowledge acquisition as a learning environment whereby the students' can participate and contribute more effectively. This need can be realised by using technology designed and implemented to assist students' engagement in their learning environment. Hence there is an essential need to capitalize on offerings of ICT applications such as podcasting via mobile phones to support HE students learning. As will be discussed in Section 2.5.2, this and other learning activities designed for mobile devices would be very much student-centred, engaging, collaborative, and contextual.

In a systematic review of HE lecturers utilising ICT in their teaching, Jump (2011) found several reasons for HE lecturers to use ICT. Their reasons were varied, but one relevant reason for this research is the desire of the HE lecturers to blur the boundaries between students' everyday experience and their (students) university life in order to ensure that teaching is more efficient. Jump (2011) summarised that this reason was to "improve student satisfaction and learning and to mediate a change in student learning behaviour" (p.62). In this review, it was reported that students were positive about the use of ICT by their lecturers, although there were some ICT components that were viewed more positively than others.

Conole et al. (2008) found in their study that there is a change in the way students are learning through using ICT. They found several aspects of ICT usage in learning: (1) Pervasiveness of ICT: students use technology to support all aspects of their study; (2) Niche, adaptive, utilitarian use: students are members of communities of practice to share resources and ask for help; (3) Personalised usage of ICT: use appropriate technologies to suit their needs and their learning is interactive and multifaceted; (4) Management of learning: easy access to information; (5) Transferability: transfer of practice of the use of technologies in different aspects of their lives to the learning context; (6) Time: expectation for information that is on-demand & fragmentation of learning; (7) Changing work patterns:

the method to gather, use and create knowledge adjusting with the technology; and (8) Integrated: Mix and switch between tools, media and content comfortably to suit their learning needs. They suggest that these impacts of using ICT towards students' learning are the reasons that ICT should be prevalent in all teaching and learning process in HEIs.

Nevertheless, there are some negative impacts reported on using ICT in HEIs learning. In a critical review of the use of ICT in university teaching and learning scenarios, Selwyn (2007) discusses the need for HEIs to break away from the monopoly held by particular companies over hardware and software in order to free critical minds and allow improved innovation. Oblinger & Oblinger (2005) state that HEIs should not "assume that more technology is necessarily better" (p.2), and have argued that the impact of technology on learning outcomes should not only be attributed to the technology as more significant is the combined effect of both technology and teaching.

The argument about negative impacts of ICT is outweighed by studies that showed the opposite. Chickering & Ehrmann (1997) recognise that the deployment of ICT in HEIs increased the possibilities for interaction and communications amongst students and lecturers especially for joint problem solving and also shared learning which enhanced face-to-face learning. This provided much needed engagement as students were seen to construct their knowledge more rather than just receiving information. McCann et al. (1998) acknowledge that students benefit from communication tools used, and collaboration can be taken outside the classroom into a virtual space. Another benefit is that ICT tools provide a greater amount and more enriched feedback as they could be tailored to each individual student which ensures that every student receives the respective attention as opposed to the masses in a big lecture hall. Whitehead, Jensen & Boschee (2003) posit that technology in teaching and learning processes leads to increased quality writing, enhanced cooperative learning, enhanced integration of the curriculum, greater application of learning style strategies, increased application of cross-age tutoring, increased teacher communication, enhanced community relations and enhanced 'global' learners. Meanwhile Oliver (2002) discusses the implications of ICT in terms of when and where students learn. This provides the flexibility for students to learn beyond the four walls of the lecture hall, and also provides learning opportunities at just-in-time moments needed by the students. This means that the temporal and geographical opportunities for learning have been extended.

Although noted to be beneficial, we still need to be mindful of deployment of ICT for learning. As stressed by Boud & Prosser (2002), “Learning arises from what students experience, not what teachers do or technology does” (p.237). Being wary of this, HEIs will need to balance between being the enabler of informed choice especially in the matters of tools, and supporting them with effective deployment. The role of HEIs in using ICTs is to help HE students “refine, extend and articulate the diverse range of skills they have developed through their experience of new and emerging technologies” (Plenderleith & Adamson, 2009, p.17).

The following two sections discuss a more detailed understanding of the context of this research. Understanding the historical context and policies relating to Malaysian HEIs, and also their perspective on using ICTs, can provide clearer and more focused picture of the learning environment that this research is based upon.

2.3.2 Malaysia HEI Background

Malaysians go through 11 years of basic education which is divided into pre-school, primary school and secondary school. The Malaysian education system follows a 6-3-2 structure (6 years of primary school, 3 years of lower secondary school, and 2 years of upper secondary school). Higher education certificates and diplomas are for students from the age of 17 with Sijil Pelajaran Malaysia (SPM) qualifications (equivalent to GCSE ‘O’ levels in the UK) while the Bachelor degree is usually for students from the age of 19 or 20 onwards with post-secondary qualifications such as Sijil Tinggi Pelajaran Malaysia (STPM) (equivalent to GCSE ‘A’ levels in the UK) or Pre-University/University Foundation qualifications (Kamogawa, 2003). There are plans by the government for those with diploma certificates to gain their degree, but these are for those mainly taking their bachelor degree through part time courses (Agadjanian & Hui, 2005). This suggests that the Malaysian government also encourages lifelong learning amongst Malaysians.

Basically, HEIs in Malaysia are categorised as either publicly-funded, including public universities, polytechnics, community colleges and public colleges; or privately-funded including private universities, private colleges and foreign university branch campuses. The Higher Education sector in Malaysia is under the jurisdiction of the Ministry of Higher Education (MOHE) which was only established in 2004. Before this all matters of HEIs

came under the jurisdiction of the Ministry of Education (MOE). The establishment of MOHE is in line with the government's aim to create Malaysia as a centre of educational excellence. MOHE is directly responsible for the operation and performance of public HEIs, while The National Council on Higher Education oversees and steers the overall development of HEIs in Malaysia. Private HEIs are guided by MOHE's policies.

In Malaysia there are comprehensive blueprints for the allocation of the national budget which follow a five year cycle. These plans have shaped how Malaysia has transformed itself from a producer of raw materials in the 1970s into a competitive emerging multi-sector economy to date. The government is moving the economy further into a more value-added production chain with a focus on high technology industries, especially with the launch of projects such as the Multimedia Super Corridor (MSC), the government designated zone for high-speed internet access. In trying to attain such a high-end economy the government recognises the need to train more knowledge and skilled workers, and HEIs of the country are to produce these types of workers (Vicziány & Marlia, 2004). There is a sense of urgency about the 'right' economic growth and development would have a critical role in the decision of Malaysia's progress. The burden is placed on Malaysian HEIs to play a role in transforming the country from an industrial base into a k-economy (knowledge economy) which is based on knowledge and information technology. Thus, it can be said that HEIs in Malaysia are under pressure to produce knowledgeable, marketable and employable graduates to meet the needs of the country's growth.

The 9th Malaysian Plan was the five-year national development agenda that spans the period from 2006 till 2010. Under this plan education, particularly in HEIs, was accorded a high priority as part of national development. More than 17 public and 20 private universities and colleges, including various polytechnics and industrial training institutes, offering courses leading to certificate, diploma, degree and postgraduate degree qualifications were formed (Norraihan & Aziah, 2007). This is in conjunction with the change of economic drivers as mentioned earlier. The 10th Malaysian Plan (from 2011 to 2015) is the current national development plan and the continuity of the country's development blueprint. One of the aims of the plan is to achieve a high-end economy which means the country would need to develop more knowledge workers (National Higher Education Strategic Plan Beyond 2020, Ministry of Higher Education Malaysia, 2007). This means that human capital development

is a key agenda item in the national development plan as well as urging HEIs to play a key role in the knowledge-based economy (Reichert, 2006).

The Malaysian government perceives education as “a means to restructure the Malaysian society and implement various affirmation action policies to reduce the inter-ethnic differences in education attainments, particularly at the tertiary level” (Lee et al., 2005, p.43). The government uses these education policies to control access to HEIs because education is perceived as a means of social mobility. Since the implementation of the New Economic Policy (NEP), the government views HEIs as a means to restructure Malaysian society. Previously as part of the British legacy of ‘divide and rule’, each ethnic group was segregated within the country’s economy, for example, Malays in agriculture and Chinese were labourers in the tin mines (Sato, 2005), while it was common for Indians to be rubber tappers. The NEP, through education, aims to eliminate the identification of ethnic communities with particular economic functions, rather “Education is perceived as an instrument for promoting national unity, social equality and economic growth” (Lee et al., 2005, p.43). Hence, the Malaysian government is attempting to steer its HEI policy in a direction that is considered for the national interest (Morshidi, 2010) where national interest can be interpreted as nation building. The National Higher Education Strategic Plan 2020 responded to the need of the nation building with detailed plans including the National Higher Education Action Plan 2007-2010. This plan is to drive the transformation of HEIs in Malaysia.

An essential direction is for Malaysian HEIs to produce sufficiently high quality human resources geared towards the needs of the nation, and one recognized way is through the use of ICT by these knowledge workers (National Higher Education Strategic Plan Beyond 2020, Ministry of Higher Education Malaysia, 2007). Furthermore, Warger & Dobbin (2009) states that a country’s economy “requires greater numbers of ‘knowledge workers’ and members of the workforce increasingly must update their skills to maintain levels of employability” (p.11), thus HEIs are seen as one type of institution in the country which can promote and introduce ICT skills necessary for the type of workers the country requires. The next section will discuss further Malaysia’s drivers in relation to ICTs and the impact they currently have in Malaysian HEIs.

2.3.3 Malaysian HEI and ICT

In support of the government's drive to reach a developed nation status by 2020, the Multimedia Super Corridor (MSC) was developed under the 9th Malaysian Plan (Kuppusamy, Murali & Lee, 2009). The MSC contained project flagships to promote further the use of ICT. There have been many ICT initiatives under its flagship projects such as the development of telemedicine and electronic government including the establishment of Smart Schools (Vicziány & Marlia, 2004). The MSC initiative also promoted the accelerated growth of local technopreneurs (Ali, 2010). Technopreneurs are entrepreneurs whose core business involves technology-based industries. This has created a more sustainable information and communication technology industry in Malaysia through the country's huge investment in setting up infrastructure and technology parks to facilitate ICT utilisation in many aspects of society.

There have also been ICT projects managed by the Malaysian Administration Modernisation and Management Planning Unit (MAMPU) under the auspices of the Prime Minister's department. MAMPU is the lead agency for ICT development in the public sector managing projects ranging from e-Governance and multipurpose identification cards, to research and development clusters (Ali, 2010). These projects had penetrated throughout the country even in rural areas, for example through the community kiosks for the Rural Internet Centre (Internet Desa) (Kakroo, 2007). The Malaysian Communications and Multimedia Commission (MCMC) is the nation's regulatory body for creating and setting mandatory standards and policies for all ICT initiatives in the country (Ali, 2010). This means that Malaysians, especially in urban areas, are also introduced to many tools and mediums that are government initiated, such as the use of Smart card as an identification card for citizens. Malaysians are required to have identification cards from birth and which are updated during their lives. The Smart card is being issued and used by all Malaysian citizens, which can be used interchangeably as their driving license and also a bank card. These are some of the ICT initiatives that most Malaysians are being exposed to.

Besides ensuring that Malaysians are connected to the internet it is also essential that the internet connects using the national language in order to minimize the digital divide between rural and urban people (Ali, 2010) This is to ensure that Malaysians are digitally connected and informed as it is believed that in the digital era the difference between groups of people

who have access to digital information and those who do not will influence their economic success (Zaitun & Crump, 2005). One way to narrow the digital divide is through education which starts from school through to HEIs.

Introducing ICT into schools in the country is a major undertaking, but it represents a major investment in the future of the Malaysian workforce. The Ministry of Education (MOE) which is responsible for all pre-school, primary and secondary schools in Malaysia has formulated three main policies for ICT in education which are: (1) ICT for all students in order to focus on reducing the digital divide; (2) emphasising the role and function of ICT in education as a teaching and learning tool and: (3) use of ICT to increase productivity, efficiency and effectiveness of management systems (Hassan, 2002, and Salbiah, 2009). Through these policies a few initiatives have taken place particularly the provision of ICT equipment and resources in each Malaysian school and also ICT training for pre-service and in-service teachers. There are still many challenges reported in these implementations, such as untrained teachers, inadequate capacity or availability of computers in schools. However, these are part and parcel of any technological implementation, and MOE is striving to apprehend the issues (Salbiah, 2009).

In terms of exposure to ICTs, the curriculum in Malaysia explicitly requires the use of ICTs in most subjects (Salbiah, 2009). There are some primary schools such as the 'Sekolah Bestari' (Smart schools) which have introduced introduce ICT as a subject. This is aligned with the principle of the Smart school which centres on the concept of teaching and learning through the use of technology (Rahimah, 1998). The Malaysian Smart School was launched in 1997 as one of the Multimedia Super Corridor's Flagship Applications. The Malaysian Smart School Flagship was "premised on the strong belief that information and communication technology is a key enabler to imparting the learning desire to all" (Smart School, 2009, n.p.). There are other comprehensive ICT initiatives from MOE such as the MYSchoolNet website which provides links to access a variety of information and ICT literacy programmes for all schools in Malaysia (Chan, 2002).

Through this exposure, it can be generally predicted that most Malaysian students will have basic ICT skills when they enter an HEI. Not only are they exposed through their daily lives through the many government initiatives, but they would also have acquired some basic ICT skills whilst in school. This exposure carries through to HEIs in Malaysia in which most

HEIs aim to provide appropriate infrastructure as well as creating conducive virtual learning support in order to heighten the mastery of ICT for HE students. Upon meeting requirements for ICT infrastructure and through the approval of the Malaysian government, there have been some HEIs that have been awarded MSC status which means that they can provide significant ICT training encourage the growth of ICT in order to develop knowledge workers and contribute to the development of Malaysia as an IT education hub (Vicziány & Marlia, 2004). Therefore, HEIs are strongly encouraged to promote ICT learning through teaching and learning strategies using ICT.

Being part of a national agenda to achieve the desired MSC status, Malaysian HEIs are implementing ICT in their teaching and learning strategies. According to Raja Maznah (2004) HEIs in Malaysia have committed themselves to elearning as they believe in its effectiveness as an alternative approach to traditional classroom methods of disseminating information. Raja Maznah (2004) gave examples of the country's private universities offering degrees using technology for their students including Tun Abdul Razak (Unitar) University, Open University Malaysia (OUM) and Wawasan University.

Abtar's (2003) study conducted a survey of elearning initiatives in several organisations in Malaysia. There were 26 participant organisations, of which 65% indicated that they had an existing strategy and policy for elearning. However issues were also identified, such as inefficient administration of elearning course materials, inadequate training for staff and students and insufficient budget, while some indicated that they were already satisfied with face-to-face training. This survey was conducted in the first phase of elearning initiatives in the Malaysian HEIs. This first phase of elearning initiatives for most Malaysian HEIs is the acquisition of sufficient IT infrastructure in order for them to offer an elearning platform (Hassan, 2002). Today, Malaysian HEIs are beyond the development of IT infrastructure stage. Research conducted a few years ago concluded that most Malaysian HEIs have sufficient infrastructure, but are lacking in planning the teaching and learning components of elearning (Raja Maznah, 2004). This indicates that much needed research such as this thesis in order to ensure any ICT initiative, such as mobile learning implementation, there is a need to manage the initiative effectively and efficiently. It needs to be further taken note that it is the teaching and learning components that are essential, and not only the IT infrastructure.

2.4 Learners (HE Students)

In the design of mobile learning environments cultural assumptions about learning of the targeted learners needs to be reflected. The cultural background influences the choices learners make within a learning environment as they are endowed with intuitive understanding and experiences (Land & Hannafin, 1996). Glaser (1976) posits that the initial characteristics of learners are part of the process of learning design, thus understanding the cultural background and also learners' level of comfort with use of ICT for learning is an essential part of the design process. Besides understanding HE students as digital learners, aspects of culture, education and the economy of the country set the context for this research as one could not discuss the Malaysian students without consideration of these aspects.

2.4.1 Digital Learners in HEIs

There are claims made that the new generation of students entering HEIs is much more comfortable using ICT as part of their lives as compared to previous students. Terms such as 'millennial', 'digital natives', 'Google generation', 'net generation' and 'I-Generation' suggest that this new generation are familiar with anything digital and internet-related and are using such tools widely. These terms provide the impression that HE students are synonymous with technology and use technology ubiquitously in their lives.

'Millennial' is the term used by Strauss & Howe (1991) to describe their generation theory. Generations are defined as "a cohort-group whose length approximates the span of a phase of life and whose boundaries are fixed by peer personality" (Strauss & Howe, 1991, p.60). 'Digital Natives' is a term popularized by Prensky (2001) to indicate the internet-generation who has been described as having innate confidence in using new technologies. 'Net Generation' indicates that learners not only consume web-based information, rather they are creating as well as producing content and using it as well as sharing it around (Oblinger & Oblinger, 2005). 'Millennium Learners' (Pedro, 2007) is the term used for students for an OECD Centre for Educational Research and Innovation research project in 2007. 'Google generation' is another term that indicates the distinct technological cultures and lifestyles of emerging generations of learners (Tapscott, 1998; and Tapscott & Williams, 2008). Meanwhile Rosen (2010) adopts the term 'I-Generation' which describes learners who

spend more time texting than talking on the phone, paying less attention to television, communicating more on instant-messenger networks and connecting to their friends via social media networks.

The current generation has grown up in an environment that is suffused with digital technologies; hence many have a natural aptitude and are skilful in using technologies to meet their objectives. This is supported by numerous reports that presented usage of ICT by current learners. For example, the National Union of Students in the UK produced a report on Students' Perspectives on Technology – Demand Perceptions and Training Needs (2010). The report found that 72.8% of participants use ICT for socialising aspects and also for their studies, while 90.1% agreed that the internet is beneficial for their studies. In terms of ICT skills, 81% indicated that their ICT skills were self-taught and 88.6% were of the opinion that they could research effectively online. This indicates not only ICT is deemed essential for learners especially for personal purposes, but they are also skilful using these tools.

In the USA, the Pew Report (2010) found that Millennial are more likely than older adults to express the opinion that technology makes life easier as well as bringing family and friends closer together. They were also more likely to have their own social networking profiles and to connect to the internet wirelessly when away from home or work. These learners also tend to post videos of themselves online. It also reported that Millennials were more likely than all other age groups to use mobile phones to send and receive text messages. However, it is noted that the Pew study did not distinguish between contribution activities (writing, posting or commenting) and consumption activities (reading, viewing or listening).

The label 'Millennial' and other labels such as Baby Boomers or Generation X, may seem over generalised. However, Strauss & Howe (1991) use this term to indicate a generational approach. They use the term to mark a particular generation in order to represent a generation's values, beliefs and behaviour in a holistic manner. A generational approach may provide us with insights into common characteristics of students currently in our HEIs. This can be the starting point for the background investigation aspect of this research. In this research the research participants are called 'digital learners' to indicate a group of HE students who have been exposed to technologies in their lives, and not because they come

from a particular generation. Digital learners provide an indication of students using technology regardless of age factor. Bullen, Morgan & Qayyum (2011a) argue for the term 'digital learners' to indicate those who are more exposed to using technology rather than taking a 'techno-deterministic' (p.61) perspective which is a more generational frame of reference. Digital learners are said to feel comfortable with and have the skills to access and use digital technologies regardless of their age. There are various studies which indicate that there are a number of HE students who make extensive use of ICT, but I have noted that there is no common use of a particular technology rather a variation of them. This includes a minority of students reported only as users but not producers on the web (Kennedy et al., 2007; Bennett, Maton, & Kervin, 2008; Selwyn, 2009; Jones & Ramanau, 2009, and Jones et al., 2009). This indicates that digital learners may not be regarded as being 'native' to technological tools as they are reported to be, and this is further discussed in the next subsection.

2.4.1.1 Digital Learners Literature: A Critical Perspective

It was acknowledged by Helsper & Eynon (2009) and Bullen, Morgan & Qayyum (2011b) that there are no differences between younger digital learners and older learners who have integrated ICT into their lives. This means it is more likely to be the exposure and engagement with technology that determines the degree of use of ICT rather than a simplistic representation of a whole generation. Bayne & Ross (2007) criticise the 'simplistic binary' assumption of the 'digital learners' label and state that the study of generations should be central to learning in whatever delivery mechanism, be it face-to-face or elearning. This indicates that a much closer review of the digital learners is needed.

There are studies that criticise the notion of digital learners. For example, Kennedy et al.'s (2007) study of Australian HE students in their first year found diverse use of technology. This is supported by Selwyn's (2009) review of literature on digital learners that found that current learners' engagement with technology is varied in terms of use and of tools choice. For example the use of collaborative and self-publishing web 2.0 technologies was low and conflicted with literature that suggested students use them prolifically. Kazlauskas & Robinson (2012) found through their research on podcasting that "the caricature of the 21st century student as an avid consumer of any and all technology does not necessarily transfer

to the learning environment” (p.328). This is supported by Donnison’s (2009) argument that some of the literature on digital learners takes a “populist approach, their propensity to describe a generation in universalising or essentialist terms and their tendency to make claims not founded on scholarship or rigorous research” (p.337). This was also acknowledged by Bullen, Morgan & Qayyum (2011b) who argued that some literatures on digital learners emerge from non-scholarly articles which were not informed by empirical research. Not only is there diverse use of the digital tool itself and low digital activity on producing, but there are issues on the literature on digital learners.

Most research on digital learners has been conducted in developed countries with emphasis on English speaking countries (USA, UK, Canada and Australia), however there are some studies conducted in developing countries such as Chile and China. Sancjez et al. (2010) found from their study of students in Chile that the traits of digital learners can only be akin to specific groups that were sophisticated users of technology. They proposed that “the students interviewed share a common trait characterised by the wide-ranging presence of ICT and other communication media in their everyday experiences, but they use them differently and with differing degrees of intensity depending on their pertaining to specific groups and niches, on their representing certain kinds of users, and on the uses and meaning that they attribute to ICTs” (p.554). In China, Shao’s (2010) study on use of digital technologies among HE students across disciplines indicates that there are different types of technologies being used in the students’ daily lives. The factor that HE students’ adoption of technology varies in their daily lives seemed to permeate even in developing country literature might provide an understanding of Malaysian HE students’ usage of ICT too.

Bennett, Maton, & Kervin (2008) pointed out that students’ level of education, social class and prior experience with technology are determining factors in students’ uptake of ICT. They also found that even if learners are immersed within a technologically rich environment, they may lack the skills and strategies to learn with technology. Thus there is a need to offer learning activities that enhance the learners’ digital skills and provide them with valuable learning experiences as proposed through this research.

We do need to evaluate research cautiously, and not just be divided into those who agree on the existence of digital learners and those who do not. Kinash, Brand & Mathew (2012) in their research found that technology may be ubiquitous to current students. The research

was conducted in order to investigate the learning management system, Blackboard Mobile Learn, but also found that some students did not consider themselves tech-savvy although they used technologies on a daily basis. Kinash, Brand & Mathew (2012) described this phenomenon as, “Just as the light bulb is a miracle, but flipping a light switch no longer feels miraculous” (p.11). This explains the fact that some students may not see technology as devices but as part of their daily routine. This finding could also provide insights of the Malaysian HE students, as they may not perceive the mobile phone as a technology but rather a tool that is part of their life.

2.4.1.2 Characteristics of Digital Learners

As presented in the previous section, there are different views in the representation of the current HE students as ‘digital learners’. By understanding the diversity in digital learners’ characteristics, suitable forms of learning support can be designed to meet the students need. This sub-section aims to summarise pertinent characteristics of digital learners.

Conole et al.’s (2008) study found that students are generally comfortable with using technology and that they use technology for different purposes. They expect that the internet can provide them with the latest information and communication on demand. Hence various digital technologies are central to students’ everyday practices that seamlessly allow them to communicate, inform them, manage their learning materials and also permit them to create or revise work accordingly. There are many other studies that either postulate or have found evidence of the characteristics of a digital learner. The following table listed these characteristics and also categorises key characteristics of a digital learner.

Table 1: Summary of Digital Learners Characteristics

Characteristics	References	Key Characteristics
Zero tolerance for delay; short attention span; need for fast communication; students’ need for instant response and feedback; fast information; Immediacy: choose instant messaging and mobile phone; use internet for research rather than library (faster); need feedback in real-time.	Frاند (2000); Jones (2002); Caruso & Kravik (2005); Andone et al. (2005); McMahon & Pospisil (2005); An & Frick (2006); Gaston (2006); Nimon (2006); Tapscott (2009); Bullen, Morgan & Qayyum (2011a)	Immediacy (learning support)

Computer is not technology; daily application of technology is common part of life.	Frاند (2000); Oblinger & Oblinger (2005b); McMahon & Pospisil (2005); Nimon (2006); Rosen (2010).	Seamless acknowledgment of technology (learning support)
Convenient access to information; convenience of a tool internet as access tool; need to select own media.	Jones (2002); Caruso & Kravik (2005); Oblinger & Oblinger (2005b); An & Frick (2006); Gaston (2006)	Convenient (learning support)
Availability of tools; well known and easy to use, familiar also transition between informal or social use to use for learning.	Tapscott (1998); Jones & Healing (2010); Bullen, Morgan & Qayyum (2011a)	Familiarity (learning support)
Proficient in multitasking; non-linear learning; using different media at the same time.	Tapscott (1998); Frاند (2000); Oblinger & Oblinger (2005b); Dede (2005a); McMahon & Pospisil (2005); Somekh (2006); Gaston (2006); Pedro (2006); Rosen (2010)	Multitasking (learning support)
Emphasise planning & time management; rule-follower; control.	Howe & Strauss (2000); Caruso (2004)	Learning management (learning support)
Globally connected; dependent on communication technologies for accessing information and for interacting with others; constantly connected to information; email is more formality and longer message; social interaction as staying connected is essential; information connection; access vast information on huge range of topics	Tapscott (1998); Frاند (2000); Caruso (2004); Oblinger & Oblinger (2005b); McMahon & Pospisil (2005); Nimon (2006); Lorenzo, Oblinger & Dziuban (2007); Rosen (2010); Bullen, Morgan & Qayyum (2011b)	Communication (learning)
Prefer it to be presented in visual or interactive mode; prefer image-based rather than text-based; visual literate; multimedia engagement.	Andone et al. (2005); Oblinger & Oblinger (2005b); An & Frick (2006); Pedro (2006)	Visual (learning)
Self-publishing (create & re-create); data manipulation; fluency in multimedia.	Frاند (2000); Brown (2002); Dede (2005a); Lorenzo, Oblinger & Dziuban (2007)	Creation (learning)
Active experiential learners; learning is participatory; authentically contexts; collecting, seeking & synthesizing	Frاند (2000); Brown (2002); Oblinger & Oblinger (2005b); Dede (2005a); Gaston (2006)	Active (learning)

experience; active engagement.		
Group activity; collaboration experience; interactive networking & community; team oriented	Tapscott (1998); Frand (2000); Brown (2002); Howe & Strauss (2003); Oblinger & Oblinger (2005b); Tapscott (2009)	Collaboration (learning)

Based on Table 1, the characteristics of digital learners are categorised as ‘learning support’ or ‘learning’. Learning support characteristics are those traits that assist in learning efficiently such as the need for immediacy, convenient, familiar and multitask. While learning characteristics of digital learners are those that need communicative, creative, active and collaborative types of learning. Understanding these characteristics is to provide better understanding of the type of mobile learning activities that are predicted to support HE students’ learning.

In terms of tools, Zickhur (2010) reports that Millennials’ general characteristics are having access to the internet wirelessly with laptops or mobile phones. They are likely to use social networking sites, instant messaging, and online classified advertisements, and listen to online music, play online games, read blogs and participate in virtual worlds. This means that there is a need to ensure that learning is appealing through multiple forms of tools in order to fulfil students’ learning needs. According to Beetham (2007) the “main intrinsic benefits of digital resources are their greater flexibility of access, reproduction and manipulation. Simply being able to study at a time, place and pace to suit them can profoundly change learners’ relationships with the conceptual material” (p.34).

It is also interesting to note that Brown (2002) found that students go beyond ‘tasking’ to ‘multiprocessing’. The argument is that when students perform several tasks, they are simultaneously engaging with and ‘cognitively in action’ with the tool. For example, they can listen to music, watch TV programmes and read a blog at the same time. Brown (2002) further explains students are faced with this kind of activity as being intertwined with judgment and exploration. ‘Multiprocessing’ shows that learners can be engaged with several activities simultaneously. Therefore to support this kind of activity students will need to access information and communicate with each other with tools that are ubiquitous in nature and afford ease of use.

The evaluation of digital learner characteristics provided insights of the current HE students. The specific mobile phone application chosen and the affordances provided by the application need to meet the needs of these learners to support their learning. However, in order design mobile learning activities based in the Malaysian context, Malaysian HE students needed to be reviewed.

2.4.2 Malaysian HE Students Background

To continue the discussion on learners in the context of this study, Malaysian HE students are discussed firstly by introducing the country to provide a general cultural context. Then this leads to a review of the characteristics of Malaysian HE students.

Malaysia is situated in Southeast Asia and located partly as a peninsula of the Asian continent, and partly as the northern section of the island of Borneo. Consisting of a federation of thirteen states and three federal territories, Malaysia attained independence from Britain in 1957, and assumed its current name in 1963. Malaysia has a population of about 28 million and comprises different ethnic groups including Malays, Chinese, Indians, indigenous people and other ethnic groups (World Development Indicators, 2012). Although the Malays form the largest ethnic group, modern Malaysian society is heterogeneous, with substantial Chinese and Indian minorities. The population of Malaysia displays considerable ethnic, social, and culture diversity. The Chinese are primarily from the Hokkien, Teochew, Cantonese and Hakka dialect groups. The term Indians refer to those whose forefathers originated from countries such as South India, Pakistan, Bangladesh and Sri Lanka. The diversity within the population is complex, influenced not only by alliance to ethnical and religious groups, but also by language, education and social class.

The fabric of the Malaysian society went through a complex process that involved domination from three successive colonial systems (Portuguese, Dutch and British) and also the influence of major world civilizations including the Indian and Chinese. This gave birth to today's pluralistic Malaysian society. The ethnically diverse society was the result of the British colonial practice of separate education systems for different ethnic groups. This had serious implications for the development of the Malaysian education system after independence in 1957. As education brings about improved status and economic mobility, this lead to unrest amongst especially the Malays, as the Chinese dominated economically at

that time. Thus through the New Economic Policy, implemented from 1971 onwards, there has been a move to narrow the gap between Malays and non-Malays in educational opportunities in HEIs (Agadjanian & Hui, 2005).

The country is tolerant to multiple religions whilst Islam remains the official religion. Malaysia embraces a progressive version of Islam (Islam Hadari) that permeates the country's architecture, cuisine and lifestyle. This means Malaysia is perceived as practicing 'moderate Islam' (Azmin & Shamsul, 2004). About 60% of Malaysians practice Islam in a religious culture that is intertwined with the Malay culture. Whilst Islam has been an important aspect of Malay identity, the understanding and practice of Islam amongst the Malays is heterogeneous (Muhammad Haniff, 2007). This means that Islamic principles play a major part of the daily lives of Malays. Besides Islam other beliefs represented within the population include Buddhism, Hinduism, Christianity; all celebrated throughout the country through different public holidays.

Malaysians may be different in terms of ethnicity, culture and religion, but there is no difference in their 'primordial aspect' as they are tied to everyday life and the same citizenship (Mansor, 1999). A 'primordial aspect' is represented through prime needs such as the need for respect the elders and so on. A plural society allows for fragments of culture amongst the different ethnic groups that could be associated with each other, and through modernisation, these fragments are integrated (Korff, 2001). This becomes the establishment of being a singular Malaysian citizen instead of being identified in the different ethnic groups. This factor is also observed in the study of social integration among multi-ethnic students in the Malaysian HEIs. Ramlee et al. (2009) propose that "despite being multi-ethnic and multi-religious, Malaysia is experiencing a gradual blurring of differences, especially in terms of costumes and dietary habits" (p.36). It could be said that despite differences in ethnicities, religious beliefs, customs and ways of life their identity is a blend of cultural similarities, hence these similarities make up of the identity of a Malaysian citizen. Therefore, in this study the participants are viewed as Malaysian although it is acknowledged that there may be differences in ethnicity, religious belief, economic class and so on.

There are a variety of mother tongue languages represented in the potpourri of Malaysian society. Although English is the second language, inherited through British colonisation, the

official language is ‘Bahasa Melayu’ which translates as Malay language as in the country’s Federal Constitution. Nevertheless, other languages such as Mandarin and Tamil are still taught in schools and are considered ‘official’ languages for the respective ethnic groups the languages belong to. However, in Malaysian daily life there are a variety of other Chinese dialects such as Cantonese and other minority languages. This scene is further complicated with the mixing of languages between Malay or Chinese and English, which is known as ‘Manglish’ (Malaysian English).

2.4.2.1 Descriptions of Asian HE Students

The historical background, culture, religion and language provide a background for understanding Malaysian HE students. However, there is a need to further investigate who how they are perceived through the literature on Asian HE students learning process. It is believed that there are many similarities between Malaysian HE students and other Asian HE students. Studies of Asian students with similar cultural backgrounds and educational experiences as Malaysian students were reviewed and Asian HE student descriptions are summarised in Table 2.

Table 2: Descriptions of Asian HE Students

Descriptions of Asian HE Students	Summary of Asian HE Students Descriptions	Literature
Preference for working in groups More collaborative learning style Cultural values of collectivism as opposed to individualism in Asian culture.	Collective rather than individualistic	Littlewood (1999) Ramburuth & McCormick (2001)
Attempt to maintain a sense of harmony, are hesitant to stand out as individuals Reluctant to question others’ opinion as worried about making the other person, or themselves, loose ‘face’ (p.84)		Littlewood (1999) Bodycott & Walker (2000)

<p>Depend on the teacher to impart knowledge</p> <p>Prefer the authority of the teacher</p> <p>The teacher is seen as “the fonts of all knowledge and to accept what we told them without question” (p.88). The issue of hierarchy ‘face’ interfere with open learning and discussion as some members are reluctant to openly contribute to the discussion or activities</p>	<p>Teacher is seen as embodiment of knowledge and to be respected</p>	<p>Littlewood (1999)</p> <p>Zirugas (2001)</p> <p>Bodycott & Walker (2000)</p>
<p>Expect teacher to evaluate learning (exams results are essential)</p>		<p>Littlewood (1999)</p>
<p>Asians students dislike ambiguity or uncertainty</p> <p>“Students responded more easily to factual-recall or direct experience questions than to open-ended questions calling for personal opinion, understandings or critique” (p.85)</p> <p>Students are less self-directed learners and prefer more structured learning environment</p>	<p>Prefer structured, and factual learning environment</p>	<p>Rao (2001)</p> <p>Bodycott & Walker (2000)</p> <p>Zirugas (2001)</p> <p>Ballard & Clanchy (1997); Biggs (1997); Kelly & Tak (1998); Smith & Smith (1999)</p>
<p>May not be comfortable with educational technologies innovations</p>	<p>Not comfortable with using technology to learn</p>	<p>Gunawardena (1998); Jesen, Christie & Baron (1997); Joo (1999)</p>
<p>Expect to provide with large volumes of information. Expected to recall this information be assessed in examinations</p> <p>Passive learners</p>	<p>Prefer lots of content to memorised for examination</p>	<p>Zirugas (2001)</p> <p>Kember (2000)</p>
<p>Demonstrated significant higher aspect of deep motivation, surface strategies and achieving strategies</p>		<p>Ramburuth & McCormick (2001)</p>

As depicted in Table 2, research on Asian HE students provides different perspectives on how they learn. There are studies that suggest that Asian HE students prefer to work collectively, as part of their cultural approach to work and live in a community. They are

also depicted as favouring a more structured learning environment rather than the ones that seek for them to be critical of something or (worse) someone, and to appreciate large amounts of information to be able to memorise for assessment. These studies report Asian HE students learning habits resemble more behaviourist approaches and that it is contextualised within a teacher-centred framework. The studies also highlighted that these students are yet to be comfortable with the use of technology for formal learning purposes. These descriptions seem rather simplistic as they could be derived from a teaching and learning system to which the students were more accustomed. This means that if the system of teaching and learning is teacher-centred, thus the teacher is regarded as the centre of knowledge and need to be respected.

There are other studies which do not agree with these descriptions of Asian students. According to Ramburuth & McCormick (2001), there was no significant difference between Asian International students and Australian students in an overall approach to learning. Meanwhile, Littlewood's (2000) study indicates that Asian students do not see the teacher as an authority figure who should not be questioned and they do not want to sit passively receiving knowledge. It appears that they want to explore knowledge themselves within a supportive environment.

The other misconception about Asian students is about them being passive in class discussion. Liu & Littlewood (1997) and Kember (2000) describe how Asian students adjust to active forms of learning when opportunities are provided, as this is part of their communal and collective culture. This is supported by Tani (2005) who describes how Asian students are able to actively participate in discussions given the opportunity. This means group work which entails a collectivist approach and a relatively supportive learning environment is able to ensure participation from Asian students.

Chalmers & Volet (1997) believe that Asian students can adapt strategically to the conditions in which they are studying. These students identify the type of learning required and adjust strategically to the demands of the course. It seems that most HE students have their own motivations for learning, and are therefore able to adjust and adapt to different learning situations and activities of their course (Chalmers, Fuller & Kirkpatrick, 1993, and Volet & Renshaw, 1995). Nunan (1995) acknowledges that teachers could be try to get

students to learn a particular way while these students are learning through their own preferred method, revealing a gap between teaching and learning.

This sub-section attempts to understand Malaysian HE students through the discussion of Asian HE students' literature in order to inform the design of mobile learning activities for this research. However, it was found that there are conflicting perceptions of these students' learning preferences. The next sub-section further discusses this issue.

2.4.2.2 Descriptions of Malaysian HE Students

Studies on Malaysian HE students are similar to those conducted on Asian HE students. Nik Aziah & Nik Suryani (2005) describe Malaysian students as adapted to an exam-oriented educational system spanning the 11 years of primary and secondary education. There is also a tendency for HE students in Malaysia to be 'spoon-fed' and to expect close supervision from lecturers (Ziguras, 2011). Respect for elders, particularly teachers, is still very much a cultural aspect even in modernised Malaysia. Malaysian HE students are also noted to be shy and rarely speak up in class. Characteristics such as obedience and conforming to rules are reported by Sue & Kirk (1972). Subramaniam (2010) concludes that "Malaysian students prefer linear, systematic and progressively organised and developed learning patterns" (p.13). These characteristics mirror those in the Asian students as discussed in Table 2 earlier.

Nevertheless, there are studies that refute the negative depictions of Malaysian HE students. Rohana (1988) dismissed the accepted view that Malaysian students cannot learn independently. In her article, she discusses the weakness in learning style amongst Malaysian students seen in the preference for being 'spoon-fed' for example. HE students in her study expressed a preference for individualised learning. It was also found that learning orientation is strongly influenced by the orientation of teaching or rather the teaching style. This is supported by other studies, including Kek, Darmawan & Chen (2007) and Nurzali & Khairul (2009) who report that a deep approach to learning is influenced by the classroom-level learning environment while poor and negative quality teaching processes result in the adoption of surface learning. As Lee, Hazita & Koo (2010) argue, students' learning behaviour could be a result of their schooling experience, especially the

idea that they are being 'trained' to perform in examinations. It is noted that the Malaysian education system is highly exam-oriented. What is often stressed about Malaysian HE students is that any form of assessment is taken seriously (Hong, Lai & Holton, 2001). Hence, Malaysian students engage in activities such as self-assessment activities on the basis that such activities may improve their performance in examinations (Subramaniam, 2010).

Nurzali & Khairul's (2009) study of classroom interaction in a Malaysian university found that classroom communication is essential for effective learning. Therefore, in order to improve communication practices between students and lecturers there is a need to find specific ways to stimulate students' communication. Holmes (2003) found that Malaysian students who worked together produced not only a more positive attitude but also better work. His study is on collaborative learning, which he defined as "more than one student working together on a task, activity or project" (p.254). He also discovered that students who worked together produced positive outcomes such as the "generation of interactive language, the promotion of an appropriate climate, learner responsibility and autonomy, and individualization of instruction" (p.254). Lee, Hazita & Koo's (2010) study on Malaysian HE students' experience of assessment indicated that assessment taking the form of group work trains students in soft skills such as teamwork, collaboration and presentation skills. Subramaniam's (2010) study found that Malaysian students rely on group support for learning, particularly for new concepts. These studies indicate that collaboration and communication are essential pedagogical activities for Malaysian HE students.

HE lecturers and learning designers must be aware of diversity in teaching and designing for Malaysian HE students. Korff (2001) has found that in the progress of achieving development through processes of modernisation and globalisation "the public self-description of Malaysia has become more Asian, Islamic, and post-colonial" (p.272). Land & Hannifin (1996) provide a much more conclusive argument that "learners often try to adjust their thinking to comply with perceived expectation of others" (p.40). Hence, it is probable that Malaysian HE students accommodate their learning the way they foresee how the lecturer wants them to learn.

2.4.3 Malaysian HE Students and ICT

Through the discussion of Malaysian education and ICT (Section 2.3.3), it has been shown that Malaysian students are introduced to varied forms of ICT in either their daily lives or through exposure at school. This section discusses the acceptance by Malaysian HE students of ICT through a review of studies on elearning.

Abtar's (2003) study indicates that Malaysian HE students show a high level of acceptance for elearning. Hong, Abang Ahmad & Kuek (2003) echoed this by stating that students have a positive attitude towards using the internet as a learning tool. The students also had adequate knowledge of the internet. This is supported by Zoraini, Kaur, & Hairudin's (2004) study of elearning readiness for the Malaysian Ministry of Energy, Water and Communication, which reported that enablers (lecturers and organisations providing e-learning) feel that overall their students were ready for elearning. It was found that 80.2% of their students have experienced some kind of elearning.

In a study by Hanafi, Zuraidah & Rozhan (2004) it was found that HE students were receptive to the need for supplementary online courses, and in particular supplementary learning materials. However, they also found that distance learning participants preferred printed materials as the main mechanism of course delivery. One reason was that the students feel that printed materials are mobile so they can take them anywhere. This is an indicator that mobility in learning is seen as essential to Malaysian HE students. Abdul Rahim & Shamsiah (2008) found that pre-service teachers are confident in using ICT and also teaching with it. They also found that there is no significant correlation between students' academic performance and the integration of ICT into teaching.

Besides the general indicators of elearning acceptance, there are other studies which illustrate aspects of ICT learning that are deemed suitable for Malaysian HE students. Hong, Lai & Holton (2001) and Lee, Hazita & Koo (2010) portray that it is possible for Malaysian HE students to have quality learning experiences through web based courses and therefore using ICT in learning adds value. Sharing knowledge was an integral part of the participants' course. However, Hong, Lai & Holton (2001) found that Malaysian students need the transition from being passive learners to becoming active learners who are more willing to explore, acquire and share knowledge. The use of technology to share information

and facilitate active learning in an HEI course may propel the transition to the engagement of students in their learning.

Subramaniam (2010) believes that Malaysian HE students find online discussion a liberating and enriching experience. Online discussion can avoid issues related to ‘face saving’, or language fluency which have been found to be barriers to learning for Malaysian HE students. He further notes that students whose profile described them as shy or introverted, and who had difficulty participating in face-to-face interaction found the online environment liberating as it allowed them the luxury of time to plan their contribution without ‘competition’ from more vocal students. As the online programme was time-independent it “allowed learners to be reflective, critical and creative, and compose thoughtful rather than spontaneous responses” (Subramaniam, 2010, p.15). Sidhu & Mohamed Amin’s (2009) study also found that Malaysian HE students feel that asynchronous online discussion promotes autonomy in learning and helps in managing their learning. Wong et al.’s (2003) study of Malaysian pre-service teachers discovered that participants were more independent, creative, and use collaborative learning skills beyond the information technology course. The exposure through ICT also enhances positive attitudes towards ICT and enables students to be active learners in their learning process.

Generally, it appears that Malaysian HE students are able to access and accept ICT to support their learning. This oppose to the previous literature of Asian HE students are not comfortable to learn with technology as in Section 2.4.2.1. Nevertheless, we do need to understand the technology better in order to design learning activities to support HE students learning. The next section is part of the Outline of Learning Activity Design (Diagram 4) that discusses the ‘tool’ aspect which in this research is the mobile phone.

2.5 Tool (Mobile Learning Affordances)

New technologies are usually unfamiliar, and as educators we need to understand the differences of their form and explore appropriate situations to apply these various technologies for effective teaching and learning (Bates, 2005). Different technologies offer different affordances in learning, and they should be selectively utilised to maximize students’ learning. However, not all technology can be used successfully to teach or learn. Research is needed to explore the opportunities that any specific technology can provide to

create not only new kinds of learning activities and experiences, but better ones to support students' learning.

There is a growing consensus around the world that research on the influence of technology in education should focus on the 'affordances' of these technologies and not on the technologies themselves (Clark, 1983 & 1994). Affordance is about perception, described by Norman (1988) as, "The perceived properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used" (p.9). For example, a chair affords support which affords sitting, thus the properties of the chair support sitting. It could be concluded that affordance could be the way in which learners could adopt, adapt, integrate and also evaluate how they use a particular tool in their everyday life.

From a social semiotic perspective, every medium and technology that we use has affordances (Kress & van Leeuwen, 1996 & 2006). Affordances are representative of constraints and also possibilities, along with the various types of representations of learning fostered or hindered by a tool (Kress & van Leeuwen, 1996 & 2006). Every technology which is used to communicate and to make or disseminate meaning has possibilities and constraints. This means that technologies are seen in terms of what they can facilitate and what they can hinder or inhibit, which influences how we construct meaning and thus learn.

Technology is a product of social needs as "when they work for us, their social affordances sometimes prove to be more revolutionary than their technical significations" (Cope & Kakantzis, 2008, p.577). This is because we make meaning through these devices. For example, the mobile phone allows us to communicate with someone geographically distant, which is revolutionary as it allows for collaboration to take place with someone from another country. Nimon (2006) believes that the mobile phone is more than a phone; it is a device through which students, "flirt, work, socialize and express their individual personality through make, ring tone and colour. Some even view it as an extension of themselves" (p.27). Affordances of a technology shape the ways in which we make meaning about ourselves and the world beyond its initial purpose. A mobile phone is not only a phone for communication, but it can be a representation of self, a tool for organization of self and whatever it affords to the user.

Laurillard (2002) advocates the creation of learning environments designed with features that "afford the learning of precepts" (descriptions of the world) (p.24) and these in turn

provide the affordance of academic learning within a set of learning activities. This is similar to the view taken by Ehrmann (1995) who pointed out that ‘worldware’ (software that is not developed for the purpose of education) seems to be used both for teaching and learning. This ‘worldware’ “proved to have great educational potential (value) and wide use for a long period of time (viability)” (p.25). HE students can use ‘worldware’, which ranges from word processing applications such as Microsoft Word to using SMS on a mobile phone, for their learning and extend their benefits to the students’ world of work upon graduation later. Worldware can elicit active learning that is based on the real-world context for HE students.

Nevertheless, Norman (1993) also cautioned us about the distinction between real and potential affordances of a tool. A chair affords sitting, but it can afford to be a ladder. John & Sutherland (2005) propose that in the real world learning is “distributed in some form between technology, the learner and the context and there is nothing inherent in technology that automatically guarantees learning” (p.406). Hannafin & Land (1997) state that “technological capabilities suggest what is possible through advances in technology, not necessarily what is required or desired” (p.175). Mobile learning is also included in this challenge as the physical and social context of use can vary (Sharples et al., 2007). This means the way in which learners adopt technology may not be the same as predicted by the learning designer. The intended learning outcome may change to accommodate the process of learning especially in an informal learning situation. One cannot predict what learners will do as there can be a chance that “new solutions are utilized in ways that never even occurred to their designers” (Keinonen, 2003, p.2). Moura & Carvalho (2009) also support this argument as when people begin to use technology they can create new ways in which to use it which are not anticipated by the designer. In their study, they successfully found that “participants were offered new ways to use their own mobile phone as an educational tool by exploring new uses of features that were only used for leisure or private consumption” (Moura & Carvalho, 2009, p.8).

John & Sutherland (2005) propose that for a tool to be more effective for a learning process it has to be visible as a learning tool but invisible as a mediating tool. This means that the tool must be familiar to the users but also be a taken for granted inconspicuous part of their daily life. The role of digital technologies in supporting learning needs a transformative role. Hannafin & Land (1997) acknowledge that “Technological capabilities dictate not how

much learner control is supported, but how much is possible. They determine not what should be, but what could be” (p.176). There is a need to develop and find new ways to creatively assist the learner in their needs and lead them to be aware how technology can be used in various settings.

New technological capabilities are usually untested in learning designs and strategies. Since they are new, a researcher or a learning designer can only redefine what is possible or feasible in order to stimulate new perspectives on the teaching-learning process. According to Hannafin & Land (1997), the challenge is for learning designers “to capitalize on the capabilities of emerging technologies based upon existing designs, while generating new designs rooted in emerging psychological and pedagogical research and theory” (p.176). The starting point in creating new designs is through understanding the affordances of the tool for learning. Woolgar (1991) proposes that defining the affordances of a tool should start with how we interpret the tool based on the assumptions about the user, the activities it stimulates and the way it could permit or hinder specific activities. Sharpe & Oliver (2007) suggest that it is also essential to understand how the technology is used to construct knowledge. The following sections are an investigation into the affordances that the mobile phone offers in terms of potential to support HE students’ learning.

2.5.1 Potential of Mobile Learning in HEIs

Cochrane (2010) recognised the potential for mobile learning as being able “to bridge pedagogically designed learning contexts, facilitate learner-generated contexts, and content (both personal and collaborative), while providing personalization and ubiquitous social connectedness, that sets it apart from more traditional learning environments” (p.134). Being able to personalise learning and being ubiquitous across various contexts are essential elements of mobile learning that differentiates it from other learning environments. Thomas (2005) proposes that mobile learning could offer “flexibility, ubiquity of access to information, and motivating increased engagement, mobile technologies and infrastructure facilitate this revolution of “always-on learning, accessible to the masses, but tailored to the individual” (p.5). Traxler (2007 & 2009) and Peters (2007) believe that mobile learning could offer learning that is ‘just-enough’, ‘just-in-time’ and ‘just-for-me’. This means that finding information rather than knowing and immediacy have become key components of

mobile learning. Thus, the prevalent notion of mobile learning seems to be that it is ubiquitous, contextual, and personal.

Pettit & Kukulska-Hulme's (2007) study looks at how mobile technologies are interweaved with learners' everyday practices, especially when travelling. This pervasiveness is also found from studies of mobile phone use. For example, Rainie & Fox (2012) found that 86% of a random sample of Americans used their mobile phone within the previous 30 days to make real-time inquiries (e.g. decision about a restaurant) or to solve a problem (e.g. information on the fastest way to get somewhere). Kennedy et al.'s (2006) research found that HE students frequently use their mobile phones to make calls, text messages, and take photos or create movies which they share with their peers. In this view, the mobile phone is used as a personal tool for communication via different types of media.

The UK Joint Information Systems Committee (JISC) (2005a) report on the synergy between mobile technologies and learners, citing it firstly as due to the fact that mobile phones are part and parcel of the modern life and secondly because "tools for learning in 21st century institutions need to reflect on changing expectations of how, when and where we learn, and that they should motivate learners to become more active and engaged in their learning" (JISC, 2005a, p.26). Therefore, providing learning activities through mobile phones could possibly engage current student in HEIs.

Three main reasons have been identified for HEIs to embrace mobile learning. They are: (1) to improve access to learners; (2) to improve access to learning of learners through exploring further potential for teaching and learning; and (3) alignment with institutional policies (Kukulska-Hulme, 2005a). The first two relate to this study. In relation to teaching and learning, Vavoula (2005) compares students without mobile tools and students who take advantage of mobile technology. She found "indications that mobile learning is more interactive, involve more 'bustle', more contact, communication and collaboration with people" (p.17). Thus, improving communication and support for learning are justifications for HEIs to start exploiting mobile learning.

A considerable amount of literature has been published on mobile learning. These studies provided a general idea of the characteristics of mobile learning as presented in the table below:

Table: 3 Characteristics of Mobile Learning

Characteristics of Mobile Learning	Literature
Context sensitive; ability to engage learning within the student's context; localised; situated; authentic	Klopfer, Squire & Jenkins (2002); Alexander (2004); Patten, Arnedillo Sanchez & Tangney (2006); Parsons & Ryu (2006); Kukulska-Hulme & Traxler (2007); Traxler (2007); Kearney et al. (2012)
Expediency; immediacy; just-in-time; speed of access to information; instant-on capability	Alamäki & Seppälä (2002); Klopfer, Squire & Jenkins (2002); Alexander (2004); Park (2005); Attewell & Gustafsson (2002); Goundar (2011); Hashemi et al. (2011)
Portable; allows anytime and anywhere learning	Naismith et al. (2005); Klopfer, Squire, & Jenkins (2002); Kim, Mims, Holmes (2006), Park (2005); Magg (2006); Caudill (2007); McConatha, Praul & Lynch (2008); Goundar (2011); Hashemi et al. (2011)
Flexible	Kim, Mims, Holmes (2006), Magg (2006) and McConatha, Praul & Lynch (2008); Goundar (2011); Shih & Mills (2007)
Convenient to use during idle moments; easy to carry; convenient availability of information	Alamäki & Seppälä (2002); Kim, Mims, Holmes (2006), Magg (2006); McConatha, Praul & Lynch (2008); Cochrane (2005); Caudill (2007); Shih & Mills (2007)
User friendly; simple to learn and use; familiar	Kim, Mims, Holmes (2006), Magg (2006); McConatha, Praul & Lynch (2008); Goundar (2011)
Collaborative; builds learning communities	Leung & Chan (2003); Klopfer, Squire & Jenkins (2002); Patten, Arnedillo Sanchez & Tangney (2005); Parsons & Ryu (2006); Kearney et al. (2012); Hashemi et al. (2011)
Individualistic; user-centred	Leung & Chan (2003); Klopfer, Squire & Jenkins (2002); Park (2005)
Comprehensive in usage of the mobile device	Leung & Chan (2003); Klopfer, Squire & Jenkins (2002); Roschelle (2003); Sharples, Taylor & Vavoula (2005); Goundar (2011)
Personal; private	Naismith et al. (2005); Parsons & Ryu (2006); Kukulska-Hulme & Traxler (2007); Traxler (2007); Kearney et al. (2012)
Increases motivation & engagement; interactivity ; empowers learners to participate	Duncan-Howell & Lee (2007); Stead et al (2006); Goundar (2011); Hashemi et al. (2011); Shih & Mills (2007)

Dynamic; pervasive	Leung & Chan (2003); Duncan-Howell & Lee (2007)
Facilitates communication; social interactivity; increases interaction; sense of connectivity	Farooq et al (2002); Klopfer, Squire & Jenkins (2002); Stead (2005); Zurita & Nussbaum (2004); Cochrane & Bateman (2009)
Bridges digital divide	Hashemi et al. (2011)
Accessibility of the device	Park (2005)

The literature reviewed in the Table 3 aims to highlight the characteristics of mobile learning and is by no means exhaustive. The table is merely an indication of the literature ranging from the year 2001 until present on the attributes that mobile learning is either postulated or proven to have. These studies point out that mobile learning can support the learning of HE students. Mobile learning is depicted to be context sensitive, immediate, portable, flexible, convenient, user friendly, comprehensive, personal, dynamic, accessible and able to bridge the digital divide. Mobile learning can also promote activities that are collaborative and user-centred, besides empowering engagement, and facilitating communication. It is interesting to note that mobile learning supports individualistic and personal learning attributes, but yet at the same time supports social engagement such as collaboration and increase interactions.

The listing of the characteristics of mobile learning as those in Table 3 is a mere step to understanding mobile learning. There were several other studies that also needed to be highlighted to provide a more in depth understanding of mobile learning possibilities to support HE students' learning. One such study is from Shih & Mills (2007) who found that their participants are more motivated in learning as they appreciate the convenience and flexibility of using SMS to support their learning. It was also recorded in the study that there was enhanced interaction between instructor and students, and that students were encouraged to collaborate more. Naismith et al. (2004) perceive that mobile learning can provide a shared conversation space as "effective learning occurs when people can converse with each other, by interrogating and sharing their descriptions of the world" (p.27). This means that mobile learning does not only provide learners with access to static resources along with interactive content, but also access to meaning making through discussion and interaction (Caudill, 2007).

Divitini, Haugalokken & Norevik (2002) propose that one way for HEIs to implement mobile learning is to explore “the potentialities of mobile technologies for coordination and communication and how they may be used for accessing timely information independent of place, new communication channels and facilitating peer and teacher communication” (p.1). This is because, as found in Jones et al. (2002) study, when using ‘handhelds’ in seminar classes, greater levels of participation can be achieved and a higher number of ideas are contributed. Furthermore, Vavoula & Sharpe (2008) acknowledge that learners can take advantage of unexpected free time by using a mobile device. Hence, greater engagement of HE students regardless of constraints of time and space would seem to be another reason to introduce mobile learning.

Another key possibility for mobile learning is the way in which it can bridge between formal and informal learning, or rather between the formal classroom and out-of-classroom informal learning (Duncan-Howell & Lee, 2007, and Hashemi et al., 2011). This is because learning is not specific to a particular time or place and formal education cannot provide learners with all knowledge and skills (Sharples, Corlett & Westmancott, 2002). Furthermore, mobile learning is believed to remove some of the formality of learning, which digital learners may find more attractive (Attewell, 2005a), and it also provides learners with more choice of the medium for learning (Hashemi et al., 2011). Kukulska-Hulme et al. (2009) postulate that mobile learning “challenges views of formal education as the transmission or construction of knowledge within the constraints set by a curriculum, calling instead for the exploitation of technology in bridging the gap between formal and experiential learning” (p.9). Cook, Pachler & Bradley (2008) propose “formal and informal learning as being part of a continuum or a multi-dimensional clustering of informal and formal learning activities rather than positioned in an either-or relations” (p.4). Arguably there is a need for research into implementation of mobile learning activities which flow from the classroom and out of the classroom for continuous meaning making by the students. This could possibly ensure the alignment between the classroom and the outside world, thus bringing authentic contexts such as real world problems into the classrooms.

Kukulska-Hulme et al.’s (2009) review of mobile learning projects within Europe concludes that “a combination of mobile and fixed technologies can sometimes support different parts of learning experience” (p.14). It is advocated that an appropriate blend of campus-based experience should be integrated with elearning to facilitate effective students’ learning

(Cobcroft et al., 2006). For example, there is a need to keep students “informed, involved and up-to-date” (Armatas, Holt, & Rice, 2005, p.30), therefore mobile phones could be used to deliver administration services such as prompts and reminders can be sent to be the bridge between elearning matters and the students (Armatas, Holt, & Rice, 2005). The design of learning experiences calls for a blend of technologies and learning approaches that are interweaved into the learners’ everyday life as these technologies and learning approaches can assist HE students to support mobility of their learning as further discussed in the following section.

2.5.1.1 Mobile Learning Mobility Aspect

It is difficult to discuss the possibilities of mobile learning without attention to the ‘mobility’ dimension, as it is an essential part of mobile learning (Parsons & Ryu, 2006). There are several aspects of mobility addressed through the literature on mobile learning.

Mobility is about multiple contexts. Mobile learning emphasises the aspect of mobility through which students are free to move within, beyond and between multiple contexts and also between topics or even disciplines (Wang, Wiesemes & Gibssons, 2012). Peters (2007) recognises that mobility allows the opportunity to learn formally or informally, and lessens the need for a fixed location to learn, and through this can change the way learners work or study.

Mobility is about interactive communication. In terms of communication, mobility of communication is not one-way between lecturers to students, but also includes construction of knowledge within participating communities (Wang, Wiesemes & Gibssons, 2012).

Mobility is about familiarity, ease and convenience. Mobility for mobile learning is also about ease of use of the device and familiarity with mobile applications which allow learners to work continuously across home and HEI settings (Passey, 2010). They permit learning activities to be taken out of the lecture hall and reflection to happen when and where demanded. However it must be stressed that it is the learners who are mobile and not only the technology (Vavoula, 2005). Learning therefore needs to be interwoven with other activities as part of daily life.

Mobility is about choice and autonomy. Ryu & Parsons (2009) recognise that mobility allows the learner not only to access resources when and where they want, but also provides students with the autonomy to do so. This means that a mobile society is increasingly fragmented and work and social practices increasingly interwoven, whilst the various available options of delivery mechanism for learning are decided by learners.

Mobility is the interaction between learners and technology. Kukulska-Hulme et al. (2009) propose that “learning experiences cross spatial, temporal and/or conceptual borders and involve interactions with fixed technologies as well as mobile devices” (p.8). These experiences cross space and time and also involve interactions with fixed computers in an changing space for learning experiences (Hashemi et al., 2011).

Kakihara & Sorensen (2002) conclude that mobility is not about movement of learners between locations, rather it consists of the events that take place within the space and time of the various contexts in which they participate. The discussion on mobility of mobile learning indicated that it involves multiple contexts; interactive communication; familiarity, ease and convenience; autonomy and also interactions between technology and learners across space, time and contexts. These aspects of mobility need to be part of the design of mobile learning activities.

With any new form of technology there is a need to be cautious about embracing its use in education. Armatas, Holt, & Rice (2005) report concerns about the implementation of mobile learning amongst lecturers in a discussion forum. They report two main issues, the first relates to the problem of manageability of the wide choice of ICT technologies, and the level of effort to introduce another platform for students. The second concern that mobile technology should be appropriately used in teaching and learning is based on theoretical principles. Parsons & Ryu (2006) also warn that although students are demanding relevant, flexible and rich learning experiences, they will only embrace mobile learning activities if these activities meet their needs. Luckin et al. (2005) summed this up by stating that any form of technology must “be cast in the role of helping to identify ways in which resources can be adapted to meet the needs of a learner rather than as a tool that can adapt itself to the context and to the learner. It must also be used as a means to provide continuity across locations: the appropriate contextualization of activities across school and home contexts is a key design principle” (p.19). In finding ways for the mobile phone to be used to support

HE students' learning the next section of the literature review investigates other studies that have designed and implemented mobile learning activities.

2.5.2 Mobile Learning Activities in HEI

The purpose of this section is to review and classify a variety of learning activities with mobile technologies in order to investigate possibilities for designing learning activities for this research. Due to the attractiveness of mobile learning as described in the previous section, there is a significant spur for studies related to mobile device use in learning. This section reports on some selected studies to highlight aspects of mobile learning activities that can be capitalised for this study. Learning activities are discussed holistically and not tied to a specific subject such as language learning. Off-the shelf solutions are also discussed. These are largely created for business or social purposes and can be appropriated for education. The most important aspect of mobile learning is that the “success of mobile learning will ultimately revolve around a mosaic of rich converged experiences” (Wagner, 2005, p.52).

Mobile learning applications are “software systems operating on mobile devices” (Zhang & Adipat, 2005, p.294) which means these software systems may not be specifically designed for educational purposes. Clough et al. (2009, pp.103-104) present several categories of mobile learning applications which are:

- Collaborative applications that encourage knowledge sharing, making use of the learner's physical location and mobility.
- Location-aware applications that contextualize information, allowing learners to interact directly with their environment; for example by collecting environmental data linked to a geographical context or accessing contextually relevant reference material.
- Data collection applications that use the handheld device's ability to record data in the form of text, image, video and audio.
- Referential applications that use dictionaries, translators, and e-books to deliver content when and where it is needed.

- Administrative applications that employ the typical scheduling, information storage, and other calendar functions available on mobile devices.
- Interactive applications that use both the input and output capabilities of mobile devices, allowing the learner to input information and obtain some form of feedback which aids the learning process.
- Microworld applications which model real world domains to enable learners to practice or act within a constrained version of a learning scenario.

These different categories of mobile applications will be revisited later in Table 4 in this section. It is noted that all mobile phone applications can provide an opportunity to engage in knowledge construction. As found by Kukulska-Hulme (2008), there are a variety of multifunctional applications which are equipped to connect to the mobile phone that could “make learning readily accessible ‘anytime and anywhere’. Learners appear to be moving to a position of power with regard to their ability to influence how and where learning happens and even its content and form” (p.8). It is not only mobile applications which are liberating for learners, but as Traxler (2009) states they can “clearly support the transmission and delivery of rich multimedia content. They also support discussion and discourse, real-time, synchronous and asynchronous, using voice, text and multimedia” (p.17). With these mobile applications, there is a need to design their usage in teaching and learning activities based on the theoretical approaches that will be discussed in Chapter 3 of this thesis.

Roblyer (1996) points out that students’ construction of knowledge in a technologically enabled learning environment does not rest on the technology, but more importantly on how the technology is used to create an effective online environment. It is essential to note that technology is exploited “to designate an artefact designed to support a specific task function rather than to represent content” (Beetham, 2007, p.35). This means that learning activities (specific tasks) are highlighted rather than the static content of a course. These activities are seen to elicit more active engagement than the static content. Vavoula & Sharples (2007 & 2008) and Ryu & Parsons (2009) emphasise that a study should focus not only on the technical aspects of the technology to be introduced, but more importantly find ways for learning activities to be embedded within the technology.

Armatas, Holt, & Rice (2005) suggest a few learning activities for mobile learning in HEIs. These are: (1) delivery of multimedia materials designed specifically for mobile devices; (2) delivery of interactive tasks, for example, online quizzes; (3) adding value through active participation in lectures, (4) allowing students to surf in the internet; and (5) communicating directly with students. However, we do need to investigate in detail how each mobile phone application could be exploited for learning support, bearing in mind that the use of technology does not necessarily bring about transformation without pedagogical learning design (Laurillard, 2007).

The following sub-sections present learning activities that could be designed incorporating the use of the mobile phone available applications. Currently available mobile learning applications and studies on how they have been used to support student learning in HEIs are presented below. The aim of these sub-sections is to gather possible learning activities that could be conducted using the mobile phone to support HE students' learning.

2.5.2.1 Administrative Learning Activities

Studies on the use of mobile devices as a learning organization tool for HE students include Holme & Sharples (2002), Sharples et al. (2003), and Wishart, Ramsden & McFarlane (2007). These projects report the eagerness of students to be able to access course materials, view course timetables, communicate via email, and organize ideas or notes through the use of mobile applications. Therefore there is potential for students to fully utilize their mobile device as a digital organizer which could assist them with managing their studies.

Corlett et al.'s (2005) study is an exploration of a Mobile Learning Organizer, a project at the University of Birmingham. Course materials, interactive messages and collaborative communication were part of the activities that took place in the 10 month long trial. It was found that there is no distinct need to customize the learning organizer as students could use the tools already available in the handheld device that they are already familiar with. Students appreciated the ability to read course materials and to get reminders of course deadlines.

Sharples, Corlett & Westmancott's (2002) research found that a mobile learning organizer could fit in the daily lives of the students. It "allows people to capture and recall an object or event that they would otherwise forget, integrate disparate sources of information into

coherent schemas, assist in performing experiments and solving problems in everyday world, and augment conversations by providing shared relevant information” (p.233). Furthermore Patten et al. (2006) suggest that administration of learning can be deployed through the mobile phone functions that range from a calendar to reference materials such as eBooks or dictionaries.

2.5.2.2 Communicative and Collaborative Learning Activities - SMS

SMS is texting via mobile phones. It has become a pervasive communication tool amongst the digital learners (Peters, 2007). SMS is reportedly favoured by students as they feel that it is a more personal type of communication (Stone, Briggs & Smith, 2002).

Trifonova (2003) reports the use of SMS for teaching and learning in several HEIs. It was found that SMS is the most common mobile phone application to be used in mobile learning research. This is similar to that noted by the participants from Sheffield Hallam University who reported that SMS is a preferred communication tool because it is immediate, convenient and personal (Garner, Francis & Wales, 2002). Horstmanshof (2004) found that the use of SMS for communication channels in Griffith University, Australia could provide learning support by creating a learning community. This had a positive influence on the students involved in the study.

According to Mellow (2005) there are three ways in which SMS could be utilized for learning support: (1) HEIs sending information; (2) students requesting information; and (3) students interacting with the environment. In the latter, an interactive model is where questions are sent out, then answered, and replied to by the student to check the answers and receive feedback (Mellow, 2005). Studies on the pattern of mobile phone use in HEIs found that reminders via SMS are very much favoured by students (Lubega, McCrindle, & Williams, 2004, and Zawacki-Richter, Brown & Delpont, 2007), and are also favoured for updating students about specific tasks (Wishart & Green, n.d.).

Stone, Briggs & Smith (2002) found that students engage faster with SMS than email. One of the benefits of this immediacy is that it can build a sense of community due to the interactive nature of the SMS application. Markett et al. (2006) found that SMS interactivity promotes an active learning environment, facilitates the development of a learning

community, provides better feedback and motivates students. Moura & Carvalho (2009) report that students have a positive perception of teachers using SMS to deliver content.

Armatas, Holt, & Rice (2005) postulate that by adopting “technologies that students are already accustomed to using to provide emotional and social support in other areas of their lives would seem logical if the goal is to connect students to each other in their educational pursuits” (p.30). SMS is considered a contextual mobile learning activity as it provides up-to-date information and reminders pertaining to the course at any type of contexts the students are in. This type of communication is considered to be ubiquitous and a two-way communication mechanism. Naismith (2007) believes that making use of students’ own mobile phones promotes students’ and lecturers’ interactive feedback with each other. However texts sent must be relevant and received at sociable times of the day and these factors are often not considered in the implementation of using SMS to support HE students’ learning (Jones et al., 2008).

There are many ways in which collaborative activities can be planned with the mobile phone. According to Ryu & Parsons (2009) mobile learning can support collaborative activities by “strengthening the organization of the learning material and information, supporting communication among group members, and helping the coordination between the learning activities” (p.11). Arrigo et al.’s (2004) project developed a mobile platform for collaborative learning where HE students would be able to collect and share live data anywhere anytime. This type of initiative could promote collaborative learning which could become part of an HEI’s teaching and learning strategy (Cabrera et al., 2002).

2.5.2.3 Accessibility to Content Learning Activities

Usually content through mobile phones can be viewed online or it can be also be downloaded. Content can be either in text, audio or video form. According to Hicks, Reid & George (2001), downloadable documents are valued as reference material and this provides for a richer learning experience as learners can get access to content anywhere and at any time.

There are several studies that were based on this possibility to access content through a mobile device. McGreal (2004) describes the development of an open source infrastructure

for a network of learning object repositories specifically for multiple mobile device platforms. Learning object repositories are usually a virtual space with static materials which can be extracted whenever a learner needs them. The availability of this type of repository permits content development to support student learning with the ability to publish it in bite-size chunks which can be downloaded to a mobile device. This means HE students can view, read or listen to these bite-size learning objects in their own space, time and place. Furthermore mobile phones can also be connected via the wireless application protocol (WAP), for example Berlin University students were able to get information on their course customized to the location on their campus. Different sources and formats were transmitted to students' mobile phones as part of this project, entitled the Campus-Mobile Project (Lehner et al., 2002). The University of Twente, Netherlands, launched the M-Poort project which provided for the availability of curricula consisting of web-based courses and information made available through web-enabled mobile phones (Cole, 2001). At the University of Pretoria, South Africa, web-enabled mobile phones are used to provide downloadable course material or feeds on course schedules, to deliver administration information and grant access to an M-portal for access to examination marks and financial statements (Brown, 2005).

Hashemi et al. (2011) posit that mobile learning activities can include connectivity for downloading and uploading course information through a wireless network or through wireless to link to the HEI's learning management system. Students could also 'beam' documents using Bluetooth technology to share information (Clough et al., 2009). This means one part of mobile learning activities is to provide for multimedia content delivery through the mobile phone, thus providing access to a variety of diverse resources with rich media (Huang, Lin & Cheng, 2010).

2.5.2.4 Reflective Learning Activities - Podcast

Podcasts too are designed to offer learning support at a time and place convenient to the student. Podcasting is the process of capturing audio and video based media (the latter is known as Vodcasts) then posting the digital file on a website or a blog. Podcasting is recorded digital audio sound files in formats including MP3 which are then uploaded onto a server, website or blog where students can download onto their computers or devices to

listen to them at anytime and anywhere they want. There are a few ways that podcasts can be designed into a course as a means to support students' learning.

According to O'Connor (2006) some HEIs in Boston, USA have adopted podcasting in their learning environments where class lectures and events are recorded. Magg (2006) also provided audio files of recorded lectures for students to review, and found that students appreciate the capability of listening to the lecture again in order to review the content as participants reported the need to relisten to specific concepts that were missed during the face-to-face lecture.

Northeastern University reported that podcasts were beneficial as some lecturers used them to pre-record lectures while using face-to-face time to focus on discussion (Willen-Daugenti, 2009). In a study conducted by Henriques (2007) podcasts were also used to review and expand on discussions about lectures and also to present supplementary materials that could not be discussed in the lecture hall due to limited time. Therefore podcasts could be created as part of pre or post lecture of the course to support the construction of understanding for HE students.

Other reported deployments of podcasting include Florand's (2007) study which employed podcasts not only for channelling information to students, but students were also asked to produce their own podcasts and then post them for peer reviews. Besides that students can also create their own podcasts with their peers or they can interview experts (Herrington & Herrington, 2007, and Cochrane & Batemans, 2010). Cochrane & Bateman (2010) also suggests that students record themselves as a means of reflecting and reporting on their progress in a project. This enables a student to be a "generator(s) of knowledge and is able to collect, display, share and analyse multiple perspectives on issues and problems" (Herrington & Herrington, 2007, p.4).

In designing and developing activities using podcasts, Salmon & Edirisingha (2008) produced guidance including, for example, that the length of a podcast must not be more than 10 minutes, and this guidance needs to be carefully taken into consideration while developing mobile learning activities to be used in this study.

2.5.2.5 Reflective Learning Activities - Moblog

Moblogs are specifically designed for mobile phone which means they do not use long texts but rather short paragraphs or lists of points. Chaka (2009) lists some learning activities that could be offered for HE students to support their learning using moblogs. For example, moblogs can elicit comments and feedback from students as they serve as spontaneous mechanisms for collaboration, peer reviews and community inquiries. Moblogs can also enable the posting of tips, notes, course announcements, assignments reviews, annotated links and many other support for students to gain access to learning anywhere and anytime. This means that moblogs can be used for administration purposes.

Another application is microblogging which is a cross between SMS texting, blogging and instant messaging. In this research, microblogging is categorised as part of the moblog concept. Wishart & Green (n.d.) describe microblogging as “micro-feedback with time increased levels of personalization” (p.12). There are various applications for microblogging, and well known examples include Twitter (<https://twitter.com/>), which is mainly for text while Tumblr (<http://www.tumblr.com/>) and Pinterest (<http://pinterest.com/>) are mainly used for pictures. These applications which can be accessed through a mobile phone could be exploited to support HE students learning, particularly in getting students to reflect on authentic aspects of the content of their course.

2.5.2.6 Multi-Perspective and Contextual Learning Activities – Mobile Camera

There are different types of mobile phone application used in HEI for different types of learning activities. One of the tools on the mobile phone is the camera. Moura & Carvalho (2008) and Ekanayake & Wishart (2011) used the camera function of the mobile phone in a secondary school setting. It is believed that taking pictures or videos and sharing them collaboratively as part of learning activities are also believed to support HE students’ learning.

There are various ways to design learning activities to include taking pictures or recording videos (JISC, 2008). For example, Muyinda (2007) suggested the collection of pictorial data on field trips. Cochrane & Bateman (2010) portray the ability to geo-tag photos using the built in GPS (Global Positioning Service) on some mobile phones in their study. This could not only present pictures but also identify the exact location where they were taken, and

thereby generate contextualised and authentic activities. Ryu & Parsons (2009) recognise that experiential and discovery learning could be combined through real-world picture-taking activity as this conveys a digital representation of the context. This reinforces the learning process as HE students are allowed to construct their understanding through a learning-by-doing type of activity which involves reflecting back what they learn to the authentic context. Kukulska-Hulme, Traxler & Pettit (2007) postulate that real-world experiences, where learners capture happenings around them and connect them to their learning, are powerful.

Meanwhile, Hoban (2009) used mobile phone cameras for students to capture images as part of an animation project for pre-service teachers. Passey (2010) recognised that the 'snap and show actions' could provide a collaborative and reflective type of learning activity. Photo-blogs could also be established by students where uploaded images that are 'picture-worthy' are reflected upon (Repo, 2005). This means that the act of photo-sharing can lead to discussion and learning. The distinction between information or media sharing, and also a real mobile community need to be explored and it is believed photos could prompt this to happen.

However, there are concerns about how such images are used, and students would need to be cautious on the dangers of placing images of themselves online (Wishart & Green, n.d.). Hoban (2009) suggests that the quality of pictures or videos which would not necessarily be clear and this could be an issue during implementation.

2.5.2.7 Possible Mobile Learning Activities

It appears the mobile phone can deliver different types of learning activities through the use of various mobile applications. Mobile learning can offer unique learning experiences that would be different from other forms of educational technologies (Kukulska-Hulme & Traxler, 2007). As discussed earlier, mobile phones could be used for information dissemination, communication, collaboration, and reflection for multi-context or specific learning purposes while using different types of media.

Mobile learning can be depicted to support active engagement in on-campus and then transfer seamlessly onto off-campus learning experiences. It also appears that the mobile phone could be integrated with other delivery mechanisms, for example, using web-based applications that are suitable for the mobile phone to allow students to upload their pictures

to a Flickr (<http://www.flickr.com/>) virtual photo depository account. Learning design for mobile phones can also allow for HE students to exploit restricted time and space for learning (Kukulska-Hulme, Traxler & Pettit, 2007). The list is no means exhaustive, but it provides an overview of the possibilities for how activities to support learning can be designed through the mobile phone for an HEI course. Nevertheless, it must be cautioned that some affordances of the mobile phone could be more important than others due to the nature of pedagogical activities (Cochrane & Bateman, 2010).

The following table describes mobile learning activities summarised through the literature review in this section along with mobile phone applications that could be used for these activities, and also the classification of mobile learning applications through the recommendation from Clough et al. (2009) schema discussed earlier.

Table 4: Classification of Possible Mobile Learning Activities

Mobile Learning Activity	Mobile Learning Focus (Clough et al., 2009)	Mobile Phone Application
Access course materials and receive/deliver notifications for alerts and reminders	Administrative	Moblog, SMS
Immediate communication and community creation (collaboration)	Collaboration; Interactive; Administrative	SMS
Access or create small bite-sized notes in multimedia (text, visual, audio)	Referential; Collaboration	Moblog, podcast
Collect data or capture information, photos or videos in context	Data collection; Location awareness, Interactive; Collaboration	Podcast, video & camera
Collaborate to share and discuss in context	Collaboration; Data Collection; Interactive	Moblog, SMS
Capture pictures or create photo-blog in context	Data collection; Location awareness; Collaboration	Camera & video

This proposed series of mobile learning initiatives provides us with initial ideas for possible mobile learning activities for this study. This study needed to move further than descriptive

case studies of these initiatives as there are not as yet any known studies of whether these opportunities for learning would be suitable and acceptable for Malaysian HE students. The next chapter focuses on the birth of social constructivist learning principles that underpin the development of mobile learning environment designed for this research project. The examples of mobile learning activities as discussed in this section, together with social constructivist learning principles explained in the next chapter, form the basis for the design of the mobile learning environment used in this research.

2.5.3 Issues and Challenges of Mobile Learning in HEIs

As with many new technologies, there are many challenges that mobile learning needs to overcome in order to be able to derive their benefits to support students' learning in HEIs. Through recognizing these issues, researchers and learning designers are made aware of challenges that face them, and more importantly can figure out ways to avoid or overcome them.

2.5.3.1 Physical and Technical Issue

Amongst the prominent issues that were highlighted in deploying mobile learning initiatives are the physical features and technical limitations of the mobile phone itself.

One of the physical issues is the small screen size of the mobile phone (Trifonova & Ronchetti, 2003; Lubega et al., 2004; Zhang & Adipat, 2005; Parsons & Ryu, 2006; and Goundar, 2011). Nix's (2005) study reported that students in the study experienced difficulty with the screen size. Lee et al. (2005) and Zhang & Adipat (2005) recognise that it is not only the display size that is problematic but also screen resolution on mobile phones. Another physical issue is the small key-size on keyboards and touch-screens which may not be comfortable to use to key in data (Kuszpa, 2005; and Zhang & Adipat, 2005). However, Kukulska-Hulme (2007) in evaluating usability issues, found that small screen size and other physical issues may not be a problem for the students, probably because they are used to the device's limited physical capabilities.

The main technical issue highlighted is the short battery life of the mobile phone (Trifonova & Ronchetti, 2003; and Corlett et al., 2005). Parsons & Ryu (2006) stressed that limited

battery life adds to the complexity of mobile learning as it causes slow operation. Ironically Cochrane (2005) and Goundar (2011) found that longer battery life than laptops are reasons considered beneficial for mobile learning. Nevertheless, Kuszpa (2005) states that regular charging is inconvenient for students. In addition other technical issues emphasised include limited performance related to storage, memory size and processor, along with multiple different browser standards and operating platforms for different devices (Corlett et al., 2005; and Zhang & Adipat, 2005). Memory and storage space are pertinent to design of mobile learning activities.

The designers involved in mobile learning also face issues due to students owning different makes of mobile phones. This makes it difficult to assume what technological access they have, and to add to the complexity they could also subscribe to different network providers (Stone, 2004; and Lee et al., 2005). Different network technologies can impact the download and upload capabilities of the mobile phone. Another issue could be the incompatibility of different mobile phone platforms, whereby some content from a mobile phone may not be accessible through another mobile phone using a different operating system (Beasley, 2002). According to McConotha, Praul & Lynch (2008), an important obstacle is students owning the necessary hardware as some do not have web-enabled mobile phones. Then there are problems of outdated phones that cannot access materials. As rightly stated by Goundar (2011), mobile device hardware and software will affect the design of mobile learning activities, for example file formats, memory and navigation issues.

It was gauged that HE students in Malaysia would have access to mobile phones since the initiation of this research. However, the type of mobile phone they own, which in this study ranges from 'basic phone' to 'smartphone' categories, is an issue that was not known before the data collection process of this study.

Mobile devices are designed for business-oriented orientations (Lee et al., 2005), therefore applying them to pedagogical needs is predicted to give rise to problems. Nevertheless, according to Hannafin & Land (1997), "not all perceived constraints are real. Some concerns reflect limited perspective rather than legitimate constraints. As technological, psychological, and pedagogical research and theory continues to advance, designers must develop systems that accommodate the real constraints of the learning environment while

overcoming those rooted in narrowness of their perspectives” (p.178). This calls for research, which this study intends to address, to balance between the affordances of the mobile phone applications and, the pedagogical and theoretical approaches in order to establish suitable learning activities that could be delivered through the mobile phone.

2.5.3.2 Mobile Network Reliability Issue

The other limitation of mobile learning is the speed of the network, especially when downloading and uploading materials to or from the mobile phone (Wang & Higgins, 2005). Moura & Carvalho (2008) experienced this problem during their study, as it was difficult for their participants to upload pictures to Mobile Flickr. Hummel & Hlavacs (2003) study reported loss of connection and bandwidth variability as a problem.

However, Magg (2006) in her study mentioned that podcast audio files can be uploaded through students’ computers, who would therefore not need to use the internet through the mobile phone and also reduce the potential cost. The upload and download function requires for the learners to sync their mobile phone to their personal computers. Incidentally, should the design of a mobile learning initiative requires a mobile network connection which could be through a subscribed mobile network or through free Wi-Fi, then there is a need for reliable network speed to ensure satisfaction (Roberts et al., 2003; and Shudong & Higgins, 2006).

2.5.3.3 Cost Issue

The issue of cost is another prominent concern. Cost can include the purchase of the phone itself, especially if applications for mobile learning require a smartphone (Lubega et al., 2004; and Shen, Wang & Pan, 2008).

The cost of contract for mobile internet access is also a pertinent issue (Moura & Carvalho, 2008). Parsons, Ryu & Cranshaw (2006) and Moura & Carvalho’s (2008) studies conclude that mobile learning can be deployed effectively even in limited technical contexts for example using ‘basic phones’ to send and receive SMS. It is believed that even simple methods like this can contribute to improved learning and could serve students’ needs. However, Naismith et al. (2005) and Conole et al. (2008) found that SMS, although popular, is regarded as an expensive option for communication.

A prominent issue such as cost needs to be considered in the design of mobile learning initiatives. However, it is also noted that there are continuous accelerated efforts to evolve devices that are decreasing in size, increasing in their capabilities, and declining in cost (Willen-Daugenti, 2009). Bonk & Cunningham (1998) propose that “technology is becoming increasingly interactive and distributed, such that individual learners have available, at rapidly declining cost, the means to participate in incredibly complex networks of information, resources, and instruction” (p.26). Despite declining cost this challenge could be an important factor in the acceptance of mobile learning for this study.

2.5.3.4 Device Ownership Issue

Device ownership is a consideration for the implementation of a mobile learning initiative (Traxler, 2007), and it is an essential aspect that affects the uptake of technology appropriation (Kukulka-Hulme, Traxler & Pettit, 2007). Students using their own device may be an issue. However, there are studies that show the opposite. Moura & Carvalho (2010) confirm using one’s own device was not an issue as participants in their research had a positive perception of using their own mobile phones to support their learning. Nevertheless, as noted by Wagner (2005) and Gomez (2007) the implementation of mobile learning presents challenges in that some students may not have access to a mobile device or the required mobile applications.

Kukulka-Hulme (2009) report on Naismith & Corlett’s (2006) review of the mlearn conferences series (2002-5) that availability of technology, institutional support, connectivity, integration and ownership of a mobile phone are essential aspects for the success of mobile learning. This perspective is supported by Sharples et al. (2005) who found that ownership of the technology was shown to be an important element because participants are comfortable with their own devices.

Litchfield et al. (2007) proposed the use of students’ own mobile phones in a variety of activities. Although the reason for the proposal was to avoid the cost of purchasing devices, other reasons included familiarity and a sense of ownership in the activities itself. This is because ownership and familiarity are important in engagement with new technologies and in developing associated skills to support learning (Kukulka-Hulme et al., 2005). According to Hashemi et al. (2011), “ownership of the device makes a difference, since a

tool that has only been borrowed may not be used in the same way as one that is owned and very familiar” (p.2478). Armatas, Holt, & Rice (2005) report in their study that universities were able to communicate with students using SMS, which is efficient and effective because of the high level of mobile phone ownership amongst the current digital learners. Furthermore by owning the device, it encourages collaboration, which will potentially lead to more innovation (Wishart & Green, n.d.).

Since the mobile phone is a personal tool for the learner, there is a sense of personal ownership not only of the device but also the learning tasks (Waycott, 2005; and Naismith & Corlett, 2006). Hashemi et al. (2011) suggest that with the availability of various types of mobile device with different types of applications, means a wider choice of learning activities for the learner. For example, with digital cameras and the possibility of uploading photos immediately the learner can share his/her reflection and this can lead to further discussion. This learning process would not be possible on mobile phones without the camera feature. This also leads to a sense of autonomy for the student to own and be involved in his/her own learning. As stated by Kukulska-Hulme, Traxler & Pettit (2007), the widespread ownership of mobile and wireless devices means that “learners are increasingly in a position to take, lead and engage in activities that are motivated by their personal needs and circumstances of use” (p.53). Nevertheless, it must also be cautioned that one group of learners may exhibit very different patterns of usage from another group which could be due to differences in the type of mobile phone owned.

2.5.3.5 Technical Knowledge of HE Students Issue

It is important to note that there could be participants who need assistance when implementing the mobile learning initiatives. Lee, Chan & McLoughlin’s (2006) study found that students listened to podcast learning materials through their computers instead of the mobile device. These students stated that they did not have access to MP3 players, yet had indicated that they had mobile phones with MP3 player capabilities. This means that students lack technical understanding, hence the research concluded that there is a need to provide appropriate support for students in any technology deployment. In a report on first year HE student experiences in using ICT in University of Edinburgh, it was found that

there is a minority of students who are not confident in using technology and that many do not recognise the potential of technologies as learning devices (Hardy et al., 2009).

Another issue is the levels of technical skill of participants in the study. Students with a “high level of use and skill did not necessarily translate into preferences for increased use of technology in the classroom and that students prefer technology to a moderate degree and as a supplement in courses” (Kravik, 2005, p.3). Kennedy et al.’s (2008) study shows that the majority of students in their study have not used their mobile phone to access the web for information or to access email. According to Bennett, Maton & Kervin (2008) “Students everyday technology practice may not be directly applicable to academic tasks, and so education has a vitally important role in fostering information illiteracies that will support learning” (p.781). This is also claimed by Hannafin & Land (1997) who suggest that “tools or resources may afford an opportunity for cognitive processing; they may not be used mindfully by the learner to extend thinking or understanding” (p.187). Students with access to technology do not necessarily use the tools to support their own learning, hence there is a need to design learning activities that not only exploit the tools students have access to but ensure the students use these tools to assist in their learning.

Students require significant levels of technical skill to maximize the potential of digital technologies (Cochrane & Bateman, 2010) while not all students explore the applications available on the mobile device (Kukulska-Hulme, 2007). Kukulska-Hulme, Traxler & Pettit (2007) suggest that some learners are reluctant to explore their mobile phone due to several issues such as cost. There is also the need to be aware that frequency of use of a mobile phone does not entail readiness for mobile learning (Corbeil & Corbeil, 2007).

2.5.3.6 Disruptions and Security Issue

Mobile learning can be seen as disruptive (Sharples, 2002). Newhouse & Rennie (2001) report that students exchange SMS messages in class and play illegal games using their mobile devices. Katz (2005) states that students find ways to cheat during exams as they are able to access information, text or distribute photos of exam questions. According to Goundar (2011) teachers are not keen to be interrupted by calls and text messages in class. Therefore, mobile phones are regarded as a nuisance rather than a tool for learning in the classroom by the lecturers.

Then there is the issue of network literacy in terms of promoting safe use of the internet (Johnson, 2001). Wishart & Green (n.d.) state that “We will see more use by students of mobile devices together with social networking tools and different kinds of ‘mashups’ and we need to note the potential implications for security” (p.11). Learners need the skills to critically evaluate and creatively produce content in a variety of media. Maslin, Zuraini, & Ramlah (2008) report the need for computer ethics amongst Malaysian HE students.

2.5.3.7 Usability Issue

Kukulska-Hulme (2007) highlights possible usability issues in mobile learning implementations. This is because of the unpredictable nature of the mobile device itself. According to Magal-Royo et al. (2007), usability is described as “the quality of an application to be understood, learned, used and is attractive by/to the user, when employed under specified conditions or in context of use conditions” (p.23). Usability can encompass social acceptance and also practical aspects such as reliability, usefulness and compatibility (Kukulska-Hulme, 2007).

The MOBIlearn project stresses for “usability requirements of all those involved in the use of the system in any way (learners, teachers, content creators) to assure system acceptability” (O’Malley et al., 2003, p.32). In ensuring usability, there are two main considerations; the context of use and the learners’ opinion of personalisation of learning (O’Malley et al., 2003). Furthermore Zhang & Adipat (2005) propose a number of usability attributes in the use of mobile phone applications for learning which are: learnability, efficiency, memorability, limitations, satisfaction, effectiveness, simplicity and readability. These are the attributes which need to be reflected in the design of mobile learning activities for this study.

The evaluation of usability is based on effective use and performance of a tool (Magal-Royo et al., 2007). It must be stressed that mobile phones are not designed explicitly for educational applications. One way to overcome usability issues is through familiarity with the tool. However, as cautioned by Keinonen (2003), in the design of mobile learning “new solutions are utilized in ways that never occurred to their designers” (p.2.) Kukulska-Hulme (2008) reports that there are mobile learning initiatives that would have learners behaving in unexpected ways which could be as in context of use or mode of use. This means that a

learning designer cannot fully anticipate what learners will eventually do with the implemented initiatives and need to be flexible when implementing mobile learning designs for learning.

2.5.3.8 Student Personal Space Issue

The mobile phone has become part of the HE students “values, affiliations, identity and individuality through their choice and their use” (Traxler, 2010, p.1). This is because owning devices indicate that learners not only use them, but probably also put in the time, effort and money to customize and learn about their functionality. It is perceived that there may be emotional attachment to the students’ mobile phones. One of the conclusions of the study on first year student experiences with ICT at the University of Edinburgh was that academicians should not intrude in students’ personal space (Hardy et al., 2009). Since the mobile phone is a personal device, there is a danger of encroaching into HE students’ personal space.

While Conole et al. (2006) found that students’ feel of ownership and control over their learning using technology is a motivator, there is still a need to understand affective issues in relation to the learner and their relationship with their phones (Cook, Pachler & Bradley, 2008).

2.5.3.9 Review of Issues and Challenges

There are many challenges in implementing mobile learning but HEIs cannot afford to ignore this type of delivery mechanism for their students due to its many benefits for learning. Bryant (2006) sees technologies as tools to “expand discussion beyond the classroom and provide new ways for students to collaborate and communicate within their class or around the world” (p.61). Although a large amount of literature has discussed mobile learning benefits, there are also known challenges in the design of learning using the mobile phone. The issues of cost, slow download, and participants’ technical skills in using the mobile phone need to be considered in the design of mobile learning activities. Nevertheless, in the discussion of these issues, there are also suggestions to overcome them.

The mobile phone is a familiar technology with easy to adopt applications. It is also gaining into a popular culture (Warger & Dobbin, 2009) which means the mobile phone is part of the HE students' daily life. Nevertheless, learners will only adapt the tool when they think it adds value to their lives (Carroll et al., 2002), therefore the popularity of mobile phones indicate that the tool is of value to HE students. This is an advantage for learning designers and lecturers who attempt to use this tool to reach out to their students beyond the classroom.

Selwyn (2003) proposes that “it would be unwise to for educationalist to dismiss the rise of mobile phone as a passing ‘fad’ or affectation of youth culture and fashion. Instead, the mobile phone epitomizes a significant technological shift as ICTs rapidly converge into highly mobile and individualized artefacts” (p.132). There is a need for a theoretical framework to guide the design of mobile learning activities, which is addressed in the following chapter.

2.5.4 Designing the Mobile Learning Environment

Mobile learning is not about the device. Mobile learning is about a change in the lecturer’s philosophical approach to teaching, and it is not simply to apply elearning design requirements to the mobile learning environment (Parsons & Ryu, 2006; and Ryu & Parsons, 2009). This means that mobile learning initiatives must establish their own design requirements in order to support their characteristics as discussed earlier in Section 2.5 of this chapter.

There are a few design guidelines proposed in the literature of mobile learning. For example, Herrington, Herrington & Mantei’s (2009) design principles for mobile learning in HEIs, and Cochrane & Bateman’s (2010) pedagogical design guidelines, based on over 15 mobile learning trials over 3 years. I have attempted to summarise them in Table 5. In the first column of Table 5, I compiled attributes for the design of mobile learning as reported by literature and organise them into different categories. The second column stated the sources of these attributes. In the last column, I categorised these attributes and summarised them into nine steps. For example Uther (2002) stresses understanding display size while Litchfield et al. (2007) suggest to investigate technical protocols for downloading from mobile phone to a computer. I have categorised these attributes as the need to understand

technical matters specifically for mobile learning as a guide for the design of mobile learning activities. Through these attributes, a more comprehensive mobile learning design guide is produced and used for this research.

Table 5: Review of Mobile Learning Design Guide

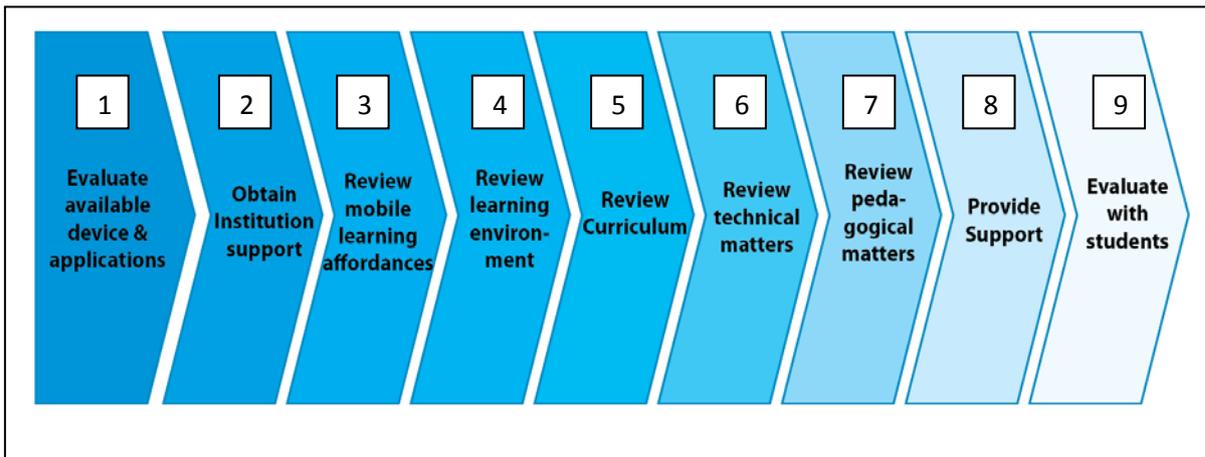
Proposed Guidelines (Attributes for the Design of Mobile Learning)	References	Summary
Availability of technology	Naismith & Corlett (2006)	Evaluation of available device and applications (1)
Assessment of willingness of learners to use their own mobile devices in a variety of learning activities	Litchfield et al. (2007)	
Connectivity across mobile networks and wireless network access	Naismith & Corlett (2006)	
Personalise: employ the learners' own mobile device	Herrington, Herrington & Mantei (2009)	Obtain institutional support (2)
Institutional support such as resources, staff training, and hardware availability & maintenance	Naismith & Corlett (2006)	
Awareness of limitations and benefits of mobile devices	Parsons & Ryu (2006) & Ryu & Parsons (2009)	Review and understanding mobile learning technical and pedagogical affordance (3)
Focus on characteristics of mobile learning	Kukulka-Hulme, Traxler & Pettit (2007)	
Understand learning environment that the design take place; mobile contexts	Herrington & Herrington (2007) and Herrington, Herrington & Mantei (2009)	Review and understand learning context (4)
Learn about the context	Kukulka-Hulme(2009)	
Integrate with the curriculum, student experiences and the mobile learning initiative itself	Naismith & Corlett (2006)	Review and curriculum of the intended course to elicit which section can mobile learning activities can support learning (5)
Critical and careful analysis into how available mobile learning applications could be used to match specific learning objectives is essential to ensure the success of any mobile learning implementation	Kim, Mim & Holmes (2006)	
Blended: blend mobile and non mobile technologies	Herrington, Herrington & Mantei (2009)	
Appropriate choice of mobile devices and software	Cochrane & Bateman (2010)	Understand technical matters specifically for
Investigate technical protocols for downloading from mobile devices to PCs	Litchfield et al. (2007)	

Due to the limited display capacity of mobile devices, information should be chunked into categories to prevent overload during processing in working memory	Koole & Ally (2006)	mobile learning (6)
Consideration of display size limit; need to “organize and navigate through ‘bite-sized’ pieces of mobile learning content” (p.5.)	Uther (2002)	
Short nuggets rather than large units of information which can be supported by appropriate use of different media types	Traxler (2007)	
Keep it short with no more than 5-10 minute modules	Trifonova (2003)	
Need to be consistent with navigation display	Parsons & Ryu (2006)	
Explore: provide time for exploration of mobile technologies Affordances: exploit the affordances of mobile technologies	Herrington, Herrington & Mantei (2009)	
Development of strategic learning activities to suit for use with student-owned mobile devices	Litchfield et al. (2007)	
Lecturer modelling of the pedagogical use of the tools	Cochrane & Bateman (2010)	
Learning strategies allow students to apply information in real life to make learning meaningful. Design activities that require the students to draw upon their social and cultural contexts	Koole & Ally (2006)	
Strategies require students to promote high-level learning	Koole & Ally (2006)	
Need to consider variations depending on learners’ context	Uther (2002)	
Keep content simple and value added functionality	Trifonova (2003)	
Specific context that is delivered just in time	Trifonova (2003)	
Needs to be a balance between instructional and informative types of approach	Leung & Chan (2003)	
Should be a pre and post activity of other type of learning to complement the classroom experience	Parsons & Ryu (2006) & Parsons, Ryu & Cranshaw (2007)	
Timely learning cues	Cook, Pachler & Bradley (2008)	
Simple aspect that the mobile device does uniquely better. To understand “the social practices by which those new affordances become powerful educational	Roschelle (2003)	

intervention”(p.286)		
Wherever: use mobile learning in non traditional learning spaces Whomever: use mobile learning both individually and collaboratively Mediation: use mobile learning to mediate knowledge construction Produce: use mobile learning to produce and consume knowledge	Herrington, Herrington & Mantei (2009)	
Technological and pedagogical support	Cochrane & Bateman (2010)	Design support system in the initiative (8)
Communication support	Parsons, Ryu & Cranshaw (2007)	
There must be a balance between effective support and intrusion	Cook, Pachler & Bradley (2008)	
The use of regular formative feedback from both lecturers and student peers	Cochrane & Bateman (2010)	Create multiple type of evaluation, and students must be involved in evaluation process (9)
Should involve learners as part of the design	Kukulka-Hulme (2009)	
Involve learners in the design of mobile learning initiatives	Kukulka-Hulme, Traxler & Pettit (2007)	
Students’ perceptions and evaluation of the mobile device	Kim, Mim & Holmes (2006)	
Students’ engagement on the use of appropriate mobile applications	Cochrane (2010)	
Level of moblogging achieved by the learners	Cochrane (2010)	
Students’ reflective feedback	Cochrane (2010)	

The mobile learning guide derived from the literature, led to the development of the mobile learning design guide used for this study. These guidelines can be adapted but mainly they are used as a linear process illustrated in Diagram 5. This guide is part of the design of the mobile learning activities in the research process. For example, in the first step, which is to evaluate available device and applications, a questionnaire was used. The use of this guide for this study is explained further in Chapter 4.

Diagram 5: Mobile Learning Design Guide



There is a need to be aware that mobile learning is a fragmented process (Syvanen, Pehkonen, Turunen, 2004) in the design for learning activities. Lee (2006) describes fragmentation in learning as “when the learning experience does not form a meaningful continuum” (p.24). Due to environmental disturbances such as the weather, technical issues (low broadband bandwidth), poor concentration levels of the learner and so on, there could be interruptions to learning. Therefore in mobile learning design, unlike static computer-based learning systems, learning should be structured in such a way that the “user can easily stop and re-start their learning in an episodic fashion, since much mobile learning take place in ‘down-time’ or as part of other time constrained activities” (Ryu & Parsons, 2009, p.11). These are considerations part of the design.

2.6 Summary of the Literature Review on the Learning Design for Mobile Learning

In this chapter, the aim is to analyse literature to inform the design for mobile learning. The discussion on learning design leads to Gorard & Taylor (2004) learning design model. Through this model, the main focus of learning design is to gauge between the ‘intended behaviour or function’ of a design to the ‘actual behaviour or function’. It is also found that learning activity is a key element of a learning design. Hence, Beetham (2007) Outline of Learning Activity is presented which highlights factors that influence the design of learning activities. The factors are the learning environment (sociocultural context of the study), the learners, the tools (affordances and issues of the technological tool selected), and the

theoretical principles for the design. All of these factors are discussed in this chapter except for the last, which is only discussed in the coming chapter.

In the learning environment discussion, literature on the use of ICT for teaching and learning in HEIs is analysed. There are many evidences of benefits for introducing ICT in HEIs, but caution is still needed in learning design in order to provide effective ICT implementations. The Malaysian HEI backdrop is also introduced to lay the ambience of the study's context. This is followed by the Malaysian HEIs and ICT to understand the need for the Malaysian HEIs to promote the use of ICT to develop the country's knowledge workers.

The second factor is in the learners' general background which explored not only the cultural background of the targeted learners but also their perceived preparedness for using ICT for learning. It is also relevant to deliberate on the Malaysian HE students as digital learners. Nevertheless, it is found that there are criticisms on labelling a whole generation of HE student with one term. Despite these criticisms, it is still felt that that the digital learner characteristics needed to be discussed. This is because the summary of the characteristics provided an understanding of the students' needs. Through the review of the digital learner characteristics, it is found that the attributes could be categories as learning traits and learning support which the learning activities is designed.

The Malaysian HE students' background is also explored. Firstly, these students are akin to the descriptions of Asian HE students. It is found that this description may be problematic as it appeared to be derived through the teaching and learning system that the students are based in. For example, need for memorisation as a learning method may be due to the way the classes and assessment are designed rather than the students' preference to learn. This means learners adjust their way of learning in reflection of how they see the lessons are being taught. This leads to the discussion of the Malaysian students. In a bigger picture, Malaysian HE students come from different ethnic groups and background. Closely linked to the various ethnic groups are also the various religious backgrounds which are intertwined with their respective cultures. This section also discussed studies that indicate that Malaysian HE students are able to embrace ICT to support their learning which suggests that they can be prepared to accept mobile learning.

The next aspect for the Outline of Learning Activity (Diagram 4) is the tool factor in which the affordances of the mobile phone for learning support and issues are presented. Traxler's

(2007 & 2009) acknowledges that research on mobile learning is problematic since it is a 'noisy' phenomenon which is based on a complex context. However, many benefits can be reached out to engage and support Malaysian HE students' especially out-of-the classroom learning activities. Understanding mobile learning characteristics and its affordances for designing learning activities is essential to the process of design. Appreciating the potential issues with mobile learning is also part of the learning design process. As evidenced through other studies earlier, there are pedagogic approaches such as collaboration, reflection, contextual, learning management that could be designed to support HE students' learning.

Finally, developing mobile learning design guide for this research is the first step in the design of mobile learning activities to support HE students' learning in Malaysia. This nine linear step mobile learning guide is adapted in this study's research process explained further in Chapter 4. In conclusion, it is gauged that there are immense possibilities to design and implement mobile learning activities to support Malaysian HE students' learning. Nevertheless, there is a need for a theoretical framework to guide the design of mobile learning activities, which is addressed in the following chapter.

3.1 Research Paradigm

Research paradigms represent “a worldview that defines, for its holder, the nature of the “world”, the individual’s place in it, and the range of possible relationships to that world and its parts” (Guba & Lincoln, 1994, p.107). Cohen & Manion (1994) describe a research paradigm as the philosophical intent or motivation for undertaking a study. This view is also held by Mackenzie & Knipe (2006) who state that it is through the selection of a paradigm that the intention, motivation and expectations of research are established.

Denzin & Lincoln (2005) posit that a paradigm in research is a set of beliefs that guide action within the research process. According to O’Donoghue (2007) this leads most researchers to focus on selecting methods that are deemed appropriate for the chosen research paradigm. However, selecting a paradigm should not stop there as researchers should extend the view of a particular paradigm throughout the whole research process. Crotty (1998) considers a chosen research paradigm as a “Justification of our choice and particular use of methodology and methods is something that reaches into the assumptions about reality that we bring to our work” (p.2) This again means that a paradigm is not only about the explanation of the use of methods in a particular study but spreads to the researcher’s set of beliefs. This means that a chosen research paradigm represents a belief system that leads a researcher to hold a particular worldview that should be represented in the whole research process.

According to Guba & Lincoln (1994), a paradigm is “the basic belief system or worldview that guides the investigator, not only in choices of method but in ontologically and epistemologically fundamental ways” (p.105). The researcher’s belief leads them to seek the theory on which the research is founded that is embedded within the epistemological and ontological beliefs of the researcher. According to Maynard (1994), “Epistemology is concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate” (p.10). It is concerned with how the researcher in a study knows things and what this researcher regards as acceptable knowledge, and the nature of knowledge (Mertens, 1998). Meanwhile Crotty (1998) states, “Ontology is a study of being” (p.10) or as Mertens (1998) explains it, the nature of reality. Ontology is, in other words, ‘what is’ and shapes epistemology, or ‘what it means to know’ (Walliman, 2006). This means that epistemology and ontology complement each other, and shape the paradigm that a researcher applies. Therefore, before a researcher

chooses a paradigm, it is best to reflect on his or her beliefs about knowledge which are the source of his or her epistemological and ontological beliefs.

Both ontological and epistemological positions are related to the choice of paradigm for a piece of research, but they also direct the selection for methodology for the research. Methodology is the “strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes” (Crotty, 1998, p.3). In other words, methodology is the series of actions required to be able to find out what the researcher believes can be discovered (Guba & Lincoln, 1994) and this is related to the research methods. Crotty (1998) states that methods are “the techniques or procedures used to gather and analyse data related to some research question or hypothesis” (p.3). Methods of research are more the established systematic search for data in order to achieve the aim of the research. These are essential parts of a study which are related to the choice of paradigm for the research. The methodology and methods for this research are discussed in Chapter 4 of this thesis.

In the past 30 years there has been much debate about paradigms and their influence in social science research (O’Donoghue, 2007). In determining the paradigm that is suitable for research it is best to understand the ontological basis for what is knowable, the epistemological basis of knowledge, and the methodological basis for gathering data to obtain that knowledge. There are some researchers who have developed diagrams which map out the respective paradigms. For example, Niglas (2001) mapped out the different paradigms and methodologies decisions to be taken in the process of empirical research. Lather (2006) and Guba & Lincoln (1994) also created summaries in the form of tables to show differences in the paradigms and these are adapted in the Table 6. Mertens’ (2005) explanation of the respective paradigms is also included in the table. These explanations have been adapted in my version of the summaries as in Table 6 in order to visualize my understanding of the main paradigms, namely, positivism, interpretivism and critical theory. My main focus is on these three as they are considered the roots of other paradigms such as post-positivism, constructivism and feminism (Wardlow, 1989; and Oates, 2006).

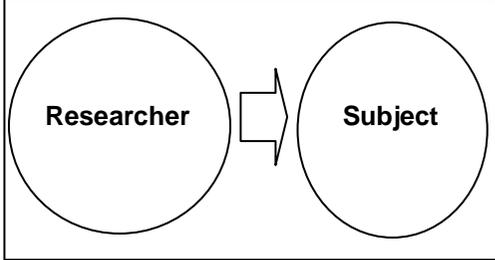
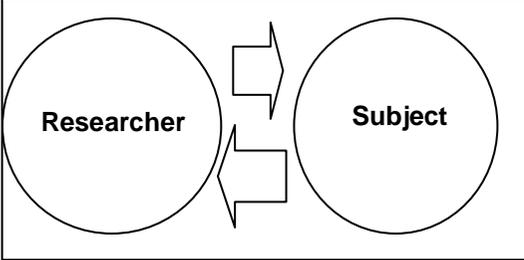
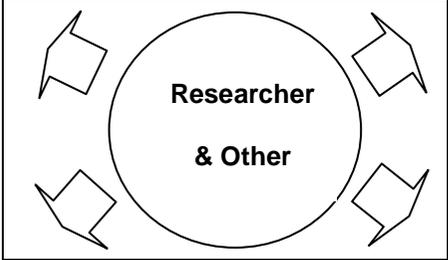
	POSITIVIST	INTERPRETIVIST	CRITICAL THEORY
			
Ontology (what is)	Reality is objective & 'found' Single truth Naïve realism – 'real' reality but apprehendable	Reality is subjective & constructed Multiple truths Relativism – local & specific constructed realities	Reality is subjective & constructed on the basis of power issues Truth is multiple & constitutes a system of socio-political power Historical realism – reality shaped by social, political, cultural, economic, ethical, and gender values, crystallized over time.
Epistemology (what it means to know)	Knowing the world Dualist/objectivist, finding truth	Understanding the world Transactional/subjectivist, created findings	Changing the world Transactional/subjectivist, value-mediated findings
Methodology (e.g.)	Experimental research Experimental/manipulative, verification of hypotheses	Ethnography Grounded theory Hermeneutical/dialectical	Action research Feminist standpoint Dialogic/dialectical
Methods (e.g.)	Measurement & survey Chiefly quantitative methods	Observation & interviews Qualitative methods predominant	Document analysis & Narrative

Table 6: Different Types of Research Paradigm

In Table 6, the diagrams were taken from Lather (2006) to provide an illustration for the relationship with the participants of the research in each paradigm. In the positivist paradigm the researcher is detached from the participant, while for the interpretive paradigm the researcher and participants construct meaning together in the context in which the research is based. Meanwhile for the critical theorist, the researcher's relationships with the participants are connected to other aspects of the context, particularly the socio-economic and political situation. This provides a snap-shot of the differences between the paradigms. A more detailed perspective on these paradigms is presented in the following sections.

3.1.1 Positivist Research Paradigm

For the positivist, truth is objective and discoverable as “there is a reality out there to be studied, captured, and understood” (Denzin & Lincoln, 2005, p.11). This, according to Kim (2003) and Oates (2006) means that a source of truth is reality as a proof of truth, which is in agreement with an existing reality. If there is no proof then the statement is false. In other words, truth is based on facts and facts are based on evidence. However, when a researcher finds truth, it is the single and only truth. It also means that there is a reality out there that the researcher needs to find the proof of, in order for the reality to be defined.

According to Guba & Lincoln (1994) ontological realism entails that apprehendable reality exists and is structured by unchangeable natural laws and mechanisms. These characteristics relate to the epistemology of the positivist paradigm, which can be dualist or objectivist as shown in Table 6. Kim (2003) states that “social reality exists independent of people and can be objectively investigated by employing valid and reliable measurements” (p.11). As described by Weber (2004) and Oates (2006), objective reality goes beyond the human mind and is therefore independent of the researcher. This means that research, for those who subscribe to the positivist paradigm, should be objective and detached from the participants or the variables of the research. This indicated that the way in which social science is studied is the same as natural science in that causal relationships can be explained and research must be value-free (Crotty, 1998; and Mertens, 2005).

From the positivist perspective, truth is something that can be proved and if there is no proof then it is not real. As Wardlow (1989) explained, this type of paradigm entails that there are universal laws which determine communal scenarios and discovering these laws enables

researchers to describe, predict and control social events. For the positivist, research is about 'knowing' the world (Lather, 2006) in other words, what is happening. The positivist paradigm can be depicted as the researcher standing behind a glass door to investigate what is happening; looking at what is happening from a detached viewpoint outside the scene so that the researcher sees the phenomenon from a 'bird-eye's view' of the 'forest' (context of research).

The positivist paradigm bases its conviction on the fact that scientific knowledge is accurate and from its perspective "objects in the world have meaning prior to, and independently of, any consciousness of them" (Crotty, 1998, p.27). Kim (2003) states that "empirical methods for the process of verification should be employed because these methods are objective and do not influence what is being investigated" (p.11). This means that the methodology used in this paradigm should be free from individual bias as data are analysed objectively. The suggested methodology is experimental and manipulative in which the use of empirical test methods is proposed. This is because this method can produce rational structures of scientific investigation and then test them (Kim, 2003).

Mertens (2005) states that quantitative methods tend to be predominant in this paradigm. The methods subscribed to by positivism are highly systematic and orderly as there is a need to propose hypotheses in order to generate predictions. These predictions are then tested, usually under controlled conditions (Oates, 2006). Kim (2003) explains that this process creates knowledge because it "constitutes an accurate description of reality, becomes accepted as truth through this rigorous empirical verification process" (p.12). Positivism seeks to identify universal variables in order to offer explanations and is about control and predictability in order for knowledge to be generalised, as this contributes to knowledge generation.

However there are a few limitations to the positivism paradigm. One of them is that contextual influences are disregarded hence; there may be missing variables from the context which influence the research (Kim, 2003). The other is that there seems to be a limitation of the truth because this paradigm relies mostly on "probabilistic inferences of the truth" (Kim, 2003, p.12). Finally, the nature of social science is subjective and therefore measuring this type of phenomenon is a great constraint in an objective perspective. The last statement was also discussed by Gage (1989) when he stated that "human affairs cannot be

studied with scientific methods used to study the natural world” (p.4). Positivism assumes that social phenomena, like the natural science, can be measured. This would be difficult since social science contains embedded values, experiences and politics that cannot be separated from the data analysis.

One aspect of the positivist paradigm is that the intent of research is prediction and control which is not part of the aim of this study. The aim of this research as explained in Section 1.4 is to focus on exploring suitable mobile learning activities for HE students, rather than evaluating these activities. Furthermore, since I was also the designer of the mobile learning activities, it would be challenging for me to separate my reflections on the design from the interpretation of the study. Therefore the positivist paradigm was not deemed suitable for this research.

3.1.2 Interpretivist Research Paradigm

For the interpretivist, truth is subjective. This is because interpretivism is a world of lived experiences where individual perception of meaning intersects with action in context. Research is “guided by the researcher’s set of beliefs and feelings about the world and how it should be understood, and studied” (Denzin & Lincoln, 2005, p.22). This is similar to the statement from Weber (2004) that “our perceptions about the world are inextricably bound to a stream of experiences we have had throughout our lives” (p.V). Truth exists within the researcher and is determined by their experiences, social background and other factors such as motivations.

Weber (2004) also recognised that the researcher and reality are inseparable. Knowledge constitutes a person’s lived experience. For the interpretive it is about ‘understanding’ the world as epistemology in Table 6. This perspective arises because the researcher within the context of the study is investigating reasons why something happens. The researcher would get into the small details of the context and reflect within his or her understanding. This perception is likened to the researcher looking at the trees and the shrubs (research details) of a forest (research context).

Truth for the interpretivist paradigm is multiple because knowledge consists of “multiple sets of interpretations that are part of the social and cultural context in which it occurs”

(Kim, 2003, p.13). Interpretivists reject the assumptions that truth is uniform which means that “phenomena would occur in the same way in different places and times” (Gage, 1989, p.5). This means that reality is multi-layered and complex with single events that can have multiple interpretations (Cohen & Manion, 1994). Interpretivist research is also open to a variety of influences since research findings are based on context or situation (Kim, 2003), thereby being capable of being influenced by a variety of sources. This further enhances the complexity of interpretivist research, and mirrors social reality as social life is complex.

Interpretivists believe that research focuses on the specifics of action and meaning construction (Denzin & Lincoln, 2005). Therefore making meaning out of the research process is essential to understanding the phenomenon studied. Guba & Lincoln (1994) state that meaning can be derived and refined through an interactive process between the researcher and the participants of the research. Since the aim of this research is to explore the perceptions of HE students in Malaysia about mobile learning activities, this means the research is also making meaning with the research participants. It is essential for this research to derive what are acceptable forms of mobile learning activities through the voices of the participants.

Crotty (1998) states that the interpretivist approach “looks for culturally derived and historically situated interpretations of social life-world” (p.67). It is essential for the interpretivist paradigm to ‘understand’ the world of human experiences (Cohen & Manion, 1994; and Lather, 2006). Knowledge is personally experienced by the researcher rather than imposed from external variables. However, research is not only about the perspective of the researcher but also those of the participants involved, which can produce unique interpretations of the situation being studied. This means gaining an understanding of participants including their attitudes and values are essential (MacKenzie & Knipe, 2006). The choice of methodology and methods must also reflect this.

As shown in Table 6, qualitative methods predominate, although quantitative methods can also be deployed (Cohen & Manion, 1994; Bodgan & Biklen, 1998; Weber, 2004; and Mackenzie & Knipe, 2006) for this paradigm. In the interpretivist paradigm it is suggested to choose methods that allow for many variables to be recorded, particularly from many different perspectives of the participants, since the most important aspect of interpretivism is to understand and give meaning to the situation, and provide a voice to the participants.

Nevertheless, it has also been mentioned that the researcher's views are reflected in the research, and this could introduce a form of bias into the research conclusions (Kim, 2003). Researchers' biases and values can also contaminate the research process as perceptions, experiences and socio-cultural background can affect the way a researcher looks at a situation, in which case the findings would be said to be unreliable. On the other hand Weber (2004) states that these can be overcome through applying criteria for evaluating knowledge claims, such as credibility, transferability, dependability and conformability which are all research tools to ensure empirical enquiry is attainable. Section 4.10 discusses this matter for this research.

Wardlow (1989) states that through the considerations taken from the research participants' voices, the researcher could be able to extract a more holistic understanding of the phenomenon. This is again similar to the foundation of this research, in which a more comprehensive understanding of the HE students' perception of mobile learning activities is essential to gauge not only the acceptance of the device for learning but also the best way in which it can be implemented. Context is also essential for this research as I believe that different contexts will produce different findings, hence the interpretivist paradigm is deemed more suitable.

3.1.3 Critical Theorist Research Paradigm

For the critical theorist truth is also subjective and influenced by the social-political environment. From the perspective of the critical theorist, researchers should take a social position and take responsibility for social change (Kim, 2003). Political and economic situations influence perceptions of society; hence the importance of power in society cannot be disregarded, as stressed by Gage (1989). Power in society gives birth to an inequitable social class structure while humans need to change the social structure and not be dominated through it (Gage, 1989). Through these situations, truth is also seen as multiple, as shown in Table 6. Research should consider changing the structure of society for the better.

In the critical theorist paradigm reality that is found through the researcher is value-oriented. Research inquiries are directed towards investigation of the context, based on the values expounded by the researcher. According to Mackenzie & Knipe (2006) the aim of the critical theorist is to transform society by addressing issues of inequality, especially in

terms of gender, disability, sexual orientation or any other marginalised part of society. Since politics and enquiry are intertwined, by aiming to change this situation the participants can be transformed for the better.

For the critical theorist, the focus is about changing the world; what can be done on what is happening. The onus is on the researcher within the context of the study to try to find the best way to make changes within society. This is likened to the researcher looking at trees and trying to find the best way to help them by looking for the power relationship within the whole forest. The researcher should be systematically investigating what is happening by reflecting on the socio-politics of the context, and proposing changes by bringing about awareness in the society. This is the epistemological basis for this paradigm.

Gage (1989) recognises that critical theorists regard researchers in both positivist and interpretivist paradigms “engage in mere technical work, more or less, with the details of education and teaching while neglecting the social system that determined the basically exploitative and unjust nature of education in capitalist society” (p.9). This means that research in this paradigm is not only about understanding conflict and probable oppression but also about bringing about change in the situation (Crotty, 1998). The purpose of the critical theorist approach is mainly about societal change. According to Wardlow (1989), critical theorist researchers need to seek “an understanding of our society and its institutions, through which the individual can and will decide to act upon injustices of our society in order to change them” (p.4). This is not the aim of this research and fundamentally this research is also not to investigate any form of injustice in the context.

The essence of the critical theorist paradigm is transformation, which needs to be done through making society aware of the context they live in, and by providing a clear description of the context, societal injustice and to some extent exploitation can be highlighted and for the society to move towards change (Crotty, 1998). Researchers need to interrogate common assumptions and challenge social structures and one aspect of research is to challenge interpretations and values in order to bring about change. This is the “value-determined nature of enquiry” (Guba & Lincoln, 1994, p.109). As shown in Table 6, the methodology and methods for this paradigm tend to be qualitative in nature which is dialogical and dialectical.

A challenge for critical theorists is that the “critical science approach also advocates a process of research that yields social change rather than pure knowledge generation” (Kim, 2003, p.13). Therefore there are debates about whether this type of paradigm is research as it does not concentrate only on knowledge production. However, critical theory places emphasis on awareness of values and beliefs as part of the empirical enquiry. I believe that by bringing forth argument and understanding of values and beliefs awareness can generate knowledge, therefore critical theory is research with a purpose. This is as explained by Wardlow (1989) who states that awareness aims to empower people with knowledge in order to promote change. Nevertheless, the spotlight on research would be on power relations (Crotty, 1998), which is not part of the basis of this research. Therefore, critical theory is not a suitable paradigm for this research.

3.1.4 Summary of Research Paradigm

Paradigmatic differences should not become paradigm conflicts (Gage, 1898). The choice of paradigm is about compatibility with the focus of the research. Each approach has its own advantage and produces knowledge on its own. As stated by Gage (1989):

If the research of the objectively and quantitatively oriented investigators led to improved student achievement and attitudes, the research community paid respectful attention. If such results were produced by interpretive-qualitative investigators, the arguments for their concepts and methods were considered to be strengthened. If the analyses of the critical theorists led to reforms that resulted in social and educational benefits, their views were also thus supported (p.8).

It could be said that due to the different orientations of each paradigm, the conclusions of the study will vary. Hence, considering this study and its focus, the interpretative paradigm is relevant to the need to understand the research participants’ perceptions of mobile learning activities as a means to support their learning. As described by Oates (2006), this research is intended to “look at how the people perceive their world (individually or groups) and try to understand the phenomena through the meanings and values that the people assign to them” (p.292). This will be discussed further in the next section.

3.2 Interpretivist Research Paradigm for Mobile Learning Activities Research

Interpretive research is an active process of social enquiry and sense making in order to construct meaning (Erickson, 1986, and Greene, 1992). Vrasidas (2001) further elaborates on the notion of sense making in the field of educational technology, whereby the main purpose is to explore the meanings that teachers and learners negotiate through learning with technology. The purpose of this study is to explore the possibility of introducing mobile learning activities to support learning from the perspectives of Malaysian HE students in terms of which mobile learning activities are deemed useful for them. This is in tandem with the focal aspect of interpretive research that is concerned with the “implicit and explicit choice and meaning from the point of view of actors in social life, regarding the actions they take in everyday life” (Erickson, 1986, p.5). The focal point of this research is the Malaysian HE students’ construction of meaning about the possibility of using their mobile phones as a supportive mechanism for their learning.

It is the researcher’s goal in interpretive research to understand the multiple social constructions of meaning and knowledge in the complex context of the study. Mertens (1998) describes how interpretive research allows for concepts that are important in a study to emerge as they are constructed by the participants. This means thorough interpretive research, findings present how they were constructed by the participants in the study, and not as the researcher has designed them. In the design of mobile learning activities for this research it was the participants who shaped these activities through their perceptions of usefulness of a mobile application to support their learning.

According to O’Donoghue (2007), human actions are preceded by intentions which are derived through the perspectives that the person holds. The main task of interpretive research is “to discover the specific ways in which local and non-local forms of social organisation and culture relate to the activities of specific persons in making choices and conducting social action together” (Erickson, 1986, p.36). This means the focus of interpretive approach is to capture the participants’ perspectives and how they act in light of their perspective. Furthermore Vrasidas (2001) also indicates that “interpretive research is appropriate when one wants to find out more about certain structures of experience, the meaning-perspectives of the actors, and specific interrelationships between actors and environment” (p.8). Thus, in addition to understanding participants’ views through their

actions, interpretive research also probes into the participants' relationships with the context examined and how this relates to their meaning making in relation to the situation.

According to McRobbie & Tobin (1997), learning environment research in most surveys focused on students' perceptions of their preferred classroom environment. They propose that "there exists a reality with absolute truths that can be communicated to other persons and that enquiry can determine and isolate variables of that reality which can then be used for prediction and control" (p.193). This means that in exploring a learning environment such as the mobile learning environment, there could be aspects of truth that arise. Through these known aspects, learning designers can 'predict' preferred classroom environment to be able to immerse the aspects in the learning design. Erickson (1989) supports this notion as "the immediate and local meanings of actions, as defined from the actors' points of view" (p.119). This indicates that meanings and purposes are attached to activities by learners, thereby known aspects will arise. As will be demonstrated in Chapter 4, Section 4.6.1, this understanding is the basis for a mobile readiness questionnaire which was implemented as one of the methods of data collection. Other methods will also be discussed in Chapter 4.

An interpretive researcher needs to understand that exploring a context generates multiple meanings. As Gage (1989) proposed "the effects on people's actions of their interpretations of their world create the possibility that people may differ in their responses to the same or similar situations" (p.5). This means that the participant in a study might differ in opinion from another participant as his/her perspective is not similar, even though they are both placed in the same environment. In this scenario, the researcher needs to discover the multiple meanings represented by the research participants' thoughts and actions. Vrasidas (2001) recognise this need when he stated, "interpretive enquiry attempts to understand the multiple layers of meaning represented by human actions and how they are interpreted by those involved" (p.5).

Erickson (1986) posits that participants take "action towards objects that surround them in the light of their interpretations of meaning-fullness" (p.25). They take action in accordance to the meaning being interpreted by them. Meanwhile, Howe (1998) describes human beings as self-creating in which they actively shape and re-shape their meanings to their actions. This, according Klein & Myers (1999) means that the researcher needs "to 'read' the social world behind the words of the actors, a social world that is characterized by power

structures, vested interests, and limited resources to meet the goals of various actors who construct and enact this social world” (p.78). Therefore an interpretive researcher needs to understand the research data not only on the surface level but in-depth in line with the context. The participants are part of the context to derive the multiple meanings of the study. Human action has meanings and must be understood in the context of social practice.

Interpretivist enquiry also allows for the researcher to gain insights into a phenomenon by being involved in the research process. Findings are based on interaction between the researcher and the participants, hence meaning is a joint creation between both (Greene, 1992). This means that reality is socially constructed between those involved in the research. We also need to be aware that in interacting with those in the study there may be room to alter the perspectives of both the researcher and the participants. Since the researcher interacts with the research participants during the enquiry process this may change the perspectives of both parties (Walsham, 1995).

Oates (2006, pp.292-293) proposes a set of characteristics of interpretive paradigm research which are outlined in the following table in order to map the relations of the characteristics to this research.

Table 7: Characteristics Adapted from Oates (2006) of Interpretive Paradigm Research for This Study

Oates (2006) interpretive characteristics	Further explanation of Oates (2006) interpretive research characteristics	Interpretation of Oates (2006) interpretive research characteristics of this study
Multiple subjective realities as there is no single truth	Realities of knowledge are constructed socially by the individual. Different cultures are perceived differently in different situations. There must be allowances for different interpretations of a situation. Therefore contextual understanding is essential in research.	<p>Different perspectives were taken from 2 different student cohorts. All perspectives and understandings were considered for analysis in this study.</p> <p>Context is presented in Chapter 2 of the thesis on learning environment and learners, and specifically in Section 4.8 pertaining to the participants.</p> <p>The literature review in Chapter 2 attempts to provide different views of the content discussed.</p>

		<p>The design of learning activities is based firstly on the various opinions from the literature review, and then based on the understandings from participants in the research. Hence, different views are considered.</p>
Dynamic and socially constructed meaning	Shared meaning (language) differs across groups and time.	<p>The two different cohorts of the study indicate across groups and time. The cohorts were from the same background but 1 year apart from each other. Mobile learning activities that were designed were constructed through the voices of the participants.</p> <p>Different meanings were extracted within the same cohorts as all voices were heard through the questionnaire and the reflective blog posts in order to generate the research findings.</p>
Researcher flexibility	<p>Researchers have assumptions, beliefs and values which affect how the phenomenon is viewed. These influence meaning, understanding and practices.</p>	<p>The intention and background of my research are declared in Section 1.3.1 in the thesis.</p> <p>My reflection is also presented in the design process of the mobile learning activities in Chapter 4 and also the discussion of the findings (Chapter 7).</p>
Study of people in their natural settings	Since it is aimed at understanding the world the contexts need to be discussed.	<p>The study is situated in a classroom environment and not in a laboratory. The natural situation of the students plays an essential part in influencing the design of learning activities.</p> <p>The tool chosen is the participant's own mobile phone in order that the usage of a personal device takes place in authentic contexts. The mobile phone being ubiquitous 'follows' the students in their environment.</p>
Multiple interpretations	Different voices of the	The participants of the study represent education faculty students who come from

offer different understandings of each phenomenon	participants.	different ethnic groups from different parts of the country. Data collected from different participants are heard through multiple methods. The different methods provide different views of the participants.
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The explanations in Table 7 are provided to satisfy the criteria for interpretive study established by Oates (2006). It is also intended to satisfy the three criteria for interpretive studies, stipulated by Orlikowski & Baroudi (1991), which are: the phenomena are examined from the participants' perspective; the phenomenon is analysed within a contextual perspective; and that the results are nondeterministic. The final criterion indicates that the result of an interpretive research cannot be conclusive.

In interpretive research, as there are multiple meanings it is not possible to reach one truth. Vrasidas (2001) states that "an interpretivist researcher can never get to the one complete "truth" and obtain a complete understanding of the setting she is studying" (p.7) as there are multiple truths. This means that it is not possible to generalise in an interpretive study, however according to Williams (2000) generalisation is unavoidable but is nevertheless limited.

Generalisation can happen as explained by O'Donoghue (2007), "interpretative studies undertaken with small populations may be in harmony with the reader's experience and thus a natural basis for generalisation" (p.65). This means that the reader of the research is able to relate and reflect on their own situation and this is called "user or reader generalisability" (O'Donoghue, 2007, p.66). This is one type of generalisation that is possible in an interpretive study.

Another type of generalisation possible in an interpretive study is as Williams (2000) describes 'moderatum generalisations' for interpretive research, which are cultural consistencies and it is this consistency that makes social life possible. This type of generalisation is "what it is that the researcher wants to understand, and of course if she can understand them then she will know something of the cultural consistency within which they reside and is then able to make her own generalisations about that cultural consistency" (p.220). This means the generalisations generated from the interpretive researcher are

produced through cultural insights. Walsham (1995) notes that generalisation is possible as it takes on the forms of concepts to specific implications or rich insights. Williams (2000) adds that “The cultural consistency that led to the moderatum generalisations is some kind of guarantee that the operationalisation represents the reality of those for whom it is inclined” (p.222). This means that cultural consistency leads to moderatum generalisations for the interpretive researcher. The argument that generalisations can be derived from interpretive research findings could possibly be applied to this research because a list of feasible mobile learning activities could be elicited through the research process.

A research paradigm serves as the foundation of a research study and the role of a theory in research is “as an initial guide to design and data collection, as part of an iterative process of data collection and analysis, or a final product of the research” (Walsham, 2006, p.324). The choice of theory is subjective, as the interpretive researcher will need to find insights of the theory. The next section presents the theory for this study which is based on Walsham’s (1995) assertion that “interpretive methods of research adopt the position that our knowledge of reality is a social construction by human actors” (p.376).

3.3 Theoretical Framework – Social Constructivism

To study something historically means to study it in the process of change; that is the dialectical method’s basic demand. To encompass in research the process of a given thing’s development in all its phases and changes – from birth to death – fundamentally means to discover its nature, its essence for “it is only in the movement that a body shows what it is”. Thus, the historical (that is in the broadest sense of history) study of behaviour is not an auxiliary aspect of theoretical study, but rather forms its very base (Vygotsky, 1978, pp.64-65).

Social constructivism is associated with the works of Lev Vygotsky (1896-1934). The excerpt above, taken from his book ‘Mind in Society’ highlights that the process of enquiry is essential in research into learning and development. It is proposed that through the process of enquiry, we understand nature better and through that understand human phenomena. John-Steiner & Mahn (1996) explain this factor as research is to “unite separate functions into new combinations and complexes” (p.194) which indicates that through the process of enquiry could arise new understanding. Vygotsky (1978) asserts that the process of enquiry

is a “scientific explanation of both external manifestations and the process under study” (p.63). This suggests that the process of enquiry is highlighted in the theory of social constructivism.

This section serves to provide an understanding of social constructivism in research and learning in order to provide the foundation of this research. One fundamental factor of social constructivism is its holistic approach. Vygotsky emphasises the need for a holistic approach to research when he used ‘the chemicals in the water metaphor’ (Vygotsky, 1987). Research entities cannot be separated to be studied as the whole meaning will be lost. This approach is taken by this study because the focus is on the holistic approach of mobile learning activities via mobile phone applications. There is no concentration on a single activity or a single mobile phone application, but instead of a multitude of activities and applications selected based on the students' preferences. This generates a more comprehensive understanding of the implementation aspects of mobile learning to support HE students in Malaysia, which addresses the aims of this research.

Vygotsky (1978) concludes, through his observation of children and problem solving, that “the most significant moment in the course of intellectual development, which gives birth to the purely human forms of practical and abstract intelligence, occurs when speech and practical activity, two previously completely independent lines of development, converge” (p.24). When combined, thought and action can transform the process of learning and based on this idea, Palincsar (1998) suggests the use of activities as a unit of analysis in research. This was based on the fact that it is not possible to separate “social, motivational, emotional, and identity processes, and the study of generalization is the study of processes rather than the study of personal or situational attributes” (Palincsar, 1998, p.354). Therefore divorcing the individual from their context and social influences is not deemed possible, hence mobile learning activities are studied within the context of the research, a Malaysian HEI course in which research participants take part. After all, learning takes place through the active engagement of the learner through these activities. One common overarching feature of using activities as a unit of analysis is as discussed by Jonassen (1999) and Carnell & Lodge (2002) which is meaning making. The act of meaning making is derived naturally and embedded in activities within a context. Thus, the focus of this research is on mobile learning activities as a form of meaning making in the context of a Malaysian HEI.

Learning and development are processes experienced by the learner within the external, natural world and along with other people, and through these processes, new conditions arise for both the learner and his/her nature as stated in Vygotsky's (1978) explanation below:

The dialectical approach, while admitting the influence of nature on man, asserts that man, affects nature and creates through his changes in nature new natural conditions for his existence. This position is the keystone of our approach to the study and interpretation of man's higher psychological functions and serves as the basis for the new methods of experimentation and analysis we advocate (pp.60-61)

The dialectical approach in Vygotsky's perspective is the "notion of synthesis to analyse a central psychological too-verbal thought" (John-Steiner & Mahn, 1996, p.195). Vygotsky (1978) examined mind and matter in an interconnected way, as he believes that developmental process is in constant dialectical change from higher mental functions. Hence, the application of the dialectical method is to the genesis of thought and language in the development of the individual human being. Through his work, Vygotsky uses the "dialectical method to analyse, explain, and describe interrelationships fundamental to human development" (John-Steiner & Mahn, 1996, p.195).

Besides understanding the social constructivism perspective on research, it is also deemed important for this study to understand the theory's perspective in learning. Learning in the perspective of social constructivism is a social activity as the learner interacts with others and also with the environment around them (Jonassen, 1999). This means that meaning and understanding are derived from social encounters within the student's context. Blanck (1990) describes this as mental activity that results from "social learning, of the interiorization of social signs, and of the internalization of culture and of social relationships" (p.44). This indicates that learning is a mental activity that occurs through negotiation of meaning with others within a given context. McRobbie & Tobin (1997) expand on this further by stating that social constructivism recognises the importance of social and personal aspects of learning. In the personal sense, meaning is constructed by individuals as new information interacts with their extant knowledge. Although it is acknowledged that there is a reality, learning is personal and subjective and only exists in the minds of the learners. However, learning does not happen only in the mind of learners because while knowledge is personally constructed, the constructed knowledge is socially

mediated as a result of cultural experiences and interaction with others in that culture (McRobbie & Tobin, 1997; and von Glaserfeld, 1993). This suggests that the learning process happens when there is interaction in a social context.

Van de Veer (2007) further points out that Vygotsky's theory centralized the fact that that "in order to understand the inner mental processes of human beings, we must look at human beings in their sociocultural context" (p.21). The respective learner and his or her environment cannot be separated from learning that takes place. According to Palincsar (1998), "Social constructivist perspectives focus on the interdependence of social and individual process in the co-construction of knowledge" (p.345). This means that through the lens of social constructivism, learning is perceived as a process of socially constructed activities within a context. It can be concluded that sociocultural context is essential to one's learning process; therefore a learning designer needs to create learning activities to support the learner's learning process within their environment.

In addition Vygotsky (1978) also emphasises culture and society in his argument in that all higher mental constructions are social in origin and are embedded in the context of the sociocultural setting of the learning environment. Apparently Vygotsky's translation of culture is that it is the essence which permeates social processes and which provides the foundation for the materialization of the learner's mental process (Wertsch & Tulviste, 1992). In this research the HE students' backgrounds and their relationships with the mobile phone are considered as part of the design of the research process. Understanding 'cultural' experience and social relationships using the mobile phones can add to the understanding of the learners' acceptance of mobile learning activities designed to support their studies.

Vygotsky (1978) also recognises that the learner and their environment cannot be separated, and that environment also depends on the learner. Van der Veer (2007) explains that "for human beings it is difficult to define the environment if only because human beings attach meaning to aspects of their environment and because this environment is partly a social environment that changes in responses to the person's actions, capacities, age and so on" (p.23). Context prevails in the process of learning.

Another key factor in the social constructivist learning process is mediation. Mediation is to bring about agreement of the intervention process through technical tools or artefacts which in this study is the mobile phone. Mediation facilitates the activity of learning. In terms of

Vygotsky's position in relation to the mediation of tools or artefacts as part of research, he points out that "we need to concentrate not on the product of development but on the process by which higher forms are established" (Vygotsky, 1978, p.64). This indicates that the mediation process needs to be focused on (and not only the end result) and he later explained that the higher forms of mental construction are developed through these mediated processes. Wertsch (1990) suggests that mediation processes do more than simply facilitate a learning activity but are also "products of the sociocultural milieu in which they exist" (p.114). This means mediation is viewed as fundamentally shaping and defining activity. This mediation was a central consideration in the study's research design. Through the mediation process mobile learning activities are shaped and defined in order to meet the aim of the study. It could safely be said that the activities in mobile learning processes are also the products of mobile learning activities.

The central tenet of social constructivism is that human action is mediated by tools or artefacts in the form of cultural tools such as a language (Vygotsky, 1978). Bruner (1962) in the preface to Vygotsky's book "Thoughts and Language" (1962) describes mediation as defined by Vygotsky as:

He believed that in mastering nature we master ourselves. For it is the internalization of overt action that makes thought, and particularly the internalization of external dialogue that brings the powerful tool of language to bear on the stream of thought. Man, if you will, is shaped by the tools and instruments that he comes to use, and neither the mind nor the hand alone can amount to much....And if neither hand nor intellect alone prevails, the tools and aids that do are the developing streams of internalized language and conceptual thought that sometimes run parallel and sometimes merge, each affecting the other (p.vii)

John-Steiner & Mahn (1996) state that tools are not used in isolation; rather they are produced socially and culturally, such that learners actively engage in activities with them. These cultural tools carry out a mediation function which stimulates mental processes and thereby bring about higher mental processes (Wertsch, 2007). It would seem that the "prime function of the tools was to shape minds and tools were in turn shaped by the minds that worked on and with them" (Edwards, 2007, p.94). This means that tools are used to facilitate

further construction of knowledge. It is proposed that human action through the mediation role of tools has the potential to change the structure of learning activity (Vygotsky, 1981).

Tools, which can be technological tools, can help individuals to construct knowledge in authentic ways (Jonassen, 1990). Technology is perceived not only as a 'product' but as a system which one learns and also a managed 'process' which channels and captures learning flow (Jonassen, 1990). Using these tools, students have the opportunity to explore a variety of viewpoints and obtain different kinds of information related to their learning for example through social mediation being mediated by technological tools such as the mobile phone (Cook, Pachler & Bradley, 2008). The mediation process also entails that interaction between contexts is stimulated through organized learning activities using these tools, which also impact individual competence. It has been established that for social constructivists meaningful learning emerges when learners are engaged in social activities which are mediated by these tools (Palincsar, 1998). Thus by using these technological tools, in this research the mobile phone, the mediation process through activities, namely mobile learning activities, can be said to facilitate the co-construction of knowledge.

Learning is an 'inter-mental process', and as well as social and cultural one (Vygotsky, 1962). In his book 'Mind in Society', Vygotsky (1978) explains the concept of inter-mental. He posits that "every function in the child's cultural development appears twice: first on the social level, and later on the individual level; first between people (interpsychological) and then inside the child (intrapsychological)" (Vygotsky, 1978, p.57). Inter-mental process means that development is both individual and social at the same time in the process of development. It seems that learning is first developed socially (interpsychologically) which is then extended into intrapsychologically within the individual for higher order processes (Wertsch, 1979 and Blanck, 1990). In designing the research process for this study these concepts are taken into consideration. This means that understanding derives from the collective views of learners in their context and also their individual perspectives, as indicated by Palincsar (1998), who states that social constructivism focuses on the "interdependence of social and individual process in the co-construction of knowledge" (p.345). In other words, what students experience socially by interacting with their context outside them will create meaning and understanding inside them, and this will influence the design of mobile learning activities in this study. The simplistic notions of 'inside' and 'outside' are interdependent as illustrated by Cole & Wertsch (1996), "social processes give

rise to individual processes and that both are essentially mediated by artefacts” (p.253). This means that human thoughts develop from social to the individual.

There are some criticisms of social constructivist theory as portrayed by Davydov. Davydov’s speech on Vygotsky’s influence on educational research (translated by Kerr) argues that there are some aspects of the theory that are not fully developed, because Vygotsky died at a young age (Davydov & Kerr, 1995). For example, Winner (1993) argues that due to the emphasis on socially constructed technologies research might miss the dynamics beyond the theory such as social class. If there are missing dynamics in social constructivism, then the theory cannot be depicted as a holistic theory as described earlier. Winner (1993) advocates examination of dynamics such as patterns for quality of life in a technological society, discussing social and moral choices further and evaluating life patterns as a whole. However, John-Steiner & Mahn (1996) argue that although construction of meaning is based on social interaction, the process is not limited to only this action. Wertsch & Tulviste (1992) present their key reflections on Vygotsky’s work; they acknowledge that there are aspects, such as ‘natural line development’, in Vygotsky’s work that need further deliberation. Published peer-review journals or discussions in conferences may address these issues as social constructivism gains more interest in research.

In this section, social constructivism as the process of enquiry is discussed. The understanding of the learning process based on social constructivism is also explored. LeCompte & Preissle (1993) state that the “purpose of theories is to help us sort out our world, make sense of it, guide how we behave in it, and predict what might happen next” (p.120). This is also supported by Bednar et al. (1991) as they emphasise the importance of linking theory to practice in the design of interventions as “effective design is possible only if the developer has a reflexive awareness of the theoretical basis underlying the design” (p.90). The challenge is for researchers to identify critical aspects of learning theory to translate them into pedagogical elements which can be designed into the intervention. This could be done by aligning and mapping social constructivist theory to be adaptable for learning design (Biggs, 2002). Mayes & de Freitas (2004) propose that as part of the design process, learning theory needs to be ‘unpacked’ to create a pedagogical approach. In this research this pedagogical approach comes in the form of learning principles to guide the design of mobile learning environment. This means I need to take the underlying assumptions of a theory in general and translate them into an appropriate design for learning.

The next sections aims to provide discussion about how social constructivist theory has been ‘unpacked’ in order to produce pedagogical learning principles which form the basis of the design for mobile learning activities. In the next section, the suitability of the theory and mobile learning are highlighted.

3.4 Social Constructivism and Mobile Learning Activities

Mobile learning is complex and as such there are many aspects that a researcher and learning designer need to consider in designing in such a versatile and portable environment. As stated by Naismith et al. (2004), the “challenge for the educators and technology developers of the future will be to find a way to ensure that this new learning is highly situated, personal, collaborative and long term; in other words, truly learner-centred learning” (p.36). There are learning values that appeal to both students and teachers in the mobile learning environment, for example, to enrich collaboration practices and also to individualise feedback (Rochelle, 2003). Besides understanding the learning opportunities of different features of mobile phones that could be made available for students (discussed in Section 2.5.2), the design of mobile learning activities to accompany an HEI course should also be based on a strong theoretical learning foundation as proposed by the Outline of Learning Activity (Diagram 4). O’Malley et al. (2005) and Sharples, Taylor & Vavoula (2005) stress the importance of contemplating the mobile learning environment through a consolidated theory that positions the students at the centre stage of the learning design.

The social constructivist approach and mobile learning fit well together. Mobile learning is a student-centred activity; yet it also promotes social connection as in the discussion of mobile learning characteristics in Section 2.5.1 in Chapter 2. Kukulska-Hulme et al. (2009) acknowledge that “inherent characteristics of mobile technologies are particularly well suited to support learning rooted in social, constructivist, contextual and collaborative principles” (p.16). Another reason for using the theory of social constructivism to study mobile learning is that it provides a space for dialectical process as learners are being engaged in a learning task, for example, discussion amongst their peers in a real-world context (Shih & Mills, 2007). Mobile learning also empowers user-led learning. This means that learners create their own content and collaborate with their peers beyond the classroom (Cobcroft et al., 2006). The continuous building and extending of learners’ meaning through

a flexible tool such as the mobile phone is thought to be able to assist learners to construct meaning within their daily context.

Vygotsky (1978) states that the nature of learning is such that social environment plays a major role in the learner's learning development, and he identified this environment as a higher order process. This is because learning does not take place in a vacuum, but rather learners together contribute to concepts, ideas and skills. Wilson (1996) describes this social learning environment as a space where "learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem solving activities" (p.5). Social constructivist learning needs to have space to promote discussion, collaboration, or arguments for interaction to take place as part of the learning process within a social environment. This space cannot only be within the limited four walls of the classroom, but it must also go beyond it, and mobile learning may offer such an environment.

Social constructivist approach also focuses on the learning process which occurs through learners' experiences. Knowledge is not fixed or external and that understanding is derived through social experience (Hannafin & Land, 1997). Von Glaserfeld (1989) asserts that students construct their learning based on their experiences, and tools are used to assist students to connect their experiences. The link between making meaning with the assistance of tools, such as the mobile phone, is a learning activity. Students are encouraged to participate in learning activities that allow them to create an external structure that reflects their internal conceptualization of the topic. As Koole (2009) proposes, mobile technologies support learners' learning both individually and collectively. This is based on Vygotsky's (1978) concept of interpsychological and intrapsychological discussed in the earlier section.

Context is an essential aspect of the learning experience in the social constructivist learning environment. Kukulska-Hulme et al. (2009) also emphasise this in the mobile learning environment by stating, "Context has been identified as a central construct in mobile learning developments, guiding projects to use mobile technologies to help connect learning across contexts and life transitions, and to form bridges between formal and informal learning" (p.16). According to Hannafin & Land (1997), social constructivism is described as being "focused on the relationship between context and knowledge, emphasizing the socially-mediated aspects of learning" (p.173). This is further explained by Brown, Collins

& Duguid (1989) who state that learning is located between contexts and relationships rather than passively in the mind of the learner. It is a joint activity that is tied to social practices and is mediated by tools. Learners are believed to inhabit a social and cultural environment, and now there is a technological aspect too. They construct their learning within this environment by the process of making meaning within it (Brown, Collins & Duguid, 1989). This process of meaning making takes place when there are opportunities to construct learning through activities in a natural context. Learning activities are those created to provide an environment to construct meaning and support learning, which is the focus of this research.

Learning activities serve as catalysts for construction of respective individual meanings within a social context. McRobbie & Tobin (1997) suggest that a “social constructivist perspective on learning highlights the role of active involvement in tasks associated with making connections between experience and extant knowledge” (p.197). One way to make this connection is to use HE students’ daily context in the design of learning activities particularly if we want to reach students before or after the classroom face-to-face sessions. The context forms the basis of students’ involvement and engagement of their learning (McRobbie & Tobin, 1997). In the beginning of this research, we suspected that Malaysian HE students had mobile phones and used them regularly in daily life. Therefore, in this research, before we set students to engage in mobile learning activities (tasks), we need to understand their familiarity with mobile phone applications (extant knowledge) in order to get them connected with the experience of the engagement with mobile learning activities. Oliver et al. (2002) stress the descriptive elements of constructivist learning settings, and as explained by Cunningham, Duffy & Knuth (1993), these could assist learning designers in understanding the forms of learning activity needed.

Pinch & Bijker (1984) posit that the social constructivist perspective on ICT could be useful in evaluating the relationship between the technology and how it is being used in a social context. They propose a multi-directional view of the use of ICT in learning which forms part of the process of technology development. These stages are: (1) interpretative flexibility, which means that people adjust how they think and use tools and how they use these tools daily; (2) relevant social group: a group that share needs and expectations comes to a consensus on a tool being selected as it works for that particular group; (3) closure and stabilisation as the social groups achieve familiarity of use; and (4) wider context, i.e. the

socio-cultural and political context in which technology implementation is taking place. These stages are part of a mobile learning initiative to promote the use of mobile phones as a tool to support HE students' learning.

As justified earlier, there is a need to 'unpack' social constructivism as a theory in order to translate it further into pedagogical guidelines that could assist in the design of mobile learning activities. This section has argued the suitability of mobile learning to the nature of social constructivism; the next few sections illustrates further how the theory is interpreted to produce pedagogical guidelines suitable for the design of mobile learning activities.

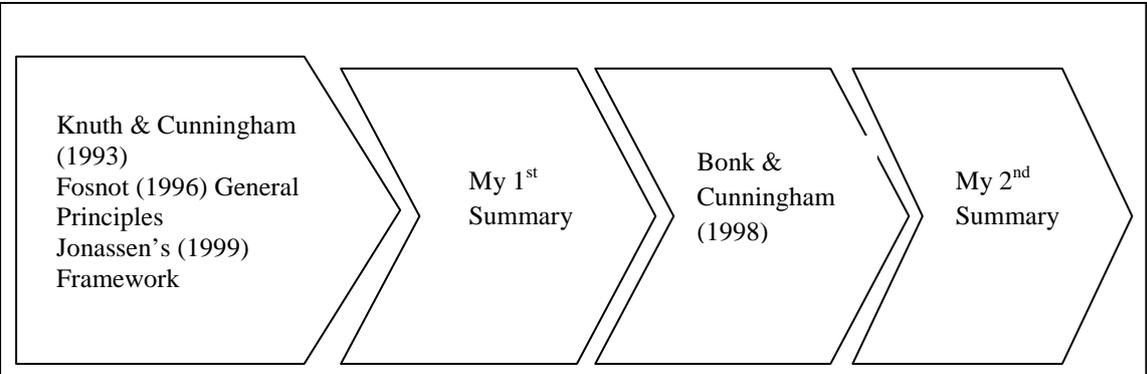
3.5 Social Constructivist Learning Principles

The educational aim of social constructivism is to create a learning environment that encourages students to construct understanding (Brown, Collins & Duguid, 1989). Conole et al. (2004) suggest aligning the learning theory with learning practice. This is done through the outline of the theory's features to produce a guide between theory and practice more explicitly. In order to develop a sound design for mobile learning activities, other works on constructivist learning environment attributes were considered. The main reason for this was to translate the design of mobile learning activities through the lens of social constructivism, in which the role of theory plays a central part in generating designs that are relevant to the learner. This was also part of the outline of learning activity as proposed by Beetham (2007) presented in Diagram 4 in Chapter 2. There were four elements of this; three (learning environment, learners, and tools) were discussed in Chapter 2, while the fourth, theoretical principles, is discussed in this chapter.

Social constructivism as a theory of knowledge development has a long history. Duffy & Cunningham, (1996) and Fox (1997) argue on the wide range of sub-theories which fall under the scope of constructivism such as radical constructivism and social constructivism. This means that social constructivism falls under constructivism as a theory. In order for me to develop social constructivist learning principles, I first reviewed the principles of learning environments. As shown in Table 8, I have reviewed Jonassen's (1999) framework for designing a constructivist learning environment, Fosnot's (1996) general principles of constructivist learning environments and, Knuth & Cunningham's (1993) pedagogical goals for constructivist learning environments in the light of potential use for this study. Whilst

described as constructivist these authors actually include social constructivist principles such as dialogue, co-operation and collaboration. In the right-hand column I summarised the overlapping attributes from the three different frameworks to derive a comprehensive list of learning principles that underpin social constructivist. I then compared and contrasted this summary with the Bonk & Cunningham (1998, p.34) list of attributes for social constructivist learning environment. This process enabled me to derive the following list of social constructivist learning principles suitable for mobile learning activities which was to be designed and developed for this study. This process is summarised through the following diagram.

Diagram 6: Summary Process Social Constructivist Learning Principles



Knuth & Cunningham (1993) Pedagogical Goals (*)	Fosnot (1996) General Principles	Jonassen's (1999) Framework	MY Summary
Provide experience of knowledge construction process : Students take on responsibility for strategies & methods	Learning proceeds towards the development of structures : Upon meaning making students progress to shifts in principles (self-organization) that are generalized across experience.	Constructive articulation and reflection : Upon observation, learners will need to articulate their reflections in order to build them into their existing mental models.	Learning activity that is student centred allows students to take ownership of their own learning
Provide experience of multiple perspectives : Students engage in activities to enable them to evaluate alternative solutions to problems			Learning activity that provides multiple points of view from the use of various resources
Embed learning in realistic & relevant contexts : Students need to equate learning & connect to respective situations	Disequilibrium facilitates learning : There is a need for students to explore and generate possibilities to either affirm or contradict their investigations in a meaningful context.	Authenticity in complex and contextual situation : learning tasks need to be situated within the natural real-world context.	Learning activity situated in a context
Encourage ownership & voice in the learning process: Students determine issues & directions	Learning is not the result of development : The process of learning that requires students to raise questions and generate their own opinions is part of learning.	Active manipulation and observation : learners' engagement in meaningful tasks and observation of the outcome of their manipulations	Learning activity that permits students engagement
Embed learning in social experience : Students' understanding is influenced by social interactions which is reflected through collaborations	Dialogue within a community engenders further thinking : Student-centred discussions to defend, prove, justify and communicate ideas in their community in order to raise to the level of shared meaning	Cooperation through conversation and collaboration : Collaboration through tasks is another way of learning. This achieved through conversations between learners' as part of a knowledge-building community.	Learning activity that promotes collaboration
Encourage the use of multiple modes of representation : Students need to be exposed to various communication mechanism			Learning activity that accords for multiple media
Encourage self-awareness of the knowledge construction process : Students' ability to explain why & how they know (metacognition)	Reflective abstraction is the driving force of learning : There should be a form of reflection such as journal writing, representation, in multisymbolic form, and discussion of strategies.	Intentional reflection and regulatory for learning : As asserted, "technologies need to engage the learners in articulating what their learning goals are in any learning situation, and then support them" (p.9). If learners know their goals and reflect the process of achieving them, they are better able to construct new knowledge.	Learning activity that recognizes reflection process of the learner

(*) Knuth & Cunningham (1993) Pedagogical goals were further discussed by Honebein (1996)

Table 8: First Summary of Social Constructivist Learning Principles

In Table 8, similar attributes were aligned across the three frameworks. For example, Knuth & Cunningham (1993) in the knowledge construction attribute recognise that students need to take responsibility for their learning, while Fosnot (1996) believes that in the development of learning structures students self-organize and Jonassen (1999) urges students to build their own mental models through their reflections. Hence, these attributes were summarised and defined as the need for students to take ownership of their own learning. This was done in a similar way for all attributes, which were categorised through their similar themes and then summarised in a list.

After producing the first summary, Bonk & Cunningham's (1998, p.34) social constructivist learning attributes were also reviewed as they could be applied to teaching practices. This was because a comprehensive set of social constructivist principles could be derived to develop a mobile learning activities for this study. These attributes consist:

- Mind: Mind is located in a social interaction setting and emerges as a result of acculturation into an established community of practice.
- Authentic problems: Learning environments should reflect real-world problems in order for students to develop interests, deeper knowledge and skills.
- Team choice and interest: Group learning activities will be meaningful in both process and product orientation if built on common interests or experience.
- Social dialogue and elaboration: Activities should be multi-solution in order to promote student-student and student-lecturer dialogue. Activities should also promote idea sharing and conversations from different perspectives.
- Group processing and reflection: Besides individual students' reflections, there should also be group processing of experiences as part of learning activities.
- Lecturer's explanations, support and demonstration: The facilitator is expected to provide explanations, elaboration and clarifications when requested.
- Multiple viewpoints: Providing different types of example, explanation and materials.

- Collaboration and negotiation: Promotes negotiation of meaning, building of agreement, discussion of conflicts and general social interaction.
- Learning communities: Provision for joint responsibilities for learning amongst students to foster ownership of their learning. Technology can be used to facilitate idea generation and knowledge-building within this community of peers.
- Assessment: Focus on team and individual participation in socially organized practices and interactions. The assessment is based on authentic, real-world problems. Assessment is cumulative, less formal, subjective, collaborative and continual.

Of the ten attributes, ‘mind’ was not included in the list for comparison as it is believed that this attribute has already slipped into the essence of this research through the embracement of social constructivism theory. As discussed earlier, social constructivism posits that knowledge is socially and culturally constructed. The other attribute that was not considered in the comparison was the ‘assessment’ attribute, because evaluation was not designed into the mobile learning activities in this research. The learning activities in this research act solely as learning support. Thus, the second layer of comparison is presented in the following table:

Table 9: Second Summary of Social Constructivist Learning Principles

Bonk & Cunningham (1998) Social Constructivist Attributes	My 1st Summary	My 2nd Summary
	Learning activity that is student centred allows students to take ownership of their own learning	
<ul style="list-style-type: none"> • Lecturer explanation, support & demonstration • Multiple viewpoints 	Learning activity that provides multiple points of view from the use of various resources	Multiple-Perspective Learning Principle
	Learning activity that accords for use of multiple media	
Authentic problems	Learning activity situated in a context	Contextual Learning Principle
	Learning activity that permits	

	students' engagement	
<ul style="list-style-type: none"> • Team choice & interest • Social dialogue & elaboration • Collaboration & negotiation 	Learning activity that promotes collaboration	Collaborative Learning Principle
Process & reflection	Learning activity that enable reflection process	Reflective Learning Principle

In summary, learning activities, if they are to be designed to support HE students' learning in a way that is founded on social constructivist learning principles, should provide multiple points of view from the use of various resources, be situated in context, permit students' engagement in the process and enable reflection, promote dialogue amongst lecturers and peers, emphasise collaboration and recognize reflection in learning. Therefore there are four main categories of mobile learning activity that are aligned with social constructivist learning principles and could be designed and implemented for HE students. These four categories are contextual learning principle, reflective learning principle, collaborative learning principle and multiple-perspectives learning principle. These categories served as a theoretical foundation to design mobile learning activities. However the detailed learning designs were based on many other factors such as students' choice of applications on their mobile phones. The design of these activities is further explained in the design process of mobile learning activities in Chapter 4. Nevertheless, the recommended social constructivist learning principles are explained respectively in the following sections.

3.5.1 Contextual Learning Principle

As discussed in Section 3.3, knowledge construction is socially mediated through technological tools i.e. the mobile phone in this research. The mobile phone allows for interaction with others in a context as discussed in Section 2.5 of the literature review. According to McRobbie & Tobin (1997) there are "multiple

ways in which individuals may construct their meaning from a given context” (p.194). As an educator there is a need to take advantage of students’ multiple contexts in order to ensure that learning takes place over and beyond their weekly 3-hour face-to-face classroom contact. Duffy & Jonassen (1992) suggest that learning activities “should provide contexts and assistance that will aid the individual in making sense of the environment as it is encountered” (p.5). This means that there could be activities designed to exploit students’ multiple contexts. For example, since the target participants are trainee teachers, they could be asked to collect pictures and videos through their mobile phones and to upload them to a virtual repository for a teaching aid bank.

Edelson (2001) postulates that when “learning takes place, the connections that can be constructed for subsequent retrieval of the new (or newly elaborated) knowledge structures depend on the context in which the learning takes place. These connections may be elaborated later, whenever the knowledge structures become reactivated” (p.357). This process of creating and elaborating is a critical part of the learning process. The implication is that the learning context can support the learner in making meaning from knowledge structures which is also supported by Jonassen (1994) when he states, “Knowledge construction is context-specific” (p.37). Context of use also needs to be considered as part of the design of mobile learning activities because this provides unique opportunities to make learning make more sense to learners (Kukulska-Hulme, Traxler & Pettit, 2007). Muyinda (2007) further adds to this by describing mobile phones as “well suited to context-aware applications simply because they are available in different contexts, and so can draw on those contexts to enhance the learning activity” (p.99).

Furthermore Luckin et al. (2005) describe the learner’s context as “a situation defined through social interactions that are themselves historically situated and culturally idiosyncratic” (pp.4-5). They propose that getting the design of learning contextually right could lead to better learning experiences for learners. They suggest that a context is no longer “a snapshot of elements interacting within a situation” (p.5), but has further developed into a dynamic historical sense of the interactions and also the relationships within the given situation

(Luckin et al., 2005). This creates social contexts that build on past interactions and build on new activities, as stressed by Vygotsky (1978). Chen et al. (1999) describe this form of context as being culturally sensitive.

Contextual activities could also offer authentic learning. Authentic learning may support “new ways of combining the real worlds with digitally re-presented information (Ryu & Parsons, 2009). In other words, by linking learning activities to contextually relevant or associated information in the form of digital representations, where learners can experience phenomena and explore concepts and relationships through combined physical and digital artefacts” (Ryu & Parsons, 2009, p.6). Traxler (2009) describes authentic learning simply as “learning that involves real-world problems and projects that are relevant and interesting to the learner” (p.18). Authentic learning activities are those where learners bring their representations of the real-world into their formal learning, such as data they have collected in fieldwork. It seems that authentic learning brings about realistic and meaningful learning activities which enhance students’ learning.

Another element of contextual activities is that they need to create the possibility of learning that is situated. According to Ryu & Parsons (2009) “learning needs to be presented in an authentic context, that is, settings and applications that would normally involve knowledge” (p.6), while Traxler (2009) defines situated learning as “learning that takes place in the course of activity, in appropriate and meaningful contexts” (p.18). This means that contextual activities can offer situated learning whereby learning is empowered with a sense of immediacy and a context specific element.

Therefore we understand that for learning to occur multiple contexts need to be utilised within the design, along with the need to base it in the cultural setting of the Malaysian HE students. Mobile learning could possibly engage learners across various contexts as it can support learning activities across time and space. This means there is an opportunity to link the learning experience of learners across multiple contexts (Luckin et al., 2005). A context for learning should also be authentic and situated in order to support knowledge construction. There can be overlap between situated and authentic learning as both ensure that students

can access resources to support their understanding (Kukulska-Hulme, Traxler & Pettit, 2007). It is proposed that contextual learning activities could be designed for situated learning that takes into consideration the location of learners at the time of learning, and for authentic learning in which “real-world problems and projects are literally within reach of their mobile device” (Kukulska-Hulme, 2008, p.7).

Thus, in this study contextual learning principle is the learning activities that promote authentic and situated learning in the multiple contexts of the participants.

3.5.2 Reflective Learning Principle

Bednar et al. (1992) propose that “learning is a constructive process in which the learner is building an internal representation of knowledge, a personal interpretation of experience.” (p.30). This suggests that learning is an active process in which students construct meaning internally as part of the learning process. The evaluation of this process can be captured in the students’ reflective awareness of their own thinking, as this implies that students can monitor both the structure of knowledge development and also the process of constructing knowledge representation (Bednar et al., 1992). Furthermore, Dunlap & Grabinger (1996) suggest that successful students are able to analyse what they do in order to evaluate their learning. These students do this through the process of reflection.

Reflexivity in learning is awareness of knowledge construction (Cunningham, 1987). The process of reflection is about self-awareness of learning and it happens when “we experience or are shown a situation where our existing beliefs are inadequate, (so) our awareness of our own state of knowing is enhanced” (Duffy & Cunningham, 1997, p.181). Furthermore, reflection is the process of thinking which entails analysis and making judgment on what has happened in order to give new meaning to a situation or event (Dabbagh, 2005). According to Lin et al. (1999), “reflective thinking is an active, intentional, and purposeful process of exploration, discovery, and learning” (p.46) and reflective thinking

includes in understanding of the learners' own learning process. This process involves "experiencing understanding of oneself as a learner in variety of contexts; organizing, monitoring, and evaluating one's learning to derive a renewed state of understanding about one's performance" (Lin et al., 1999, p.46).

Hannafin & Land (1997) describe learning as a "dynamic process of 'reflection-in-action' where action is used to extend thinking and reflection is governed by the results of action" (p.170). This means there are actions and on-going thoughts about the concepts being learnt. The concept of reflection-in-action is also discussed by Schon (1983), who believes that reflection-in-action is a process of thought-based action, that is, thinking is not separate from doing but rather they complement each other. This means that reflection-in-action links a learner's action with his or her thoughts about the consequences or feedback associated with the action (Schon, 1983). This shows that reflection is part of the process of learning through actions or activities.

The aim of teaching HE students to reflect on their thinking processes is for them to increase awareness of their own learning, and to use that awareness to adapt their thinking to other contexts (Lin et al., 1999). It is believed a tool such as the mobile phone could assist in this process, for example through review, display, prompts or even modelling social interaction between student peers. Learning activities that encourage learners to evolve a richer understanding of their knowledge (Cunningham, 1987). This means inducing learners to become active in mental activities that enable them to reproduce thought processes or invoke greater introspection during learning.

Learning activities which could be suited to the mobile phone and which could be designed for reflection include activities that provide opportunities for learners to reflect on their knowledge and experiences, offering the opportunity to reorganise and restructure knowledge. One recommendation for promoting reflection is to prompt students to review what they have done then analyse achievements or compare it with those of their peers (Wilson & Cole, 1996). Honebein, Duffy & Fishman (1993) discuss the need to generate and evaluate alternative perspectives for content from the syllabus as "constructivist learning focuses on skills and strategies, rather than facts and rote memorization" (p.106).

This means there must be a space in the design of mobile learning activities, such as through the use of SMS, for students to discuss, argue, comment or support each others' opinions. The process of reflection can create structures to retrieve and reorganise understanding. It constitutes a refinement phase of the learning process which could be made part of the syllabus. An example of a mobile learning activity that allows reflection would be students gathering pictures and videos through mobile phones, after which the students are asked to reflect on the usefulness of the media to them. Students could also reflect by commenting on the choice of pictures or videos of their peers.

Another effective reflection activity is when a learner "revisits the evidence of their conclusions in order to assess their validity, identify the limitations of their understanding, and clarify its applicability" (Edelson, 2001, p.379). This is because reflection requires perspective, and fostering activities that encourages learners to communicate about their activities and understanding could elicit real reflection. Mobile learning can be a tool that supports reflection on activities that promote enquiry either through record-keeping during the enquiry to provide concrete products for reflection, or by supporting reflective communication (Edelson, 2001). Kukulska-Hulme, Traxler & Pettit (2007) and Traxler (2009) propose that mobile learning allows for learning designs that provide for spontaneous reflection and self-evaluation.

Reflective activities for this research are those that firstly allow students to review their own learning processes and secondly that support the process of analyzing and making judgements to create new meanings, based on others' perceptions.

3.5.3 Collaborative Learning Principle

Collaboration is the essence of a social constructivist learning environment. Wood et al. (1995) and Dunlap & Grabinger (1996) support collaborative activities as they argue that through working in groups, learners are able to refine their knowledge through argument, structured controversy and reciprocal learning, which create shared-meaning for the content. Learning is a

collaborative process, as learners not only learn from experts but also through their peers. Through interaction with their peers, learners are able to test ideas with each other and help each other in building or refining knowledge structures (Grabinger & Dunlap, 1996). This means that collaborative activities not only employ but can also encourage social negotiation.

Collaboration means working in groups to discuss or debate issues, and is also part of reporting, presenting findings, negotiating and defending knowledge acquired through learning environments (Oliver, Herrington & Omari, 1996). During collaboration or social negotiation, there appears to be a common aim to share viewpoints and ideas, and also to collaborate on problem-solving and knowledge-building (Duffy & Cunningham, 1996). A learning designer can form groups to provide variation in learning activities, share workloads, and also promote peer teaching. Dunlap & Grabinger (1996) further argue that collaborating in “peer groups help students refine their knowledge through argumentation, structured controversy and reciprocal teaching” (p.68).

Social interaction during the learning process encourages active knowledge construction. Social interaction provides mediated interpretations of experiences, while what is learned about the world depends upon communication within groups (Vygotsky, 1981). Young (2003) highlights the need to create a purposeful setting that allows interaction and communication, engaged and steered by the learners themselves. Through this connections can be formed, and these reflect learners’ shared learning goals. There is a need for learners to learn how to sustain mutual relationships which involve shared practices (Wenger, 1998) when they are engaged in doing things together, through collaboration with peers. This according to Dabbagh (2005) indicates that social negotiation is an integral component of collaboration. Learners are not only able to construct meaning through discussion, but they can also make meaning about how to be in a social context. For example, they might learn about taking turns in arguments, respecting various opinions and how to continuously maintain the flow of discussion.

Collaboration between students encourages interaction between two or more learners to maximize their own and each other’s learning (Dabbagh, 2005). This

indicates that the act of collaborating is not only to be embedded in learning, but also enhances respective individual's learning processes. Dabbagh (2005) categorises types of collaborative activities as follows: (1) joint construction of knowledge; (2) joint negotiation of alternatives through argumentation, debate, and other means; and (3) student reliance on both fellow students as well as teachers as learning resources (p.36). McRobbie & Tobin (1997) state that "from a social constructivist perspective, the development of understanding of writing and discussion of ideas with peers is an essential element in learning" (p.199). Using the mobile phone, 'writing' and 'discussion' can be designed which utilise mobile-enabled applications.

Learning is not static but a process of participation; therefore the learning process is more effective when learners converse with each other through sharing or questioning each other's description of the world. Students not only interact with their lecturers but also their peers. This interaction process can be internalised to form mental constructs which follows Vygotsky's (1978) interpsychological and intrapsychological concepts as discussed in Section 3.3. Therefore, to bring learners' discourse out of the classroom, the mobile phone is apt, because it can be used for immediate and impromptu discussions, which is discussed further in Section 2.5.1 on the characteristics of mobile learning.

In this research, collaborative activities are defined as those which encourage interaction between and amongst a group of learners to maximise mutual learning in a given task. The main aim is to reflect on concepts, share ideas, solve problems and build knowledge which can be done through peer teaching or project-based activities.

3.5.4 Multiple-Perspectives Learning Principle

From the social constructivist perspective, learners are based in multiple contexts. Spiro et al. (1991) stress the need for different contexts and different resources in order to construct knowledge. This is because complex concepts are ill-structured and therefore require multiple representations. Learners can be supported in connecting relevant knowledge via a variety of representations and

opportunities to interact with the concepts being studied (Spiro et al., 1991). This leads the learner to construct meaningful relationships through being exposed to different perspectives, in which mobile learning activities can provide the platform. Hannafin & Land (1997) support this argument by stating that “constructing personal meaning by relating new knowledge to exciting conceptions and understandings; technology promotes access to resources and tools that facilitate construction” (p.170). Earlier, Jonassen (1991) postulated that one of the aims of social constructivist is the promotion of multiple perspectives on reality within the learning environment through available tools.

Different views of people can be received through use of various resources. Existing knowledge serves as a point of reference or as foundation for new knowledge to be built on (Dunlap & Grabinger, 1996). Hence there could be a space for relevant information to trigger reflections about any given content. One would expect that information does not come from only one source in a social constructivist learning environment, but rather from different sources and even through different media. This means that multi-perspective learning activities are represented through different types of medium, for example, content is represented differently through text or visual means. Multi-perspective learning activities can be designed by presenting information in a variety of ways to encourage learners to view the knowledge base from multiple viewpoints and find their own connections and explanations (Dabbagh, 2005).

Furthermore, Jonassen (1994) and Lefoe (1998) assert that design of learning activities needs to provide learning experiences which encourage students to look beyond their own perspectives. This is because in order to develop one’s view, there is a need to compare with alternatives. Multiple perspectives can be deployed through encounters with a text or also through discussion with others. Concepts exist within a web of meaning which is mediated by individuals’ cultures (Vyotsky, 1962), thus, different points of view from different cultures can help learners to make meaning. Cobb (1994) stresses that it is important “to consider what various perspectives might have to offer relative to the problems or issues at hand” (p.18). Through exposure to multiple points of view when understanding or judging issues, learners are able to rearrange information to

construct new knowledge (Duffy & Cunningham, 1996 and Dabbagh, 2005). They can also acquire flexible and meaningful knowledge structures through this process. Being exposed to different perspectives based on different cultural contexts involves engagement in the process of learning.

Lin et al. (1999) call for learning designers to “use a design that build(s) the opportunity for learners to compare reflection with the multiple perspectives of others” (p.59) in creating learning activities. Furthermore the authenticity element needs to be part of the design of multi-perspective learning activities. Duffy & Jonassen (1991) believe that real world problems through multiple viewpoints can be explored by students. This is because it is only when students have authentic problems in the form of real-world issues that they can construct understanding and improve their ability to solve problems. According to Hannafin & Land (1997) learning activities require “the processes of exploring, inquiring, and constructing representations and/or artefacts” (p.169) while “understanding involves continually modifying, updating, and assimilating new existing knowledge” (p.169). Dabbagh (2005) proposes that multi-perspective learning activities be designed through presenting information in a variety of ways. The goal of promoting multiple perspectives is to generate disagreement within discourse so that learners are aware that there are multiple perspectives on issues especially for real world situations (Dabbagh, 2005). This entails students becoming engaged in exploring other perspectives in order to achieve a meaningful resolution to the issue, and new meaning can be generated through this process.

In multi-perspective learning principle, feedback is also essential. Feedback can be delivered through various mechanisms including verbal responses, visual representations and sensory-tactile feedback. It is also believed that the opportunity to test assumptions and to receive feedback is critical to the learning process (Land & Hannafin, 1996). For example the Languages Development and Hypermedia Research Group (1992) report from their project Bubble Dialogue on the need to allow learners to manipulate their thoughts and ideas through unstructured internal and external feedback dialogues, in order to encourage sharing of viewpoints and perspectives amongst users.

Therefore, there are two main ways of delivering multi-perspective learning principle proposed in this study. The first is through multiple media or multi medium representation. The other is multiple discussions through different opinions from different people in other words multiple voices of students. These are the main aspects of the design of multi-perspective activities to support HE students' learning through the use of the mobile phone applications. The goal is to generate activities that promote awareness of multiple perspectives on an issue set in real-world context and to construct new meaning in the context of their exposure to other perspectives.

3.5.5 Summary of Social Constructivist Learning Principles

In summary, to realise the full potential of mobile phones and all of their associated opportunities for learning, a study of design for learning activities to suit the need of HE students is essential. While designing these learning activities, learning theory is needed to structure the design because there is a need to reconsider pedagogical practice with underpinning theory (Sharples, 2005; and Beetham & Sharpe, 2007). The chosen theory in this study, social constructivist, provides guidance and integration for the design, implementation and evaluation of the proposed mobile learning environment, enabling a holistic view of mobile learning activities through the mobile phone. The students, the technology tool and the activity that students engage in are part of a joint learning system in which learners can build expertise not only in using the tool itself but also in the learning environment and the activity for which they make use of the tool. The theory discussed was then translated into social constructivist learning principles in order to provide guidance for the actual learning design to ensure the principles are developed cohesively. Through the provision of social constructivist learning principles, learning experiences can be designed to provide the opportunity for HE students to take control and construct their own learning.

Grabinger & Dunlap (1996) recognise that learners construct knowledge a variety of forms. They are not passive recipients, but on the contrary take an active role in developing new understanding. It is essential to provide a conducive learning

environment for learning support for students to take place. An effective learning environment supports learners' learning intentions to derive and solve problems through use of available resources and tools (Jonassen 1992; and Hannafin & Land, 1997). Tools such as the mobile phone provide access to the learning support.

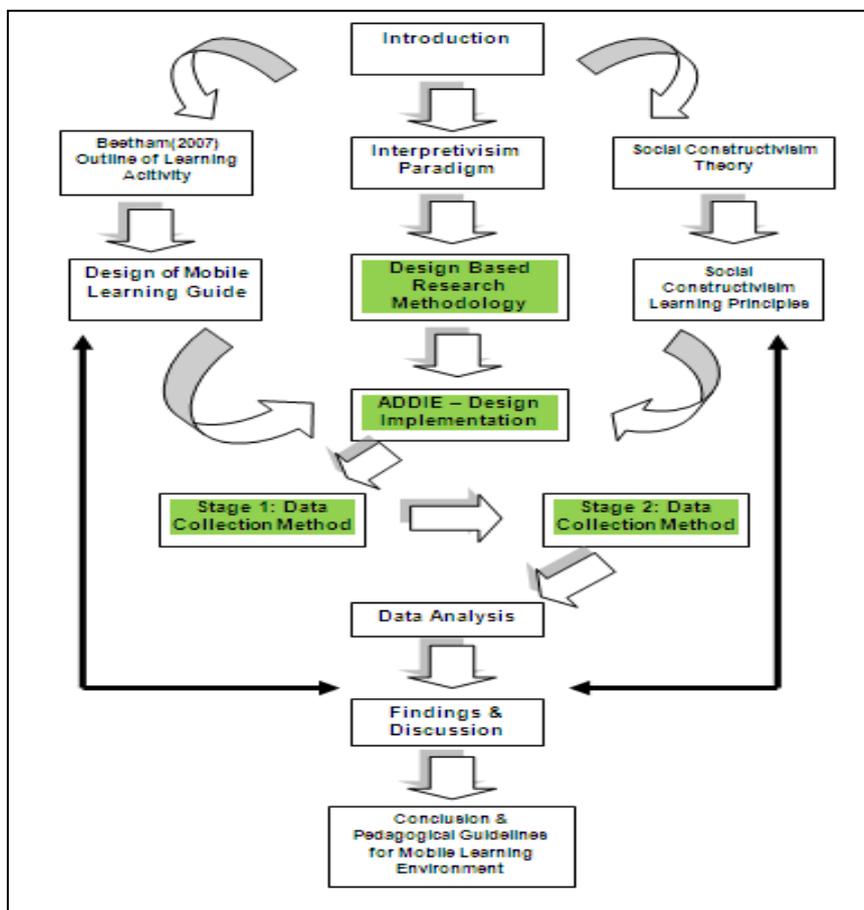
There is a need to examine pedagogies that are suitable for mobile learning and to conceptualise mobile learning from the learners' perspective rather than in terms of the affordance of the tool (Traxler, 2007). This chapter has partly reviewed the theory of social constructivism to guide the design of mobile learning activities for this research. The previous chapter (Chapter 2) has partly discussed mobile learning possibilities. The coming chapter (Chapter 4) presents how mobile learning activities are designed in this research to support HE students learning. Wagner (2005) suggests that "mobile learning will ultimately revolve around a mosaic of rich converged experiences" (p.52). Meanwhile Perkins (1999) argues for use of the 'Swiss army knife' (p.10) concept to represent social constructivism in a virtual environment incorporating multiple strategies and interpretations to be able to provide an effective learning environment. Therefore as explained in this chapter, the social constructivist learning principles to be used for the design of mobile learning activities are based on: contextual learning principle, reflective learning principle, collaborative learning principle and multiple-perspective learning principle.

Chapter 4: Research Process and Design Process

Overview

In this chapter the methodology of this research is presented. Design-Based Research (DBR) is described along with ADDIE (Analysis, Design, Development, Implementation, Evaluation) model being used to translate DBR's cyclic nature for the research process. The design process is represented through the mobile learning design guide. The research process and design process are explained in which the two iterative stages of this research are presented in detail. This chapter is part of the thesis guide as in Diagram 2.

Diagram 2 : Structure of Thesis for Designing Mobile Learning Activities



Further implementation of mobile learning activities is presented in terms of social constructivist learning principles elicited in the previous chapter. Various data collection methods are also outlined. As this research is based on an interpretive approach the context of the study and the participants are discussed thoroughly. In this chapter, ethical issues and challenges in this study are considered. Finally the strategy for data analysis is described.

4.1 Methodology – Design Based Research (DBR)

The methodology of this research adopts the Design Based Research (DBR) approach. At times DBR is interchangeably known as design experiment (Brown, 1992; and Gorard, Roberts & Taylor, 2004), design science (van Aken, 2005), design research (Kelly, 2003; and Collins, Joseph & Bielaczyc, 2004) and design and development research (Richey & Klein, 2007; and Ellis & Levy, 2010). Andriessen (2007) recognises that regardless of the name used, all these share a common pursuit of a “scientific ideal of creating perspective knowledge in order to improve professional practice” (p.2) and this knowledge can be applied to solving real world problems.

DBR is “an attempt to combine the intentional design of learning environments with the empirical exploration of our understanding of those environments and how they interact with individuals” (Hoadley, 2004, p.205). It is concerned with improving the design of pedagogical interventions and how they affect learners. DBR takes a progressive refinement approach whereby a design is placed in a real world context to gauge how it works and is then revised in order to improve the design (Collins et al., 2004). Reeves, Herrington & Oliver (2005) further describe DBR as the “integration of known and hypothetical design principles with technological affordances to render plausible solutions to these complex problems” (p.103). This is also supported by Herrington et al. (2007) and Cobb & Gravemeijer (2008) who portray DBR as a family of methodological approaches whereby design and research are interdependent with the aim of solving practical problems. The design of the learning environment acts as a context for the research and through that a practice of retrospective analysis is conducted throughout the research process in order to inform and improve the design of learning. Bell (2004) suggests that “design-based research can be understood as attending to the alignment of designs with their ultimate embedded contexts-of-use as understood and mediated by those engaging in the activities” (p.249). It could be said that through DBR, this research’s aim to gauge the possibilities for mobile learning activities to be embraced by Malaysian HE students can be achieved.

DBR is a suitable methodology for research on design of technology-enhanced learning environments. As advocated by Seeta & Herrington (2006) DBR is “a research approach that is particularly suited to the exploration of significant education problems and technology-based solutions” (p.742). Intervention in DBR can take many forms (Design-Based Research Collective, 2003), in the form of tools, learning activities or the curriculum. It is important to note that these interventions are based on theories which have been revised during the design process to produce credible outcomes (Design-Based Research Collective, 2003).

DBR arises from the need to address theoretical questions in context, the need to approach learning in the real world and also to go beyond the restrictions of formative measurement of learning (Collins, Joseph & Bielaczyc, 2004). According to Barab & Squire (2004), DBR research “moves beyond simply observing and actually involves systematically engineering these contexts in ways that allow us to improve and generate evidence-based claims about learning” (p.2). The Design-Based Research Collective (2003) recognises the aim of DBR in education is “to inquire more broadly into the nature of learning in a complex system and to refine generative or predictive theories of learning” (p.7). This means that DBR has the potential to bridge the disconnection between research theory and learning (Wang & Hannafin, 2004; Bell, 2004; Collins, Joseph & Bielaczyc, 2004; and Herrington et al., 2007).

Brown (1992) argues that DBR enriches understanding of the complexities of the classroom, whereas laboratory research, with strict control of experiments and isolated variables cannot do justice to the reality of classroom scenarios. Kukulska-Hulme (2008) postulates that research in mobile learning is unpredictable and thereby requires participants’ openness to not only “capture aspects of the world around them” (p.8), but also provides opportunity for them (the participants) to personally reflect what they are learning. Gilbert, Sangwan & Han (2005) propose that through the use of mobile devices, “the scope of use expands to fulfil emergent needs” (p.207). The unpredictable nature of mobile learning needs a flexible research methodology that allows for ‘Jack-in-the-box’ surprises as they are described by Kukulska-Hulme (2008). Therefore, it is

believed that DBR being flexible makes it a suitable methodology for the ubiquitous nature of the design of mobile learning research.

The purpose of DBR is to solve real world problems of designing and implementing interventions while adding or refining theories and design principles (Wang & Hannafin, 2005). Through this methodology my research questions on the enquiry of participants' preparedness for mobile learning, the design of learning activities using the mobile phone, and also exploration of issues raised in an intervention based on an actual setting could be answered. This demands a methodology that allows for the process of theory refinement and practice as contribution to the research. The process also allows for deeper understanding of the challenges along with practical applications for teaching and learning experiences as it is proposed are offered through DBR (Collins, Josephy & Bielaczyz, 2004).

Through DBR design, knowledge other than the field explored, which in this research is mobile learning, could also be produced (Edelson, 2002; O'Donnell, 2004; Wang & Hannafin, 2005; and Sandoval, 2007). Van den Akker (2009) suggests that better understanding of the design process in the form of 'design principles' to support designers could be an outcome of using DBR. This is because learning designers need to reflect on the design implemented and problems which arise in each design iteration and in turn designers review the design process and thus produce refinements of the design principles. Barab & Squire (2004) acknowledge that "the design is conceived not just to meet local needs, but to advance a theoretical agenda, to uncover, explore and confirm theoretical relationships" (p.5). DBR is suitable for applied research which can engage in design work in order to identify new design possibilities.

Mor & Winters (2007) describe DBR as a study of applied functions as it is about "the design of learning processes, taking account of the involved complexities, multiple levels and contexts of educational settings" (p.2). This research is based on actual settings, namely an HEI course in Malaysia. Being in context is essential to an interpretive approach and social constructivist theory as reviewed in Chapter 3, therefore the methodology of the research also needs also to stress on this fact. According to Greeno (2006) DBR entails that the individual and the

learning environment cannot be separated rather “the context of the enquiry must be seen as a means to an end rather an end in itself” (Herrington et al., 2007, p.6). Hence context of this research is used to gain understanding, but the meaning derived from the context could go beyond a single environment. Therefore, the use of context is a construction of understating and knowledge of the phenomenon studied.

Barab & Squire (2004) posit that in DBR research participants are not ‘subjects’ assigned to an intervention or treatments; instead they are co-participants in both the design and analysis of the study. In DBR research is a process of co-construction of meaning through collaboration and interaction with participants in a real-world context (Reeves, 2000; Design-Based Research Collective, 2003; Bell, 2004; O’Donnell, 2004 Reeves, Herrington & Oliver, 2005; and Wang & Hannafin, 2005). Herrington et al. (2007) support this notion as they state that the input from participants is valuable and due to the contextualised nature of DBR, hence descriptions of the participants are essential. In this research, participants are described generally as digital learners (Section 2.4.1), Malaysian HE students (Section 2.4.2), then more specifically later in Section 4.8.

4.1.1 Differences between DBR and Action Research (AR)

Action Research (AR) is also known as collaborative enquiry, emancipatory research, action learning, contextual action research, participatory enquiry and practice-based research. AR is described as having similar characteristics to DBR as both are set in real-world contexts, are iterative, collaborate with the participants of the study, and are also able to produce theoretical outputs. Cole et al. (2007) argue that there are similarities between AR and design research as both proactively intervene in real world phenomenon, and give birth to valuable changes which create knowledge. They also noted that the phenomenon studied would not remain static for both methodologies.

McNiff & Whitehead (2011) portray AR as “a form of enquiry that enables practitioners in every job and walk of life to investigate and evaluate their work” (p.1). Norton (2001) and Mills (2003) define AR as a practical approach to

professional enquiry in which the research aims to understand professional action from the inside, carried out by practitioners in their own practice. Thus, AR is a form of professional enquiry. AR is also intended to “derive from participants’ own research that is facilitated by researchers rather than interventions designed and progressively refined jointly with researcher” (Wang & Hannafin, 2005, p.6). This is supported by McNiff & Whitehead (2011) who state that knowledge produced by the “action piece of action research is about improving practice” (p.14). Although new knowledge of improving practice produces new theory which is similar to DBR, the fundamental focus differs. The overall goal of development research using DBR is to solve real problems while at the same time constructing design principles that can inform future decisions. In this research DBR is used to establish theoretical design principles for mobile learning activities and does not aim to understand ‘professional action’. This remains the slight difference between the two methodologies.

Furthermore, Gorard, Roberts & Taylor (2004) argue that DBR goes beyond the “model and hypothesis-generating stages of research” (p.586), as at each stage “different data collection methods are more or less appropriate and complementary” (Gorard, Roberts & Taylor, 2004, p.586), hence amendments are done within the iterative process (in the field itself) and rigour is the key to the methodology. They argue this differs from AR because AR stresses the effectiveness of the intervention, whereas DBR stresses the process of design or intervention.

There are slight differences between DBR and AR such that design research lacks reflection to specific learning as opposed to AR, and also AR studies rarely generalise their findings into concepts to contribute to theory building (Cole et al., 2007). Cole et al. (2007) and Sein et al. (2011) proposed for a merger of these methodologies known as action design research. Nevertheless, due to the focus of the study on learning design, DBR was selected as the methodology.

4.1.2 Problems in DBR

One of the challenges of the methodology is that it does not provide a formal procedure for dealing with problems arising from its 'messier nature' (Gorard, Roberts & Taylor, 2004). Barab (2006) acknowledges that social context is unique, thus the prediction of problems can be difficult. Nevertheless, empirical claims can simultaneously be derived through the manipulation of interventions, due to the flexible nature of DBR. O'Donnell (2004) also voices concerns that "may also be expressed about the features of particular contexts that receive attention and those that do not" (p.259). This means amongst the many elements of a natural situation, which element in the context can the researcher concentrate on as there can be a multitude of elements to be considered. This is because the context that the research is based upon is complex (O'Donnell, 2004). Therefore in continually adjusting the design, it is very difficult with DBR to precisely identify which combination of elements works. Identifying the contributors to success is difficult as it is a joint effort of the students, tutors, and other factors within the environment. In this research, the research aim and questions are those that guide the analysis of a contextual situation which is based in an HEI course in Malaysia.

O'Donnell (2004) also highlights the problem of the 'seen' and 'unseen' elements in DBR. According to him participants "do not just exist as persons within a classroom, but bring their private lives, thoughts and beliefs. Nor are all elements of the available context simultaneously salient to the student" (p.260). Thus, researchers need to be aware of capturing these 'unseen' elements in the research process. The different data collection methods from the different stages of the research hope to address this challenge.

According to Barab (2006) a prominent challenge for DBR is to describe the findings in a way that others can understand, in other words, how to re-contextualize the findings with respect to the local situation. It is difficult to generalize any form of research in a naturalistic context due to the complexity of the real world (Collins, Joseph & Bielaczyc, 2004; and Barab & Squire, 2004). Barab and Squire (2004) propose dealing with this by focusing on the aim of DBR which is to:

develop flexibly adaptive theories that remain useful even when applied to new local contexts. The potential of flexibly adaptive theory does not result because the theory was somehow generated in a context that was free of confounding situational variables, but rather, because the theory is supple enough to maintain its robustness even in the context of changing situational variables. Theory generated from design-based research, from this perspective, must strike a balance between refinement and adaptability (p.11).

One way to overcome this issue is to engage dialectically with theory, design and the extant literature (Barab, 2006). Thus, the flexibility of DBR calls for a balance between refinement and adaptability of the proposed research outcome which leads to constant engagement between discussion of theory and practice.

DBR research moves beyond observation. It “involves systematically engineering contexts in ways to allow us to improve and generate evidence-based claims about learning” (Barab & Squire, 2004, p. 2). Researchers in DBR are active participants in the socially constructed contexts in which they study and design for learning activities (Wang & Hannafin, 2005). Yet, their role as learning designers “draw[s] connections to theoretical assertions and claims that transcend the local context” (Barab & Squire, 2004, p.8). This means that DBR researchers assume the role of both learning designers and researchers. DBR research relies on the social interaction with research participants in order to discover and understand the complexity of the learning environment (Reeves, 2000, Design-Based Research Collective, 2003, O’Donnell, 2004, Reeves, and Herrington & Oliver, 2005). Hence, the researcher as a learning designer also assumes a practitioner role. This indicates that DBR researchers are included in the research environment they create.

My role as a DBR participant researcher took multiple roles mainly as a single researcher, learning designer, and also as an invited tutor for the course that the study was placed in as described in Section 1.3.1. The greatest issue I had to deal with as a DBR researcher was that of remaining objective and truthful to my finding. Research validity in DBR is often addressed by the partnerships with participants and the iteration process which “result in an increasing alignment of

theory, design, practice, and measurement over time” (Design-Based Research Collective, 2003, p.7). The issue of validity is further discussed in Section 4.9.

4.1.3 Process and Methods in DBR

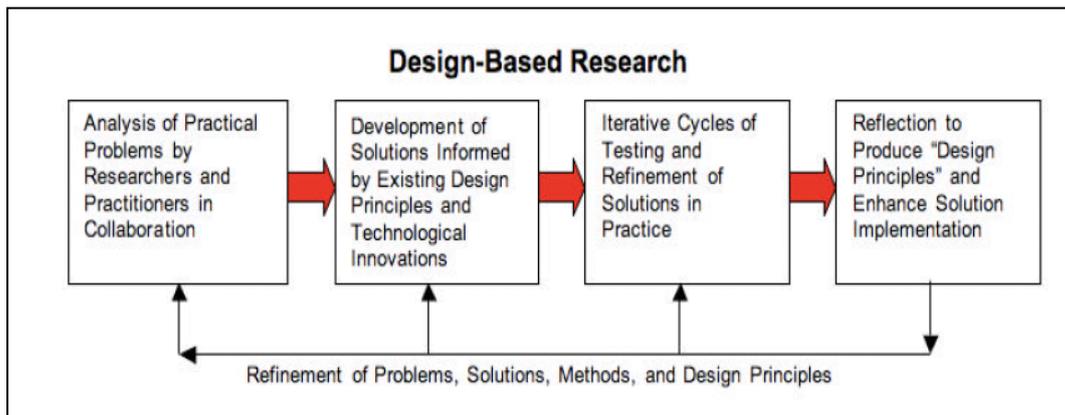
DBR methodology needs to utilise multiple resources to support the theoretical principles underlying specific innovations. Herrington et al. (2007) proposes that different methods of data collection are suited to different phases of research. For example, data that aim for contextual understanding are more likely to be gathered in the earlier stages of the research such as the use of a questionnaire in this research. The details of the questionnaire are presented later in this chapter through Section 4.6.1. Data collection methods also vary as new needs and issues emerge through the research process (Wang & Hannafin, 2005).

Conn et al. (2003) allow for real-time review of data analysis to be able to provide feedback into the study as it progresses. This provides opportunities for me as the researcher to notice and possibly capitalise on unanticipated elements during the implementation (diSessa, 2004). According to Wang & Hannafin (2005), in unexpected situations a learning designer may refine the design in order to deal with external or unanticipated influences. This agility further enforces the idea that DBR is a flexible methodology.

It is proposed by Kukulska-Hulme (2008) that it is better to track the learner’s experience holistically through mobile learning usability research. This allows for the openness to other forms of learning that the mobile learning process affords. The flexibility to other forms of learning indicates that the evaluation of design “can only be made in terms of particular implementations, and these can vary widely depending on the participants’ needs, interests, abilities, interpretations, interactions, and goals” (Collins, Joseph & Bielaczyc, 2004 p.17). Taking a holistic view of the situation, van den Akker (1999) proposes for a wide variety of success indicators derived from possible forms of interventions and different contexts. In this research, there are several applications and different types of learning activities that were being designed in the mobile learning environment, thus different forms of interventions were possible.

DBR has been described as a process of continuous cycles of design, enactment, analysis and redesign (Design-Based Research Collective, 2003). There are not many publications that provide detailed guidelines on the process (Andriessen, 2007). Nevertheless, Reeves (2006) proposes a model for DBR stages for educational technology research as presented in Diagram 7.

Diagram 7: Design Based Research Approaches in Educational Technology Research (Reeves, 2006)



Based on Reeves' (2006) DBR model, Herrington et al. (2007) propose that the model serves as a set of guidelines for preparing a dissertation proposal for doctoral students. Therefore both models are used and the table below maps out the DBR phases against the narration of this thesis.

Table 10: Phases of DBR Mapped Against the Thesis

Phase from Reeves (2006) DBR Model	Element or Topics to be Described in Thesis	Representation in this Thesis & Explanation by Herrington et al. (2007)
Phase 1 : Analysis of practical problems	Explanation of research aim, research questions and rationale of the problem	Chapter 1: The exploratory nature of DBR calls for more open research questions
Phase 2 : Development of solutions informed by design principles & technological innovations	Review of design principles, theoretical framework, tools and intervention	Chapter 2 & 3: The literature review facilitates creation of draft design guidelines to inform design. It also identifies concepts underpinning the design

Phase 3: Iterative cycle of testing and refinement	Discussion of data collection, participants, data analysis and structure of the implementation	Chapter 4: Description of proposed intervention
Phase 4: Reflection to produce design principles and solutions	Presentation of design principles and artefacts	Chapter 5,6,7 & 8: The product of design is an output which could take the form of design principles, practical or societal outputs

The projection of DBR against this study as in Table 10 is part of the development of mobile learning design guidelines for this research. Herrington et al. (2007) recognise that “design principles contain substantive and procedural knowledge with comprehensive and accurate portrayal of the procedures, results and context such that readers may determine which insights may be relevant to their own specific settings” (p.7). This means that the content and depth of the design principles vary as they can either be generic or based on multiple research results (Wang & Hannafin, 2005).

With reference to the phases in Reeves’ (2006) DBR model, it is noted that a learning theory needs to be selected first, before the design takes place. Wang & Hannafin (2005) propose that a learning theory needs to be selected in order to ensure the value of the research and then the learning designer needs to revise or refine the theory. The theory-driven nature of design-based research is important, as this approach can be considered to yield more comprehensive results than an evaluative method for a technological initiative such as this research. In this research social constructivist theory has been reviewed and learning principles discussed in Section 3.5.

In reporting on DBR, Collins, Joseph & Bielaczyc (2004) suggest the elements of the design which could be tools or applications used and specific learning activities and how they fit with the aim of the research. There is also the need to describe the context and how the design was implemented in each setting. The description of each phase and the changes in design made need to be reported followed by the outcome found. As DBR allows the researcher to make in situ

changes to the intervention, I can determine which are critical and non-critical elements (Gorard, Roberts & Taylor, 2004). As a learning designer for this study, I need to establish an implementation strategy. Finally, I need to build a coherent picture of lessons learned including the limitations of the design. The design implementations are presented later in this chapter also as part of the research process (Section 4.3).

Collins, Joseph & Bielaczyc (2004) suggest capturing dependent variables for more rigorous research. These variables are: (1) environmental variables such as engagement and student control; (2) learning variables such as skills and learning strategies; and (3) systemic variables such as ease of adoption and cost. Independent variables are defined as any factor that could affect the success of the implementation such as the setting, background of learners, or the support given by lecturers for the implementation, and those elements that were embedded in this research design. However it is essential that “designers do not emphasise isolated variables” (Herrington et al., 2007, p.6). Even though researchers study specific concepts or processes, they do so with an integrated lens (van der Gravemeijer, McKenney & Nieveen, 2006). This means I need to view the context holistically and not focus only on a single element of the context. This process is essential during the data analysis (see Section 4.11).

Capturing the iterative cycles of research is an essential element of the DBR methodology (Barab & Squire, 2004; Wang & Hannafin, 2005; and Anderson, 2005). As shown in Diagram 7, Reeves (2006) started the process with the analysis of the problem. This is followed by the development of solutions based on past studies. After that, the interactive cycle of refinement of the design is conducted. Finally, reflection is conducted through the implementation of the design. Nevertheless, the iterative cycle remains as a broad understanding on its implementation. It is noted that within DBR methodology there are many different instructional design models, yet most of them have similar conventions to the Analysis, Design, Development, Implementation and Evaluation (ADDIE) Model (Allen, 2006). Lauren (2003) further notes that DBR is closely bound to its research context and it can be approached in many different ways. Thus, I used a more structured instructional design model, ADDIE, in order to provide a

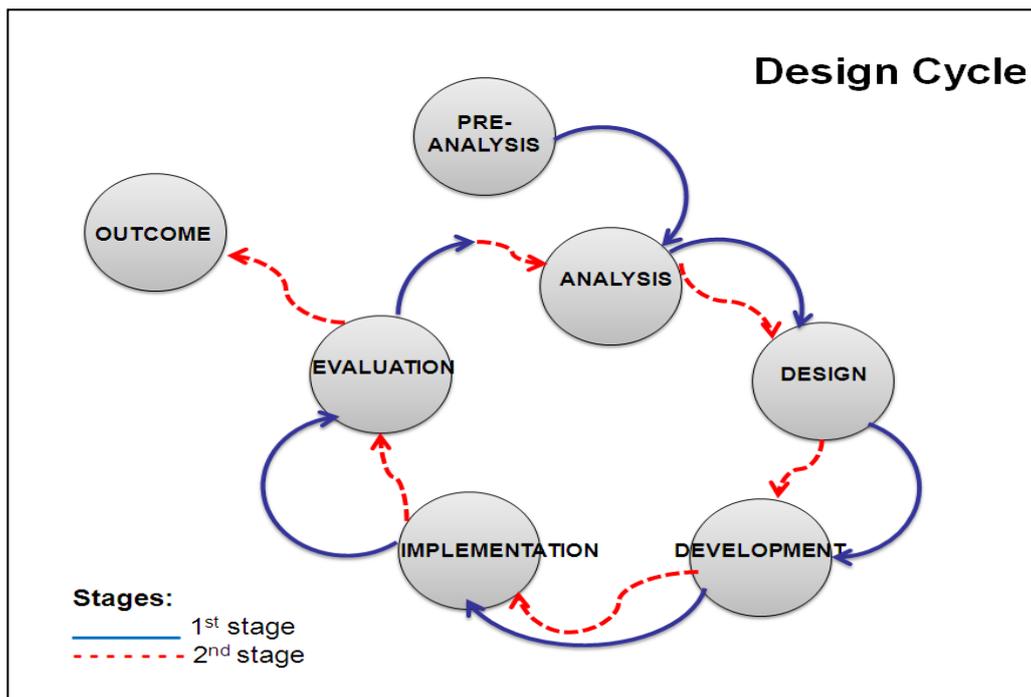
more detailed account of DBR's iterative cycle. The research design of this study took into consideration the need for two stages of iterative cycles for the design process. These iterative cycles are discussed in greater length in the next section.

4.2 Research Design Process – ADDIE Model

ADDIE is an acronym from a systematic approach of a generic instructional design process which is Analysis (of user needs), Design, Development, Implementation and Evaluation. It is a common approach widely used in the development of instructional courses (Peterson, 2003). The ADDIE Model is a colloquial term used to describe a systematic approach to instructional development which is synonymous with instructional systems development (ISD) (Molenda, 2003). ISD is a systematic approach for comprehensive design, development and management of both instructional materials and systems (McCombs, 1986). In other words, it is an approach to develop better instruction and learning through the integration of pedagogy and technology (Woo & Reeves, 2007). Karagiorgi & Synmeou (2005) and Jonassen, Cernusca & Inoas (2007) argue that the act of analysis, development and evaluation as the ADDIE Model supports the construction of meaning in order to enable the transition from theory to practice. This means that the ADDIE Model compliments DBR as a methodology as “a series of approaches, with the intent of producing new theories, artefacts, and practices that account for and potentially impact learning and teaching in a naturalistic setting” (Barab & Squire, 2004, p.2).

The ADDIE model is cyclical in nature and makes the analysis of the learner central to the process (Peterson, 2003). ADDIE is suitable for this research as the participants are its main focus. This allowed me to involve the participants whilst taking their social context into account through investigation of their mobile phone usage as part of the learning activities. Diagram 8 illustrates the research design cycle. It shows Stage 1 and Stage 2 of iterative cycles as required by DBR. As in the ADDIE model, the process contains phases of analysis, design, development, implementation and evaluation. I have also added a pre-analysis process to Stage 1, and an outcome phase to Stage 2.

Diagram 8: The Design Process of the Study



The iterative cycle of the research process is aligned with the requirements of DBR as a methodology. The 2 stages also ensure that rich data is achieved as a means of answering this study's research questions. Through each step of these iterative cycles, data were collected. The discussion of the choice of data collection methods is presented later in this chapter (Section 4.5).

4.3 Research Process and Design Process

The research process for this study was conducted across two stages to ensure reliability of the data. Further explanations of the sub-sections within each phase of the ADDIE Model as in Diagram 7 are presented. The first stage was implemented from June to September 2009 while the second stage was carried out between June to September 2010.

In Chapter 2, the mobile learning design guide has been presented through Diagram 5 whereby nine linear elements were proposed. These elements are absorbed into the design process of this study. During the design process, Amiel & Reeves (2008) propose that through these cycles of testing and refinement a more comprehensive outcomes for the intended study can be produced. Each

phase of the ADDIE Model has its purpose and explicit functions (Peterson, 2003; and Allen, 2006) and these along with the mobile learning design guide (Diagram 5), are explained in the next few sections.

4.3.1 First Stage

4.3.1.1 Analysis Phase (Need Analysis)

Hannafin & Land (1997) suggest that to design a learning environment for social constructivism, there is a need to explore resources in order to manipulate them. The main aim of the analysis phase is to explore the context especially the resources and also to understand the participants further. This phase is further divided into the pre-analysis phase and analysis phase as illustrated in Diagram 7.

4.3.1.1.1 Pre-Analysis Phase

The purpose of this phase was mainly to pilot the mobile readiness (MReadiness) questionnaire. The questionnaire was piloted with 40 participants. The objectives of the questionnaire were to gain better understanding of common mobile device(s) and habits of the students towards mobile device(s), awareness and knowledge of virtual features in a mobile device, common virtual practices and their willingness to participate if mobile learning services were offered. More details about the MReadiness Questionnaire are discussed in Section 4.5.1.

In this stage, as proposed through the mobile learning design guide shown in Diagram 5 permission to conduct the study was obtained from the institution (details in Section 4.6), and through the MReadiness questionnaire evaluation of the mobile device, and applications used by the participants were sought.

This pilot phase served the purpose of testing the questionnaire as a research instrument. Most importantly, I needed to ensure that students understood the instructions, questions and the choice of responses. Bryman, (2008) stresses the importance of the questionnaire's validity by asking students to judge whether the questions achieve the aims of the questionnaire. At the end of the questionnaire session, I verbally asked the students if they felt that the

questionnaire had met its purpose. Changes were made to the piloted questionnaire which was then implemented for the Stage 1 participants.

4.3.1.1.2 Analysis Phase

DBR stress to identify key elements in a design of the initiative and to study their influence on the learning design (Collins, Joseph & Bielaczyc, 2004). The purpose of this analysis phase was to gather information on the participants and the selected course. This structure was proposed by Vavoula and Sharples (2007) for mobile learning research when they stated that the first step is “a phase of activity analysis to interpret how people work and interact with their current tools and technologies, and a phase of systems development to design, build and implement new interactive technology” (p.394). This analysis phase is in conjunction with the mobile learning design guide (Diagram 5) which requires the review of the course curriculum in this phase of the research process. The analysis phase also reviews mobile learning affordances and understanding the background of the learning environment. The review of the learning environment was also gathered through participation in the tutors' meetings, attending face-to-face classes on the course, and also participating in the virtual learning management system.

The phase also served as an understanding of entry behaviours of the participants that are deemed essential in social constructivist learning (Perkins, 1992). I perceived entry behaviours as the current knowledge and skills which participants bring before the introduction of mobile learning concepts. Knowledge about students' understanding and their ability to use mobile phone applications is essential for designing mobile learning activities. I needed to understand the participants' familiarity and skills in using their own mobile phones. This is conducted through the MReadiness questionnaire.

4.3.1.2 Design and Development Phase

The data collected in the analysis phase was evaluated and, the findings were used as part of the selection of appropriate mobile learning applications, and the

design of mobile learning activities suitable for the intended course. In accordance with the mobile learning design guide (Diagram 5), technical and pedagogical matters needed to be reviewed. Therefore the following considerations were taken into account in the design of mobile learning activities: technical factors; common usage of mobile phone applications; and learning activities that could be blended with other delivery platforms for the intended course. These considerations are further discussed in Section 4.4 in the narration of the actual implementation of the mobile learning activities.

Technical considerations were critical to this research as the mobile applications chosen should neither be too complicated for participants to use, nor for me, as a researcher, to design. The second consideration was familiarity with the mobile applications by the participants. Timmis et al. (2008) report that participants are more comfortable with applications that they are already familiar with. The analysis phase provided information on this. The final consideration regards the blending of mobile learning activities with other learning activities conducted online as part of the course, which was necessary for this research as mobile learning activities were not standalone. They were part of the course; hence they needed to fit with the syllabus and also be compatible with the other delivery platforms within the course.

4.3.1.3 Implementation Phase (Stage 1: Mobile Learning Workshop)

The implementation phase was conducted across three phases; ‘before’, ‘during’ and ‘after’ the 3 hour mobile learning workshop. The mobile learning design guide (Diagram 5) requires that any intervention of design be supported. In this study, support for participants is part of the mobile learning activities.

According to Brown, Collins & Duguid (1989) there is a need to study concepts as tools to be understood through use rather than delivered through instruction. Thus, mobile learning as a concept needed to be introduced to the participants. The introduction of mobile learning as a concept was carried out through a mobile learning workshop. The design of the mobile learning workshop was adapted from Mayes’ (1995) design framework which comprises the following

stages: (1) conceptualisation (coming into contact with the concepts), (2) construction (building understanding through performance of meaningful tasks), and (3) dialogue (discussion on the creation of new concepts). This framework was also adapted by Fowler & Mayes (2000) in their own study. Therefore, the mobile learning workshop included a face-to-face workshop (conceptualization) followed by learning activities (construction through meaningful tasks) and the students' reflective blog (dialogue). Furthermore, this is also the structure of the course that the research was based upon as explained in Section 4.6.

The purpose of the workshop was to introduce the participants to the concepts of mobile learning, and to be the basis for implementing selected mobile learning activities. The workshop also aimed to obtain input from students regarding ideas for mobile learning activities and tools. The initial ideas for mobile learning tasks and tools were informed by previous mobile learning literature, such as the use of SMS and moblogs to support learning (Discussed in Section 2.5.2).

The mobile learning workshop was conducted during the 3 hour face-to-face class time. In Stage 1, the workshop was conducted in Week 15 of the course. There were 3 phases of the mobile learning workshop, which were as follows:

4.3.1.3.1 Pre-Workshop

The students' mobile phone numbers were collected via the group representative. The list was submitted via email to me and a few days before the workshop an email was sent to remind them to bring their mobile phones (along with power cables), microphone/ headphones, and their own laptops to the mobile learning workshop. An SMS message was sent to all students a day before the workshop as a further reminder.

4.3.1.3.2 During Workshop

The structure of the mobile learning workshop was designed firstly to introduce the concept of mobile learning. It focused on the definition, characteristics, and challenges of mobile learning. Examples of mobile learning activities and free

mobile phone applications that are available to the students for their own learning were presented to them. These examples are attached in Appendix B.

Then a hands-on session was conducted. Firstly a document was sent via the Bluetooth application, this was a PDF document of a single page article on education technology. The document was mobile phone friendly as participants were able to read it even on a small screen size. The students were intended to receive the document via their mobile phone, and then read it on their mobile phone in their free time. Then the session continued with an introduction to the class-response system using PollEverywhere software (<http://www.polleverywhere.com/>). Students were able to send comments or questions via the web or SMS. This was done throughout the class and I had to constantly check for responses via the desktop computer and then respond in class.

The second session was on podcasting. The students were asked to create an MP3 audio file using Audacity software. They were asked individually to create a 1 minute audio file on the topic, 'what kind of teacher I would like to be'. As the participants were familiar with this software no training was provided. This was because participants had received training in a previous face-to-face class as part of the same course. Support was also provided through step-by-step instructions made available through the virtual learning management system. Moreover, the tutors were ready to assist them should any students have difficulties. The MP3 file was to be uploaded into their Windows Live folder, which they were to download to their phone. This folder comprised their respective individual virtual space. The participants were to listen to these audio files and comment on it in the respective peer blog posts.

The students were told to download the MP3 file to their mobile phone through Bluetooth, the web or through syncing their phones to the computer. In the workshop, students who were not familiar with synchronising their mobile phones with the computer were given hands-on advice. This was explained further to the participants as it could assist them in the act of uploading and downloading learning materials. This act would be cost-saving as students would not need to use a mobile broadband network.

4.3.1.3.3 Post Workshop

The students were asked to reflect on their understanding of mobile learning through their blog. They were encouraged to try out proposed mobile phone applications such as Qipit (to capture notes), mobile Facebook and eBook. These mobile phone applications had already been presented in the workshop. Students were then encouraged to blog about their experiences in trying out their chosen mobile software or applications.

During Stage 1 the students were asked to reflect on their experience of activities conducted during the workshop in their respective blogs. They were asked specifically to write about two things: (1) to reflect on the possibility on using mobile learning activities such as being given SMS messages, capturing pictures, and listening to a podcast to support their learning, and (2) to reflect on the possibility of using a particular application such as Qipit (<http://www.qipit.com/>) to support their learning. The list of applications proposed for the students to try was introduced in the workshop and is documented in Appendix B. The students were also encouraged to try out any other application that they felt could assist them in their learning and to blog about it.

4.3.1.4 Evaluation Phase

In this phase, the participants were walked through the mobile learning activities. The main focus for their feedback was on the usefulness of the mobile learning implementation and also issues that they had with the activities. A sample of students was interviewed individually online. There were three volunteer participants for the interview. Other data were obtained from the students' blog posts and posts in the learning management system discussion forum that was established to assist them during the mobile learning implementation. The data collection methods are discussed in Section 4.6. Evaluating the design with the participants is also required by the mobile learning design guide (Diagram 5).

In the DBR process, it is recommended that the researcher interacts with learners to develop different aspects of the learning design (Collins, Joseph & Bielaczyc, 2004). The interaction with participants for evaluation was conducted in this

phase. Suggested aspects include the students' cognitive level (what do learners understand before they enter a particular learning environment) and resource level (what facilities such as the type of mobile phone that are available and how they are integrated with the activities) (Collins, Joseph & Bielaczyc, 2004). Thus students' cognitive level and resource level aspects of the exploration were embedded during data gathering which are discussed further in Section 4.5 of this chapter.

4.3.2 Second Stage

4.3.2.1 Analysis Phase (Needs Analysis)

The second round of analysis of the ADDIE design model illustrated earlier in Diagram 8 was deployed. This phase involved a new cohort of students on the same course, which means the research was conducted the year after Stage 1. The MReadiness questionnaire was again distributed to these students at the beginning of the course. It served the same purpose as in the first implementation.

In accordance with the mobile learning design guide (Diagram 5), the evaluation for mobile learning affordances and the learning environment were based upon the outcome of Stage 1 findings. The changes made are explained in the implementation phase.

4.3.2.2 Design and Development Phase

The second stage of analysis was used for further design and development of the learning activities for HE students. This is a similar process as in Stage 1 as proposed by Anderson (2005) and Amiel & Reeves (2008) in that cycles of testing and refinement iterate through each phase of DBR in order to produce richer outcomes. The same considerations that were used in Stage 1 were taken into account in Stage 2. Technical and pedagogical issues were further scrutinised to ensure the deployment of the second round was found more valuable by the intended participants. The Stage 1 findings provided a better understanding for learning design for mobile learning activities.

4.3.2.3 Implementation Phase (Stage 2: Mobile Learning Workshop)

The purpose and implementation of the workshop session were similar to the workshop in Stage 1. The aim of the workshop was to introduce the students to the concepts of mobile learning and to the specific mobile learning activities for the course. The workshop was conducted in Week 15 of the course. The implementation of Stage 2 lasted for 3 months and continued until the end of the course, making it a longer duration than Stage 1. The mobile learning activities were implemented throughout the course, for example with the use of SMS messages and moblog posts. In accordance with Stage 1, the Stage 2 implementation stage also had 'before', 'during' and 'after' the 3 hour mobile learning workshop.

4.4.2.3.1 Pre-Workshop

The same process was done as Stage 1, that is notification and reminder was sent.

4.4.2.3.2 During Workshop

The workshop was useful as a means of moving the research from a phase of analysing activity in the real world context, to focusing on practical issues and the design of specific technological features as envisioned by DBR. The introduction of the mobile learning workshop was similar as Stage 1.

As opposed to Stage 1, Stage 2 had only one hands-on session which was the session on podcasting. The reasons for this are explained in the findings chapter (Section 6.2). Explanation of podcasting and the ways it could be used for teaching and learning were presented to the students and the students were introduced to Audacity software which allows them to create MP3 audio files. As in Stage 1, it was not necessary to teach the participants how to use the software as they had already been exposed to it. Again, support in the form of step-by-step documentation of the software was made available through the learning management systems and also in the form of available tutors in the workshop itself. The students were then asked to form groups to create a 1 minute audio file on something they could use to teach English language to their own students.

This MP3 file was uploaded to a virtual space for other students to write their comments. This activity was not implemented in Stage 1. Before that the explanation of syncing their mobile phones to the computer were also explained as in Stage 1. The reflections of these changes in the mobile learning activities are discussed in Chapter 6 for Stage 2 findings (Section 6.5).

4.4.2.3.3 Post Workshop

The students were asked to blog reflections on their understanding of mobile learning. They were then asked to try out at least one mobile learning application that they expected would be able to support their learning. The students were also asked to blog their experience of using the selected mobile application to support their learning.

The students were asked individually to create an audio podcast reviewing any topic from the course. They were requested to upload the podcast onto a designated online space so other students could download them onto their mobile phones. Their peers could listen to the audio files through their mobile phones and leave their comments on the podcasts. The comments from peers could focus on the quality of the podcast or the quality of the review.

The participants were asked individually to collect images, video or audio files to be placed in the virtual digital repository. They were encouraged to capture everyday visual images or audio through their mobile phones. The participants needed to explain the reason(s) behind their choice of images, video or audio once they were uploaded. They were also asked to explain the use of these files in their own teaching. These were the activities that the participants went through in this phase.

4.3.2.4 Evaluation Phase

All of the participants' blog posts were reviewed and some participants were interviewed in order to elicit their reflections on the mobile learning activities. The feedback derived from this evaluation highlighted three challenges: (1) whether the participants were able to accept mobile learning as part of their

course, (2) students' opinions of different mobile learning activities and the use of mobile applications for learning, and (3) the issues the participants were concerned the mobile learning activities. The students were interviewed individually through an online chat forum of their choice which will be discussed in detail in Section 4.5.3 of this chapter.

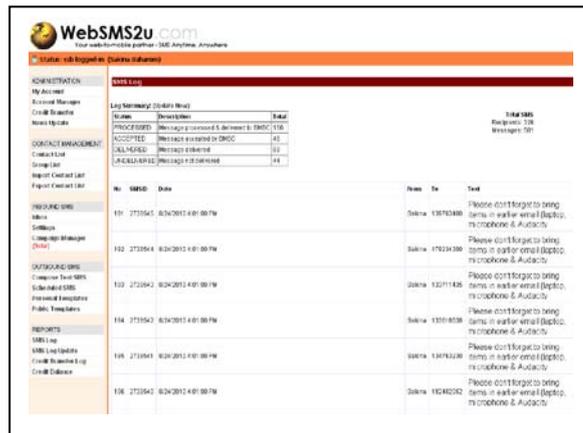
4.4 Mobile Learning Environment

The mobile learning environment was constituted from the proposed mobile learning activities (derived from Chapter 2 of the literature review) and the social constructivist learning principles derived from Section 3.5 i.e. contextual, reflective, collaborative, and multiple-perspective. In the following sub-sections, these learning principles are described, along with the mobile phone activities and mobile phone applications derived through Section 2.5.2. In some cases mobile phone applications were used for more than one activity. In the mobile learning environment, the learning principles are known as activities. This is because the central focus of this study is on the learning activities designed with the mobile phone applications.

4.4.1 Contextual Activities

Contextual learning principle as discussed in Section 3.5.1 indicates that learning support is provided in multiple contexts that promote authentic and situated learning. One of these activities for mobile learning is the series of SMS blast messages that are delivered to the students and tutors on the course. An SMS blast is a text message that can be sent quickly and easily to a group of people. In this study SMS was used throughout the course to serve as a bulletin board, for reminders, or to send individual messages to the students. SMS messages were sent through a web-based platform. The platform was provided by a company called WebSMS2u (<http://www.websms2u.com/>). I created an account, which could deliver SMS messages to either an individual or to all students. The illustration below shows a screenshot of the webpage.

Screenshot 1: Webpage of the SMS Blast Platform
 (Note: small screen size to protect the participants' phone numbers)



The usage of SMS is considered a part of a contextual mobile learning activity as it provides current information and reminders about any matter pertaining to the course. As learning entails a sense of immediacy, as discussed in Section 2.5.1, SMS messages are considered as situated learning. This is because SMS messages could be received or sent in the various contexts participants are in.

The digital repository can support contextual activity. The usage of digital repository fulfil the need of digital learners who want activities that creates and captures as discussed in Section 2.4.1 of the literature review. A virtual space was created for the participants to upload audio, video and images captured with their mobile devices. As they were pre-service teachers, the repository could be used as a teaching aid later in their teaching career. The platform for the participants to upload the different media files was Flickr (<http://www.flickr.com/>). This was also a reflective activity as the students needed to write their reflections on why and how they perceived they might need to use audio, video or images in their daily lessons. Since the picture, video or audio capture was done as and when the students saw something they perceived could be used in their lessons; this meant that those items were taken within the students' authentic context.

Another phone application that was used as a means to support student learning was Qipit (<http://www.qipit.com/>). The software allows students to upload a picture relevant to their multiple contexts from their phone camera and turn it

into a PDF file which can be printed later. Hence the decision to take a picture was based on student engagement and reflections on the content of the course.

4.4.2 Reflective Activities

All the mobile phone applications could be deployed in ways that offered opportunities for reflection. Reflective learning principle was implemented in two ways: (1) formally asking the students to reflect and construct learning by producing an outcome such as a podcast or, (2) informally providing opportunities for them to reflect and construct their understanding based on others' views as discussed in Section 3.5.2. Lee (2006) suggests that mobile learning activities support flexible cycles of doing and reflecting, and do not tie activities to access to a computer. This means reflective type of activities is able to be delivered through the mobile device.

Another reflective activity in this study involved the students being asked to create an individual podcast on any topic from the course to reflect their understanding of content. They were requested to upload the podcast to a virtual platform whereby their peers could download it to listen to it through their mobile device. The peers could add their comments about the podcast. The students had to understand and reflect on the topic they had chosen and explain that topic in their own way.

The digital repository could also be viewed as a reflective activity, as the students needed to choose and capture images which were uploaded onto a virtual platform and then submit comments on them. In particular, the students were asked to describe why and how they planned to use the picture. This encouraged the students to go through a process of analysing and making decisions about their own learning process.

SMS messages were sent to the students as reminders and questions to prompt reflection in the form of small bite-sized messages. The students were expected to reflect on them on their own. This also established a platform for the students to construct their understanding in an impromptu way.

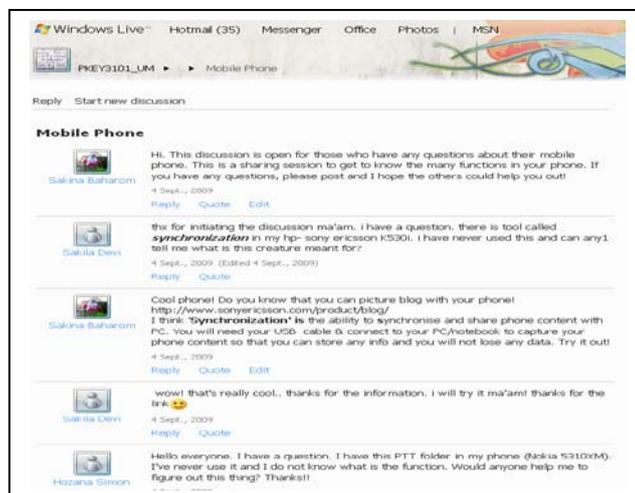
Finally, students needed to construct their understanding of the small bites of notes through the moblog. The moblog introduce questions concerning reflections on a topic.

The students were also required to reflect on the concept of mobile learning as a topic after the mobile learning workshop in their respective blog. They also needed to reflect on any mobile phone applications that would support their learning. Reflective blogging is a “constructive process of acting within an environment and reflecting upon it” (Sharples, 2004, p.4). Hence asking the students to write reflective blog posts during their course gave them the opportunity to construct knowledge based on their context.

4.4.3 Collaborative Activities

As discussed in Section 3.5.3, activities that promote discussion and refinement to understand a topic from the course come under the collaborative learning principle. The students were given support through an online discussion forum designed to answer mobile phone related queries. In Stage 1 of the study, the discussion forum was placed under the group’s Windows Live, the students’ social network space, whereas in Stage 2, the discussion forum was placed in the university’s learning management system. This virtual support was intended to provide peer support and this was specifically stated in the introduction to the discussion forum. Screenshot 2 provided the illustration of the discussion forum.

Screenshot 2: Webpage of the Discussion Forum
(Note: small screen size to protect the identity of the participants)



Students were required to work in groups to produce an audio podcast for a specific, targeted audience. Screenshot 3 shows an example of a podcast was uploaded and commented on by other participants.

Screenshot 3: Webpage for the Podcasts (Example)
(Note: small screen size to protect the identity of the participants)



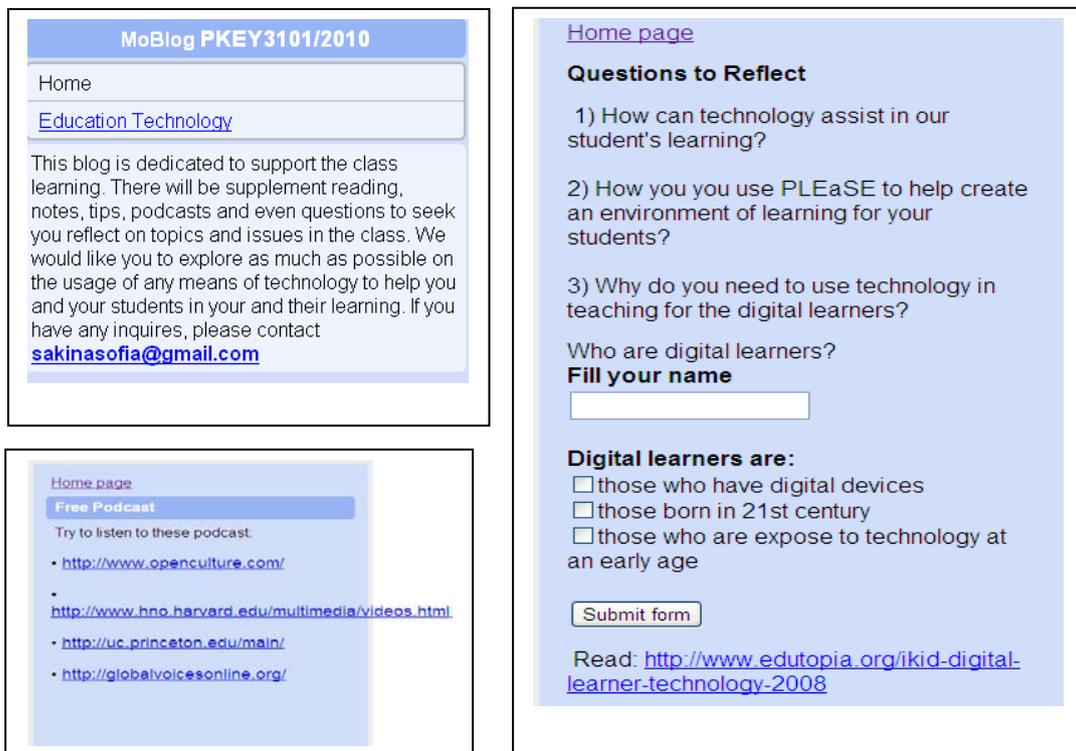
SMS also provided a mobile space for the students to collaborate with each other on assignments. According to Lee (2006), due to the comprehensive nature of mobile phones, collaborating and sharing cuts across time and place which has been discussed in Section 2.5.1 of the Literature Review of this study. The ‘always on’ capability of SMS was expected to ensure a fast and convenient way to communicate amongst the students. Therefore SMS as a type of mobile communication application was seen as being able to foster informal collaboration amongst students.

4.5.4 Multiple-Perspective Activities

This type of activity usually takes place when the students are either situated in multiple discussions with different people or when they are exposed to multiple resources as explained in Section 3.5.4. Multiple-perspective activities were

represented in the moblog which was specifically created to store multiple sources for the course. The moblog was a blog that was designed so that it could be viewed via a mobile device. The content of the moblog was static containing downloadable items such as relevant eBooks, audio podcasts and multiple-choice quizzes. The moblog was designed through a platform called Wirenode (<http://www.wirenode.com/>) which enables a person without programming knowledge to design blogs that are suitable to read on a mobile phone. The website for the course moblog was <http://mylearning.wirenode.mobi/>

Screenshots 4: PKEY3101/2010 Moblog



Through the moblog, students were provided with short notes to construct their understanding of the content. These materials were taken from sources additional to the course to support the course content. Screenshot 4 provides us with a glimpse of the PKEY3101/2010 Moblog.

The other multiple-perspective activities were the podcasting activities. Besides creating a podcast in a group, the students were individually asked to create a podcast on a reflection on a topic from the course. The students then uploaded the podcast to their respective virtual sites which then could be uploaded to an MP3 player or their mobile phone. This was a multiple-perspective activity as the

students needed to consider the audience in their design of the podcast. Students listening to each others' podcasts provided another perspective of the individuals' chosen topics.

4.5 Data Collection Methods

According to Vygotsky (1978) the “search for method becomes one of the most important problems of the entire enterprise of understanding the uniquely human forms of psychological activity. In this case, the method is simultaneously prerequisite and product, the tool and the result of the study” (p.65). Reflecting this, John-Steiner & Mahn (1996) concluded that social constructivism should emphasise methods that bring about cognitive and social change rather than highlighting the division between quantitative and qualitative approaches. DBR researchers employ a mixture of qualitative and quantitative methods in order to design and develop effective learning environments (Design-based Research Collective, 2003; Collins, Joseph & Bielaczyc, 2004; Sandoval & Bell, 2004, Dede, 2005; and Creswell, 2007). This is because multiple mixed methods generate data from multiple sources can confirm the credibility of the findings (Wang & Hannafin, 2005). Therefore multiple methods are proposed.

There are three major data collection methods throughout the Stage 1 and Stage 2 research process. The summary of the data collection methods for this research is presented in Table 11. The detailed explanation of the data follows upon this section of the chapter.

Table 11: Summary of Data Collection Methods

Research Activity*	Data Types & Participants No	Purpose of Data	Research Question
Analysis	MReadiness Questionnaires Stage 1: 70 Stage 2: 75 (all students in the cohort)	<ul style="list-style-type: none"> • Information about the availability of participants' mobile phone • Feedback on students' level of comfort with their mobile phones • Perception of appropriate mobile learning activities to support the 	RQ 1 & 3

		students' learning	
Design & Development		<ul style="list-style-type: none"> •Issues to be considered in implementing the design of mobile learning activities 	
Implementation	Students' blog posts Stage 1: 70 Stage 2: 75 (all students in the cohort)	<ul style="list-style-type: none"> •Usefulness of mobile learning activities using different mobile applications •Feedback from real scenarios when the designed mobile learning activities were implemented •Problems and issues faced by students in the implementation of mobile learning activities 	RQ1, 2 & 3
Evaluation	Students' online interviews Stage 1: 3 Stage 2: 6	<ul style="list-style-type: none"> •Usefulness of mobile learning activities using different applications •Feedback from real scenarios when the designed mobile learning activities were implemented •Problems and issues from students and researcher's perspectives on the implementation of mobile learning activities 	RQ1, 2 & 3

(*) this ADDIE cycle will be repeated twice with two cohorts

4.5.1 Questionnaire

Ruane (2005) believes that a questionnaire is “a self-contained, self-administered instrument for asking questions” (p.123). In this research a mobile readiness questionnaire known as the MReadiness questionnaire was utilised. The MReadiness questionnaire was deployed with both the Stage 1 and 2 participants. This had three purposes: (1) to gain better understanding of common mobile devices and applications; (2) to investigate students' perceptions of usefulness of mobile learning activities, and (3) to understand how the students use them to support their learning. This would enable understanding of mobile phone

applications or activities for the initial mobile learning design. This questionnaire was distributed to the students in the second week of the course for both Stage 1 and 2.

There were three sections of the MReadiness questionnaire which were used for this research. The first was intended to gain an understanding of the background of the participants, including age range and gender. The second section was about the mobile devices that they have access to, the type and common features of their mobile phones. In the final section the participants were asked about their expectations regarding the usefulness of mobile learning activities to support their learning. It was essential to know which type of mobile phone applications students were already using in order to match the mobile learning activities to the appropriate applications. Timmis et al. (2008) pointed out that “the students chose tools based on friendship groups and lifestyles, economic, and access factors” (p.373). Therefore, for students to be able to use the mobile applications of their choice, the applications included had to be those that the students were already using.

The questions informed by the literature discussed in Section 2.5, particularly the rubrics for mobile learning activities. Besides deriving ideas from previous studies, I also placed a free text response option in relevant questions to widen the options for the survey participants in answering. Dickerson & Browning (2009) suggested a few ways to choose appropriate applications for mobile learning. Amongst these are the availability of the technology amongst students, the students’ familiarity with the technology, the type of communication (asynchronous, synchronous, or combination) and also the direction of communication (lecturer to student, student to student, student to lecturer). These were considered when designing the questionnaire items.

This questionnaire was piloted with 40 students from a different HEI from that of the study. The pilot was done in Multimedia College, Kuala Lumpur where I had access to the gatekeeper of the business programme. The participants’ details are as described in detail in Section 4.8. The purpose of the pilot was to test the effectiveness of the questionnaire to meet the survey’s aim, and thereby to test the adequacy of the instrument, and to record average time taken to complete the

questionnaire. This was the Pre Analysis phase of Stage 1 (Section 4.3.1.1.1). The pilot was also conducted to improve internal validity of the questionnaire by being sensitive to ambiguous or difficult questions/statements in the questionnaire, gauging the need to add, re-word, discard or re-scale response options for questions and statements, and by gauging whether the instructions in the questionnaire were clear.

In the pilot the students were selected at random by the gatekeeper of the business programme. A specific time was given to me to meet the students to conduct the questionnaire face-to-face. The participants took on average 10 minutes to complete the questionnaire. There was one question about places where the students frequently access the internet (Section 2 of the questionnaire), which two participants did not understand, which used a Likert scale. I rephrased that particular question to ensure that targeted participants would not be confused in answering it. After collecting the questionnaires I sought the participants' opinions on the questions such as what devices they commonly use. There were some who gave suggestions on the content of the questionnaire such as the addition of mobile devices (I added mobile broadband pen drive) and types of instant message (I added Google Talk to the list of items). These changes were made to the questionnaire.

For Stage 1 participants, the MReadiness questionnaire was delivered on the second day of class (Week 2). These paper-based questionnaires were delivered after class, which meant that all students who attended would need to fill in and return the questionnaire. I also wanted to ensure that all questions were understood, so I attended the session in case there were questions. The students returned all questionnaires without any questions. In Stage 2, I deployed the MReadiness questionnaire through the course's learning management system, Moodle. This meant that in Stage 2, the questionnaires were deployed online. This questionnaire was deployed during the second week of the face-to-face class and the time allowed for students to fill it in was one week. The change in the deployment method was made because I was confident that the participants could understand all the items in the questionnaire and also because deploying an online questionnaire made the administration much easier.

Kumar (2007) and Bryman (2007) list a few considerations for formulating questions and responses to questionnaires. These suggestions were taken into account in developing both questionnaires. For example, it was important that the questionnaires should use simple language and avoid technical jargon. Ambiguous questions should also be avoided as they can be interpreted differently by different participants. This means that the questions and choice of answers must be clear. These were the matters that I had particularly paid attention to during the pilot of the questionnaires. I also needed to ensure that I did not ask questions that were based on assumptions for example, a question such as 'how long have you used the mobile phone', assumes that students have mobile phones.

I had also taken into consideration the way that I would need to communicate my findings by choosing the response scale. For example whether it should use categories such as the type of mobile phone, or use an attitude scale on an issue such as "favourable, uncertain, unfavourable, and strongly unfavourable". Some sections of the questionnaire use the Likert scale in the MReadiness questionnaire. This meant that the multiple-indicator measures finer distinctions of a question, hence deeper knowledge of the data can be derived (Bryman, 2008). For instance, the list of mobile applications that made an impact on the students learning or personal organisation was determined through the indicated frequency of use (many times a day, at least once a day, at least twice a week, less than twice a week) and through the rating of each provided applications such as 'very useful', 'useful', 'possibly useful', 'probably not useful' or 'don't know'.

4.5.2 Students' Reflective Blog

Research strategies in mobile learning research need to be adaptive to include alternative approaches such as analysis of interaction logs and students' contributions to externalized constructions of meaning (Taylor, 2006). In this research participants were asked to blog their reflections on mobile learning activities. Students created blogs as part of the taught course, in which they blog on weekly themes that were given to them after the face-to-face classes. These blog posts and active participation in them was part of the course assessment.

Several mobile learning studies have used a diary, for example the usage of the logbook to track daily activities of location, duration, and type of activity in order to reveal patterns and trends in technology adoption as in Sharples et al.'s (2005) Mobile Learning Organizer study. The use of students' blog posts for data collection was deemed similar to the use of a reflective diary. This is because the blog is seen as a virtual diary. Vavoula (2005) suggests using structured diaries for mobile learning research; a structured blog post would also be a similar means of gaining insights into the deployment of mobile learning activities to support participants' learning.

Vavoula (2005) proposes the following types of entries for a reflective diary which are: (1) when the participants had used the device for a specific purpose for the first time, (2) when the participants found the device particularly useful, and (3) when the participants found a specific problem or difficulty with using the device. These were the types of entry that participants in this study had to blog after the mobile learning workshop. The students were asked to write reflections on mobile learning after the workshop. They were also asked to reflect on the use of one mobile phone application that they perceived could assist in their studies. These applications were discussed in the mobile learning workshop and are listed in Appendix B.

The main aim of the blog posts was to capture the participants' thoughts on using mobile learning as a HE student. They were also to ask to blog on issues that they had regarding the mobile learning activities or applications being used. They were also required to reflect on possibilities for using a mobile learning application to support their own learning. From a series of mobile phone applications introduced to them during the mobile learning workshop, students were requested to choose one application to try. Reflections, through the participants' respective blogs, were requested in both Stage 1 and Stage 2.

Blogs are online journals which use a simple interface without the need to understand of web scripting such as HTML (Yang, 2009), and therefore they are easy to create. Stone (2012) recommends blogs for collecting feedback as they are a "low stakes, non-intimidating vehicle" (p.259) and issues can easily be raised by the participants. Brescia Jr. & Miller (2007) and Jones & Alony (2008)

advocate blogs as a source of data as they are personal journals published online which allow for freedom of expression and can therefore provide rich personal views. The benefit of blogs as a data collection tool is that they do not require synchronization between researcher and participants, and are therefore more convenient (Jones & Alony, 2008). Unfortunately, blogs are not always well written or are not well elaborated, with poor phrasing or irrelevant context (Jones & Alony, 2008). However, I addressed this by personally contacting the participants through email to seek further clarification if there are any parts that required me to do so.

Yang (2009), in her study of using blogs to enhance reflection, found that HE students in Taiwan regarded the flexible time and space for them to reflect and discuss as liberating. However, the author did caution that anonymity is a big issue when grades and friendship were at stake, because in an Asian culture questioning and challenging are not favoured traits. I managed this situation by acting as a 'prompter' through all the participants' blog posts. In the comments section of their blogs, I posted questions in order to engage students into further reflection when they replied to the feedback. I also declared that I was a guest tutor, hence was not part of the assessment team. My role in the research is highlighted in Section 1.3.1 of this thesis.

Nevertheless, as cautioned by Bryman (2008, p.228), just as with any form of diary usage for reflection, I was aware of problems that might arise, for instance:

- Diaries can suffer a process of attrition as students could lose interest on the task of completing a diary
- Students may become less diligent over time about their record keeping
- Failure to record details sufficiently quickly so that memory recall problems arise.

However, I overcame these issues by only requesting the students to submit 3 entries on the mobile learning topic for the duration of the whole course. This seemed not to be onerous for the students as they needed to write other weekly reflective blog posts about other topics in the course.

4.5.3 Online Interview

Somekh (2007) suggests that interviewing is a means of gaining insights into students' knowledge and understanding. Vavoula (2005) proposes the use of interviews by mobile learning researchers as an approach based solution. This means that interviews are used for mobile learning research in order to settle hands-on problems, because through interviews "questionable accuracy of recall, the degree to post-rationalisation skews data, and the effects of the participants' concern over image" (Vavoula, 2005, p.341) could be overcome. This means that I was also able to capture different perspectives on the use of mobile devices for learning.

In this study online interviews were used to gain feedback from students as to the possibility of providing mobile learning as an additional delivery platform, the usefulness of the mobile learning activities and also problems that the students faced, as outlined in research questions 1, 2 and 3 of this study. The reason for using the online mechanism was because it was difficult to gather students for face-to-face sessions due to their workloads and also the fact that the students and I were based in different countries.

One of the basic issues in designing for online interviews is whether the selected participant has the equipment and appropriate access for the interview to be arranged (Madge, 2006). There should be flexibility for participants to respond conveniently to the interview questions. If the interview is synchronous there is also the need to arrange an appropriate time. One of my concerns in this research was the potential transfer of costs to the participants through the use of the internet. I overcame this by ensuring that the students could use the computers at the university where my research was conducted, which have internet access.

According to James (2007), due to the lack of body language and other linguistic clues such as tone of voice, online interviews carry some disadvantages. On the other hand, I believed that the students selected were proficient and experienced in the online environment, and would be comfortable with using emoticons, for example ':)' or acronyms such as 'LOL' (laugh out loud) to replace body language. In a similar way as with a face-to-face interview, I put my participants at ease and gained their confidence through small talk at the beginning of the

interview session. Furthermore, I took steps to listen, reassure and develop sensitivity to comfort issues as the means to develop a personal relationship with the participants. In their study, Nik Aziah & Nik Suryani (2005) found that when they interviewed Malaysian HE students through email, there was no issue of dominant or shy participants. This encouraged me to deploy this method further.

Online interviews can be synchronous or asynchronous. Hewson & Laurent (2008) explain that asynchronous interviews tend to “generate richer, more detailed, elaborate and reflective data” (p.68) whereas a synchronous approach tends to be playful, less elaborate but captures the instincts of the participants. Therefore I decided to use synchronous interviews through individualised chat sessions with the students in order to better capture an authentic student voice. For the synchronous interview, it is felt that participants might have difficulty in catching up in real-time typing. This is because there are two skills in typing (language grammar and spelling) (Chen & Hinton, 1999) and also the difficulty of capturing the flow of thoughts. Furthermore, if English language is used, then the students need more time to write and think as this is not the participants’ first language. These were the two main issues with synchronous online interviews. I overcame them by not pushing for the students’ feedback immediately when asking a question; hence they felt at ease with the pace of the interview to provide feedback. I also allowed for the students’ use of ‘Manglish’ (Malaysian English – usage of colloquial English language that allows Malay language in the communication) which the students felt at ease to use. I believed that Malaysian HE students would be able to open up to me more through this informal chatty method that I presumed most of them were comfortable with.

I employed open questions as it gave me room for broader and general information on issues discussed (Anderson, 1998). Through this type of question I was able to find better insights from my participants. The questions also put my participants at ease as this type of question is easy to answer. Then I gradually sought out specific answers on the particular mobile learning activity that the participants had experienced. The questions asked were whether the participants found a specific mobile learning activity useful in supporting learning, and what were the environmental issues they experienced while accessing mobile learning

activities. They were also asked questions about where they usually accessed mobile learning activities, what common application of the mobile phone, whether they were able to communicate or reflect better with applications of the mobile phone, whether they found the ubiquitous nature of the mobile phone applications useful, and whether the activities had supported them to construct their understanding of the course content. I selected the participants own chat forum as they would be familiar with it. This is to ensure that the participants felt at ease during the interview session.

4.6 Context of Study

Vygotsky argued that an understanding of the participants' environment was essential to explaining their behaviour and development (van der Veer, 2007). Therefore I needed to understand the context of the research as it is part of understanding the study as proposed by interpretivism and social constructivist theory. In Chapter 2, characteristics of Malaysian HE students (Section 2.4.2) and the participants as digital learners (Section 2.4.1) were discussed. This section provides a more detailed description of the participants of the research.

Educational Technology in Primary Education (PKEY3101) was the course chosen for this research. The course's main aim was to introduce the use of educational technology in the classroom to trainee teachers. Due to the nature of the course, introducing mobile learning concepts to the students was welcomed by the main lecturer, and the deployment of mobile learning activities to support the course was welcomed. The curriculum for the course is provided in Course Information in Appendix A.

These students met for a weekly 3 hour face-to-face lesson as the main delivery mechanism of the course. The course used Moodle as the university's learning management system. Social networking was also used as part of the course as another virtual means of delivery. The choice of social network tools was influenced by the recommendations of the main lecturer and the group of tutors. For example, in Stage 1 of the research process, Windows Live was used whereas in Stage 2 Google Sites was administered. Thus, there were several

delivery mechanisms in this course, and mobile learning was viewed as another delivery mechanism added to support students' learning.

There was one main lecturer and five tutors for this course, including me. The need for several tutors was due to the fact that the face-to-face classes and workshops involved intensive one-to-one and one-to-many communications. These tutors were able to assist, particularly with the various types of virtual discussion. Most of these tutors were skilled in their own instructional technology tools and areas of interest, such as use of video, e-Portfolios, or Moodle for teaching and learning, and chose to lead particular lessons on this basis. Since I was researching in mobile learning, any activities in this area came under my responsibility. My role in the course was made known to the participants at the beginning of the class as per illustrated earlier in Section 1.3.1 of this thesis.

Weekly topics were designed and delivered on the course and the Course Information, documented in Appendix A, was used as a guide. However, an initial meeting at the beginning of the course and various forms of virtual discussion shaped the course, especially the decision on the type of web-based tools which would be used for teaching and learning, to be introduced to the students. There were two types of assessment for the course. There was the main examination that the students needed to take, which constituted 40% of their total marks. The other marks came from three assignments of 20% each. The first assignment was their ongoing ePortfolio, the second was an ongoing Reflection Blog and the last assignment was to produce a teaching product; for example a video package kit for teaching.

The course was based on the Pedagogy of Engagement Integrating Technology (PoEIT) model. This model provided the basis for immersing students in the use of web-based tools for their learning (Raja Maznah, 2006). In the class, students were guided to explore, develop and reflect the construction of their understanding through creating learning content either individually or in groups. The tutors would introduce the tools and facilitate the students' learning processes virtually through the various delivery mechanisms. The basic tenet of the course placed the learner at the centre of the learning process, and the tutors

were in the role as guides (Prawat & Floden, 1994). Usually, as described by Raja Maznah (2011), in “the three-hour weekly class meetings, the first hour was often used for activation of prior learning followed by lecture and demonstration” (p.5) of the web-based tool that could be used for teaching and learning. This was also the structure of the mobile learning workshops in Stage 1 and 2 which were designed as described in Section 4.4.1 and 4.4.2.

The tutors appeared to view learning as a shared process, as at times both the tutors and the students were also learning about the tools at the same time. At times tutors took on the facilitator’ role, especially in transforming the affordances of tools so they could be used as teaching resources. The course was based on the notion of transformation of knowledge which is the ability to apply the knowledge of tools to the design of teaching materials, rather than only knowing the mechanics of the tool.

Research participants had been predicted to take an active role in their learning. The creation of artefacts that could be applied to their own teaching practice would be an outcome of the course. Creating these artefacts was made part of the course assignments in order to provide them with rewards for their efforts, and to motivate them to deliver the products. Students were also assessed on their weekly reflective blog posts. The students were given support through the university’s learning management system to design and develop their individual blogs. The blogs were set up on user-friendly platforms such as Windows Live blog and Google Sites. Different forms of support were offered: step-by-step guides, video tutorials and discussion forum support. Every week the students were requested to write their reflections after each lesson. Guidelines on blogging and reflective practice were also provided to the students. This included criteria on which their reflections would be graded. Peers and tutors alike were expected to comment on these posted reflections.

Students’ exposure to ICT was investigated on the first day of the course. The survey indicated that the students were already familiar with ICT tools and that they did own some form of device which could connect to the internet, such as a laptop. The students also subscribed to social network tools such as Friendster and Facebook (Raja Maznah, 2011). However, a much more detailed survey on

readiness for mobile learning was implemented in order to gauge the preparedness of these participants to accept this type of learning.

4.7 Participants

There were three different cohorts of students in this study including the pilot stage of the research process. All of the cohorts were students from selected HEIs in Malaysia. Ruane (2007) and Bryman (2008) define the study participants as 'convenience samples' as they were chosen due to convenience of access. I was able to gain access to the course for several reasons. I was a former officer of the university's Vice-Chancellor and the targeted course came under the supervision of my former Master's thesis supervisor. Ruane (2005) describes gatekeepers as "individuals who can give the researcher legitimate access to the field" (p.165). Furthermore, these participants were also a purposive sample because they were chosen based on my judgment that these participants would likely provide information that could achieve the objective of the research (Kumar, 2005; Bryman 2008). The course was chosen for being flexible enough to provide me with the capability to introduce an innovative teaching pedagogy, since the course is an introduction to educational technology; hence I was encouraged to use a variety of technologies freely throughout the course.

In the Pre-stage section of the study, the pilot questionnaire was implemented. The students were a group of 40 students at the Multimedia College, Kuala Lumpur. These were third year students taking business multimedia courses. Even though the pilot participants were on a different course from the main participants of the study, they had a similar background to that of the participants in Stages 1 and 2 as they were studying in a Malaysian HEI. They were also within the same age group.

For Stages 1 and 2 of the study, participants were enrolled for an introductory course on Educational Technology in Primary Education (PKEY3101). These were third year B.Ed Teaching English as Second Language (TESL) students from the Faculty of Education at the University of Malaya, Kuala Lumpur. The course was a 120 credit course which was scheduled for a 14-week semester. It

was compulsory for the students to pass this course to be able to graduate for a bachelor of education degree.

These students met for a weekly 3-hour face-to-face session as the main delivery mechanism of the course. They also used Moodle as part of the university's learning management system. Social media networks such as Windows Live were also used on the course as a delivery mechanism mainly for the students to build their respective blogs and reflect on the content of the course. There were 70 participants in Stage 1, all of whom participated in the MReadiness questionnaire and who also submitted their reflective blog posts. There were 75 participants who took part in Stage 2, all of whom also participated in both data collection methods. For the online interview sessions, there were three participants in Stage 1 and six participants in Stage 2.

4.8 Ethical Issues

In a research study there are many ethical issues to be wary of. There are ethical issues concerning research participants such as the issue of consent, privacy and anonymity, the possibility of causing harm and the confidentiality issue. There are ethical issues in relation to the researcher being biased, or making inappropriate use of information. The ethical considerations reviewed for this study were based on the Graduate School of Education Ethics, University of Bristol, submission form (Appendix C). The University of Bristol was my former university when the data collection was taken; hence the ethical approval came from them.

There are also other ethical issues within a virtual environment, such as the mobile learning field, that would be similar to any data collecting research which includes informed consent. On the consent form detailed information on the research, the nature of data collected, confidentiality issues, and also the rights of participant(s) to withdraw from the study were stipulated clearly. Marge (2006) stated that issues and challenges from more traditional research could still arise when using virtual methods. Therefore, since some of my data collection methods were in the form of virtual methods such as using the students' blog posts and also the online interviews, such issues were deliberated.

According to Ruane (2007) the “ethical obligation remains for researchers to anticipate likely outcomes and to take those steps that would mitigate the harm and maximize the benefits that might come to participants” (p.19). One way to address this is through debrief sessions whereby the researcher can provide more information about the study and elicit feedback on their thoughts, reactions and negative after-effects. I provided the briefing and then the debriefing sessions verbally during the first day and on the last day of the course respectively for the participants in both stages of the research process.

Ruane (2007) emphasises the issue of informed consent. He stressed “the right of individuals to determine for themselves whether or not they want to be part of a research project” (p.19). Anderson (1998) posits that the “most fundamental principle for ethical acceptability is that of informed consent: the involved participants must be informed of the nature and purpose of the research, its risks and benefits and must consent to participate without coercion” (p.18). Students in this study were fully informed about the research and also all aspects of this research project that might influence their decision to participate. Issues highlighted were the cost of some mobile learning activities. I briefed them on how to reduce the issue of cost, for example by downloading through their desktop or notebook computers and then transferring the files to their phones. Formal consent was granted by the participants through the MReadiness questionnaire. By agreeing to fill in the questionnaire the participants agreed for the results of the questionnaire to be used for research.

Furthermore Ruane (2007) also raises the issue of volunteerism as the participants were to volunteer to be part of the research. He noted that “institutional settings entail authority relationships that are inconsistent with true voluntarism” (p.19). Anderson (1998) also discusses this possibility of students volunteering for this study out of obligation because I was seen as more powerful. This means that the students might find it hard to say ‘no’ to authority as I was a tutor on the course. In Asian culture it is perceived that the issue of power relations could be problematic in data collection. In this research as noted by Anderson (1998) and the British Psychological Society (n.d), the students do have the right to withdraw from the study. Thus, I stressed to the participants that

their participation in this study was by no means linked to achievement of course credits. However, should there be a withdrawal from the study; I needed to ensure that I could identify the part of my raw data that needed to be excluded.

I was also concerned with the public versus private issue. As recognised by the British Psychological Society (n.d), internet communication is often effectively public through greater visibility, traceability, and permanence, but research conducted online could be more publicly accessible and could leave permanent records of communications. According to Anderson & Kanuka (2003) there a difference between confidentiality (researcher knows the identity of participants but take steps to keep them confidential) and anonymity (researcher takes steps to ensure identities are not revealed to them). In this research, the participants' identities are known, hence I was more cautious to safeguard the participants' anonymity.

I understood that as much as I wanted to it was quite impossible to ensure absolute anonymity of the participants especially in an online environment. In my interview sessions, even though they took place via a closed medium such as the platform Windows Live or Google Talk, there was a need to ensure safety measures for the chat or discussion sessions. In order to preserve the anonymity and integrity of the research participants, I have decided not to include direct quotes from public or semi-public sources that were used in this study as research data. Protecting the identity of the research participants is more important than the research evidence. If I used direct quotes in my publication, that data could be traceable to any particular student or groups. This traceability notion was something that I needed to ensure as anything could easily be searched online nowadays particularly in the students' blog posts. However, quotes from the online interviews, which were conducted privately, were included as research evidence.

4.9 Challenges

There are many challenges in DBR and mobile learning research. In this section these challenges are discussed in order to ensure the rigour of the research.

Rigour in DBR requires the connection of the outcome and the intervention in order to ensure better alignment between theory and design (Hoadley, 2004). DBR acknowledges the terms and concept of ‘validity’ and ‘reliability’ (Design-Based Research Collective, 2003; and Hoadley, 2004). Nevertheless it uses the term ‘replicability’ instead of ‘generalisability’ (Design-Based Research Collective, 2003; and Hoadley, 2004). This study does not engage in the debate over terms used, such as trustworthiness versus validity. However, the study takes the stand of Morse et al. (2002) that any form of research necessitates rigour, hence the need for reliability and validity even in qualitative research.

Validity in DBR is addressed through partnership with the participants and also the iteration process which increases the alignment of theory, design and practice (Design-Based Research Collective, 2003). One of the major challenges in DBR highlighted by Sandoval (2007) is that DBR tends to collect too much data hence the need to focus on the right data. Thus, in order to ensure validity, DBR needs to warrant the “likelihood that our interpretation of the result accurately reflects the truth of the theory and hypotheses under examination” (Hoadley, 2004, p.204). According to Hoadley (2004), further evidence of validity is achieved when the intervention created is “aligned to the represented theory, and systemic validity which calls for the true inferences of selected theory in order to communicate the findings” (p.204). The combination of several methods encouraged by DBR also increases the validity of this research. The methods serve as a checking mechanism for the findings gathered.

As DBR takes place in the real world, another problem is the lack of researcher control unlike where the research is situated in a laboratory setting (Peterson & Herrington, 2005). In a real world context there are many factors that cannot be controlled and this means that DBR studies are exposed to many variables which are deliberately not controlled and could therefore lead to ‘under-conceptualisation’ and ‘over-methodologisation’ (Dede, 2004, p.114) which means shallow reflections and too many methods. In this research the aims and research questions guided the comprehension and process of data analysis, thus the issue did not arise.

There is also the issue of replicability in DBR. Collins, Joseph & Bielaczyc (2004) warn that DBR, being contextualised within educational settings with factors that cannot be controlled, means that researchers cannot ensure that the intervention can cut across all contexts. Generally speaking it is difficult to make general claims due to the different factors in any context, but there could be selected features that may be repeatable. According to Hoadley (2004), to establish replicability in DBR research, it is the responsibility of the researcher to document what happens in an unbiased way and not only select and capture data that confirm prior understanding. This goes on to produce a highly refined process (Design-Based Research Collective, 2003) in which generalised findings are applied in a local context to guide a richer design process (Hoadley, 2004). Through this process the mobile learning pedagogical guidelines are derived.

Besides the methodological challenges, there were also issues arising from the field of mobile learning itself. In this study the students were using their own mobile devices. For the researcher, this means “less control over the research context and increased complexity, for example in terms of controlling variables” (Pachler, 2004, p.4). The implications of this for the research outcome are that by using personal mobile phones, the devices or mobile applications were likely to become outdated quickly (they have a short lifespan), hence making it difficult to replicate the study. There was also the need to adjust the learning design to changing technology. However, as proposed by Traxler & Kukulska-Hulme (2005), it is the evaluation of learning instead of technical stability that should be the focus of mobile learning research. Besides meta-cognitive change in students, which would indicate that learners had learned something as a result of the intervention, the evaluation of the study may also focus on affective or social changes (Traxler & Kukulska-Hulme, 2005). Affective or social changes are concerned with the feelings, values and preferences of the learners in this study. Moreover these social changes can also be evaluated in terms of the various ways in which learners could collaborate, reflect and view multiple-perspective opinion in a context such as by increasing interaction or competencies amongst their peers. Therefore as stressed in Chapter 1 and 2, the emphasis of this research is not on the technology but on the learning support capabilities of the

mobile phone which means that the issue of expeditious technology change is not a central issue.

The shifts to working in real-world context raises many issues related to methodology when the researchers are also designers of the educational environments (O'Donnell, 2008). Furthermore, the researcher can introduce observational bias because they are involved in the multiple tasks of documenting and analysing, providing feedback and creating interventions (Kumar, 2007). As stated in Section 1.3.1 (Chapter 1), I have several roles in this research. Hocking (n.d.), in her reflection on a design-led PhD thesis, states that the “personality of the designer is reflected in the design writing to help highlight the individual context of the author which permeates through the work, giving it direction and characterising its innovation” (p.3). Hoadley (2004) suggests that in DBR the “researcher is both a participant in a particular context and an agent for trying to generalize to other contexts” (p.211).

I overcame this challenge to establish credibility of the data by scheduling a series of member checks throughout the research process. One way was to take “data and interpretations back to the participants in the study so that they can confirm the credibility of the information and narrative account” (Creswell & Miller, 2000, p.127). This is also a collaboration between the participants and the researcher which is encouraged by DBR and also the mobile learning design guide (Diagram 5). I worked with the all the participants of the online interview on the matter which one way was the check their own respective interview transcript.

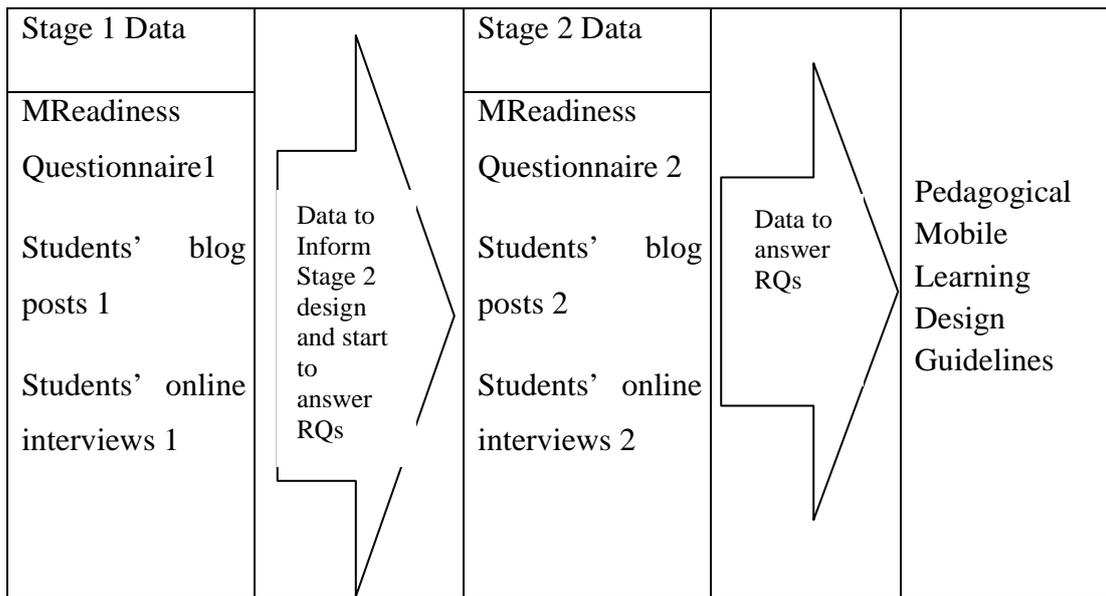
In determining the validity of research, Creswell & Miller (2000) also recommended peer review or debriefing which is “the review of the data and research process by someone who is familiar with the research or the phenomenon being explored” (p.129). I worked with one of the tutors in the course to assist me with the process of reviewing the interpretation of the data for each stage of research process. Besides that my former supervisor at University of Bristol also reviewed the coding and themes derived from the raw data.

4.10 Data Analysis Strategy

Various data collection methods were employed to derive the necessary data to achieve the goals of the research as described in Section 4.6. The data gathered through the two stages ensures reliability of the data collected and also ensures rich data for the different purposes for each type of data. Each method and resulting data set was intended to fulfil a different purpose, either to inform the design or to evaluate the participants' perceptions of the usefulness aspect of the mobile learning applications and activities to support their learning. The summary of the data collection process and its functions are presented in Table 11 (Section 4.6).

In this study there was no separation between the data collection and analysis phases as analysis occurs throughout the study. In taking a social constructivist position, data that was analysed needed to be viewed through the lens that views all human activities as taking place in a cultural context that is mediated by tools and best understood through the historical development which was discussed thoroughly in the review of the interpretive approach (Section 3.2). Thus, data were collected and analysed first with the aim of informing the iterative design process, and also understanding the students' perceptions on the use of a particular mobile application to support their learning. This means that at each stage of the research process data collected at that particular stage was analysed on its own. This was particularly important as Stage 1 data, be it from the MReadiness questionnaire, the reflective students' blog posts or the individual interview findings, were intended to inform the design and development of Stage 2 research process. This process is illustrated in Diagram 9 as follows:

Diagram 9: Data Collection Process



The intervention analysis for this study was seen holistically as suggested by the Design-Based Research Collective (2003). Hence, the analysis aimed to gather comprehensive findings in order to be able to answer the study's research questions. The need to view findings holistically was also supported by Vygotsky (1978). Through the lens of interpretivism, which requires multiple voices, all participants' opinions were studied. No participant was avoided or left out and therefore the main analysis frame of this study was to view the data holistically. This analysis cycle was conducted in two stages as in the stages of the research process.

The qualitative data, namely the questionnaire outcomes, were based on descriptive statistics which were used to analyse the closed questions. The purpose of the Readiness questionnaire was to inform the design of the mobile learning activities because it was intended to provide a picture of the students' use of mobile phone applications, their digital experience and their perceptions of a range of possible mobile learning activities. The interpretive approach and social constructivist principles acknowledge that the background of the person is important, hence the students' background experience with use of mobile phones was important in addressing the research questions about which mobile phone applications and associated learning activities could provide useful support for

the students. The Stage 1 questionnaire was processed using SPSS software, and for the Stage 2 questionnaire, the findings were derived from the university's learning management system.

Content analysis of the qualitative data collected through interviews and observations of the online activities during the teaching course needed to be organized in the light of the main themes of the research. The process of coding is described later in this section. I was aware that interpreting such a rich variety of data would be challenging in terms of assembling it into a meaningful, accurate and elaborate account of the students' learning experience. As Kumar (2005) describes it, classifying the themes meant that I had to examine all the verbatim responses to identify both those that support and those which contradict my arguments. The interpretive approach calls for multiple voices, and therefore all verbatim statements were studied regardless of whether they supported or did not support the mobile learning activities.

Teddlie & Tashakkori (2009) describe the separation of data analysis 'parallel mixed data analysis', whereby the data collected must be analysed separately and once the results are completed for each data set then these findings can be utilized to inform, explain or strengthen the results from other data sets. Wang & Hannafin (2005) recognise that DBR analysis "is conducted simultaneously with data collection and coding to improve the design and to address theory-generation goals" (p.17). In order to interpret and explain findings from the qualitative data in this study, such as students' blog posts and the interviews, the emerging themes that resulted from the qualitative data were used for further analysis of the data. These emerging themes, which were in the form of structures or clusters and were derived from qualitative data, were able to enhance understanding of the survey results. These clusters were based on the social constructivist learning principles. This means that theory of learning, in this case social constructivism, informed the analysis across the 2 stages. At the beginning, a set of categories arising from the theory was elicited through the data and at the end during the discussion of emergent categories. Other themes studied were based on the core research questions of the study, such as whether the students were prepared to accept mobile learning as another platform for

course delivery, the mobile activities and applications that the students seemed to use regularly to support their studies, and issues that were raised by the students in engaging with the mobile activities.

The research question for this study of ‘what’ could be answered through the questionnaire whilst the ‘how’ (or ‘how’ not) would be answered through the qualitative data. For example which mobile learning applications were favoured by the students to support their learning could be answered through the questionnaire but how these applications were useful was answered through the interviews and/or the students’ blog posts.

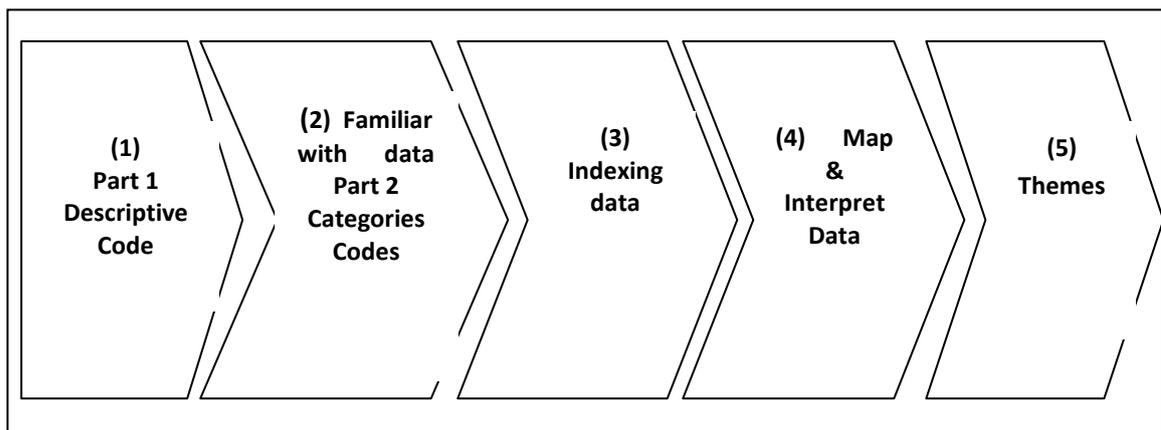
In the first step towards analysing the qualitative data, I adapted the analysis framework suggested by Ritchie, Spencer and O’Connor (2003). This framework is proposed to be particularly useful when considering practice-related questions because it is a relatively straightforward and structured means of organising data. The five stages of the analysis framework suggested by Ritchie, Spencer and O’Connor (2003) are:

1. Familiarisation with data (becoming thoroughly immersed in the material collected)
2. Indexing data (labelling key issues that emerge across a set of data)
3. Devising a series of thematic charts (allowing patterns across a set of data to be explored and reviewed)
4. Mapping and interpreting data (looking for associations, providing explanations, highlighting key characteristics and ideas)
5. Developing a thematic framework (identifying key issues from data)

I added another step to this framework in order for it to be suitable for this research. Before becoming familiar with the data I had listed the initial codes based on the social constructivist learning principles namely contextual, reflective, collaborative and multiple-perspective. I had also added codes for the predicted mobile phone applications that could be used for learning support such as SMS, and also codes for the advantages and disadvantages of mobile learning based on opinions of the participants. I named this the Part 1 descriptive code which is presented in Appendix E. Upon familiarisation with the data as step 1 of Ritchie, Spencer and O’Connor’s (2003) analysis framework, and step 2 of data

indexing, the series of codes were revised and named the Part 2 categories codes. The selection of part 2 codes was done using Microsoft Excel in which verbatim responses were cut and pasted into categories for the designated codes. An example of this process is attached in Appendix F. Then I proceeded on to step 4 of interpreting the data in which I produced the 5-step thematic framework which provided further analytic themes to answer the research questions. The main aim of the thematic framework was to determine the relationship between the mobile phone applications and the participants' learning activities. Furthermore, evidence of the mobile learning activities' support for learning, and issues raised by the students were also captured. Further thematic analysis of the codes was conducted in order to develop more integrated themes to directly address the research questions of this study. Diagram 10 illustrates the qualitative data process for this study.

Diagram 10: Qualitative Data Process



The selection of codes was done manually through colour coding for Part 1 descriptive codes (Appendix E). For the Part 2 codes, verbatim quotes from the participants were selected to illustrate the identified categories; an example is presented in Appendix F. The frequency of the themes which emerged was also recorded in order to see which issues or ideas were more commonly discussed by participants. The codes were marked according to the stage of the research, the type of qualitative data, and the initials of the participants, for easier identification. For example, S1BIY indicates Stage 1 taken from the blog posts and IY indicates the initials of the participant. The notion that extraction of themes is capable of providing answers for my research questions is supported by

Boyatzis (1998): “A theme is a pattern found in the information that at minimum describes and organizes the possible observations and at maximum interprets aspects of the phenomenon” (p.4). For the Part 2 categories, I generated a much more detailed set of codes in order to make the data more meaningful. This approach is proposed by Marshall & Rossman (2006) who state that “each phase of data analysis entails data reduction, as the reams of collected data are brought into manageable chunks, and interpretation, as the researcher brings meaning and insight to the words and acts of the participants in the study” (p.156). For example, in the ‘advantages theme’, there appeared to be sub-themes such as ‘cost’ and ‘low-broadband internet’, therefore a more analytical thematic framework was drawn from the Part 2 categories’ themes. These themes appeared to be in the form of activities such as contextual activities.

4.11 Summary of Research Process and Design Process

In this chapter there are two processes being explained. The research process constituted the adaption of DBR as the methodology and also the use of ADDIE Model to translate the research process in detail. DBR was deemed suitable to meet this research’s aim while supporting interpretivism as the research paradigm and social constructivism as the research’s theory. Through the ADDIE phases, the narration on how the research process was conducted and also the activities implemented were explained in detail.

Besides the research process, there is also the design process of the mobile learning environment. These two processes were consolidated in the explanation of the ADDIE phases and also through the implementation of mobile learning design guide as in Diagram 5. The 9-step linear process of the mobile learning design guide was adapted throughout the analysis, design and development, implement, and analysis phases in both stages of the research process. This means that research process and design process run parallel to each other. The mobile learning workshops both in Stage 1 and 2 explained the implementation of the mobile learning environment. The design process was not only explained by the mobile learning design guide, but also through the mobile learning environment developed through the social constructivist learning principles. The

activities were explained in detail through the four learning principles: contextual, reflective, collaborative and multiple-perspective.

There were 2 stages of data collection which were analysed and discussed separately because Stage 1 data informed the Stage 2 data design and implementation, as discussed earlier. Throughout these two stages, data were collected through the MReadiness questionnaire, the students' blog posts and also the students' interviews.

There were bound to be challenges in any form of research, especially in design research. DBR challenges were discussed, along with challenges from the mobile learning field. Perceived issues were addressed as best as possible including ethical issues that might arise. This was to ensure credibility of the data collected.

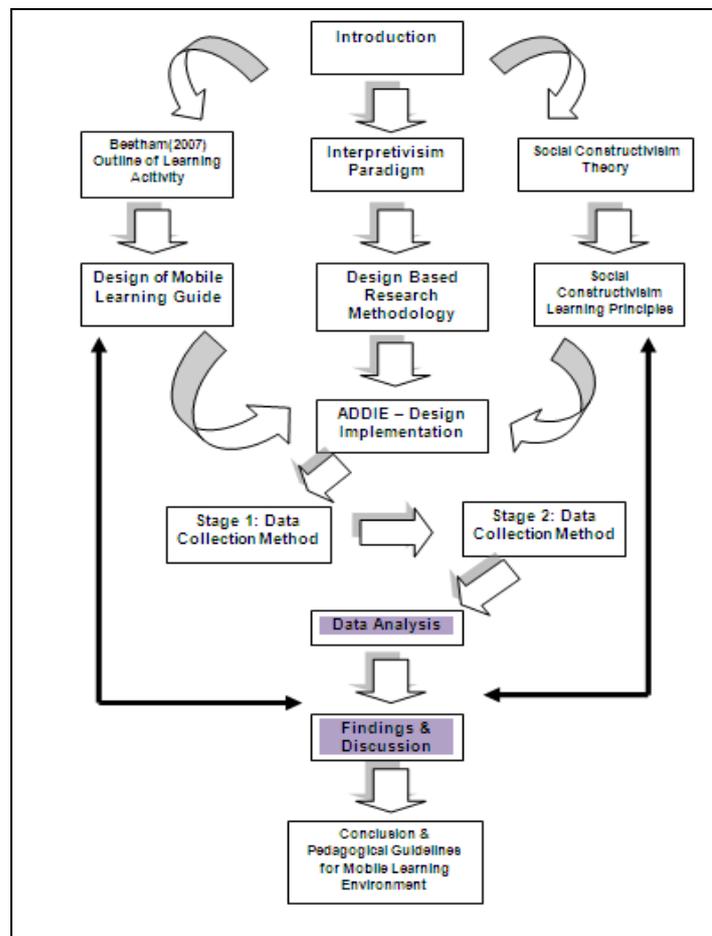
The analysis of data was also presented in this chapter. The questionnaire data was analysed through descriptive statistics, while the qualitative data was analysed in line with Ritchie, Spencer and O'Connor's (2003) framework that was adjusted to suit this research. Since the data was examined separated through Stage 1 and 2, the findings are also separately discussed in the respective chapters 5 and 6. In the findings, the results are discussed in the form of various mobile learning activities. This means the learning principles are discussed as learning activities as part of the research's findings as the focus are on the activities designed. Chapters 5 and 6 lead into the discussion chapter in order to answer the research questions, and both are used to produce the pedagogical guidelines for the design of mobile learning activities for HEIs.

Chapter 5: Stage 1 Findings

Overview

This chapter provides the analysis of Stage 1 of the research process, its main outcomes and how these informed the design of mobile learning activities perceived by the students as being able to support their learning for Stage 2. The process of this chapter is as illustrated in the thesis guide in Diagram 2.

Diagram2: Structure of Thesis for Designing Mobile Learning Activities for HE Students



This chapter presents the findings from the MReadiness questionnaire, the students' reflective blog posts, and the students' online interviews. A deeper understanding of HE students' conceptions of mobile learning is derived from the data analysis. The chapter concludes by describing the development for Stage 2 activities with the aim of not only enabling further the iteration of the research process, but also to fully address the research questions.

5.1 MReadiness Questionnaire for Stage 1

There are three sections in the MReadiness questionnaire. The first is aimed at understanding the study participants' backgrounds, where age range and gender are requested. The second section is about the mobile devices they have access to, i.e. the types and common features of their mobile phones. In the final section the participants were asked the potential usefulness of mobile learning activities for them.

There were 70 students in the Stage 1 cohort and all answered the questionnaire, which was distributed to them in the second week of class. There were 97.1% of the students aged between 21 and 23 (68 out of 70), while the remaining 2.9% were aged 24 and above (2 out of 70). There was a balance in numbers between male (55.7%, 39 out of 70) and female teacher trainees (44.3%, 31 out of 70) for this course.

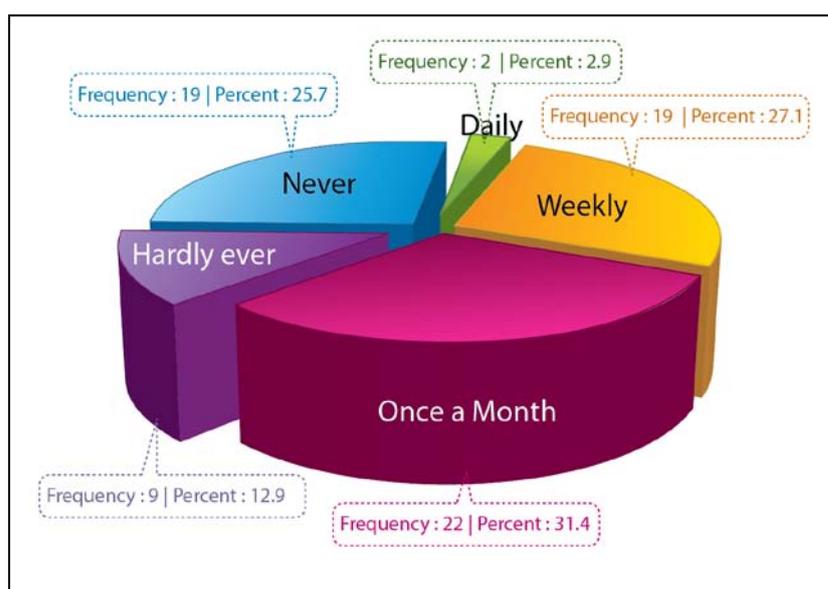
In terms of mobile phone ownership, all students owned at least one mobile phone, though one student reported that he was not currently using his because of the cost. Forty Nine (70%) participants owned one mobile phone, whilst 18 (25.7%) participants owned two mobile phones, and 3 (4.3%) owned three or more mobile phones. The participants were also asked if they would provide their mobile phone number to their course tutor. There were 69 out of 70 (98.6%) said that they would not mind giving their phone numbers, but one participant (1.4%) said that he/she did mind. Nevertheless, when permission was sought to send these students SMS messages later on, all of the students provided their phone number except the one student whose mobile phone was not in use.

Many of the participants did not have a large memory capacity on their phone. Seventeen (24.3%) of them reported that they had less than 60MB, while 43 (61.4%) had 60MB to 2GB, and 10 (14.3%) had more than 2GB. Thus, the participants had mobile phones with sufficient memory to store some form of data, either as text or audio files. This provided an opportunity to design activities in which small bites of course content could be delivered to the students' mobile phones. These could be either be accessed online or downloaded to their phones (directly or via a computer if they were concerned about cost). Nevertheless, in

designing mobile learning activities, I was wary of the file size for any content (text or audio) as it would affect the time taken to download.

In terms of activities students carried out using their mobile phones, it was noted that most students 'synced' their mobile phones to their computers. A majority of the participants synced their mobile phones to their computer on weekly (19, 27.1%) or monthly (22, 31.4%) basis. Nevertheless, quite a number of them (22, 31.4%) had never synced their mobile phones to their computer. The frequencies of the participants syncing their mobile phones to their computers are as below:

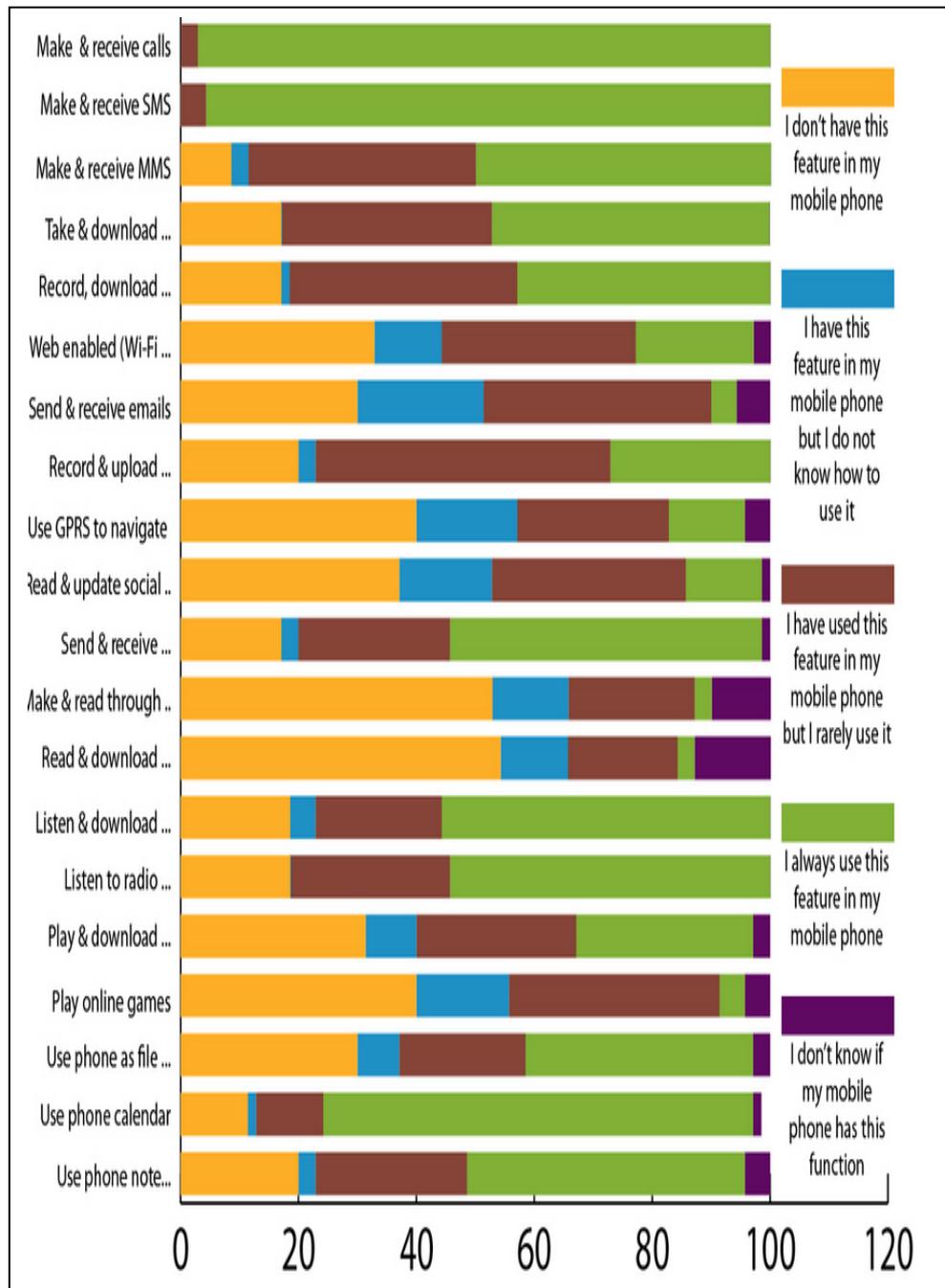
Graph 1: Frequency of Syncing Mobile Phone to Computer (Stage 1)



It is not surprising that most participants used the communication tools on their mobile phones, namely calling and sending SMS. In the list of uses of mobile phone functionality, 68 (97.1%) of the participants reported that the use of calls and SMS features of the phone were the most frequently used. Other frequent activities were 'use phone calendar' (51, 72.9% 'always use' this feature), 'listen and download MP3 songs' (39, 55.7% 'always use' this feature), 'take and download pictures' (33, 47.1% 'always use' this feature), and 'use of phone note-taking' (33, 47.1% 'always use' this feature) play an important role for the students as they frequently use them in their daily lives. Out of 70 participants only 12 (17.1%) did not have a camera facility on their mobile phone. The illustration of

mobile phone applications used by the participants is as Graph 2, while a more detailed representation is presented in Appendix G.

Graph 2: Frequency of Use of the Mobile Phone Applications (Stage 1)



The least frequent activities were reading and downloading PDF documents (2, 2.9%) and creating or reading Microsoft mobile office documents (2, 2.9%). Apparently this was because most of the participants do not have these capabilities on their mobile phone (38, 54.3%) and (37, 52.9%) respectively. Nevertheless, the activity of sending and receiving through Bluetooth was quite high with 37

(52.9%) of students reported that they always use this mobile application. This would mean that documents being sent were in different formats than Microsoft Mobile Office such as JPEG image files. The detailed frequency of mobile phone application usage is presented in Appendix G.

Twenty three (32.9%) of the participants did not have a Wi-Fi or 3G functionality on their phone to enable them to surf the internet and a further 2 (2.9%) were not sure whether or not they had this feature. There were 45 (64.3%) who were able to surf the internet through their phones. It was further reported that of those who had internet-enabled mobile phones, 23 (32.9%) of participants rarely use this capability as compared to 14 (20%) who use this regularly. Participants were asked the reason(s) for this with a list of options in which they could mark as many choices as they wanted. Most of the participants felt that the internet charges when using a mobile phone were expensive and that the connection was too slow, as indicated in Table 12.

Table 12: Reasons for Not Using Internet in Mobile Phone (Stage 1)

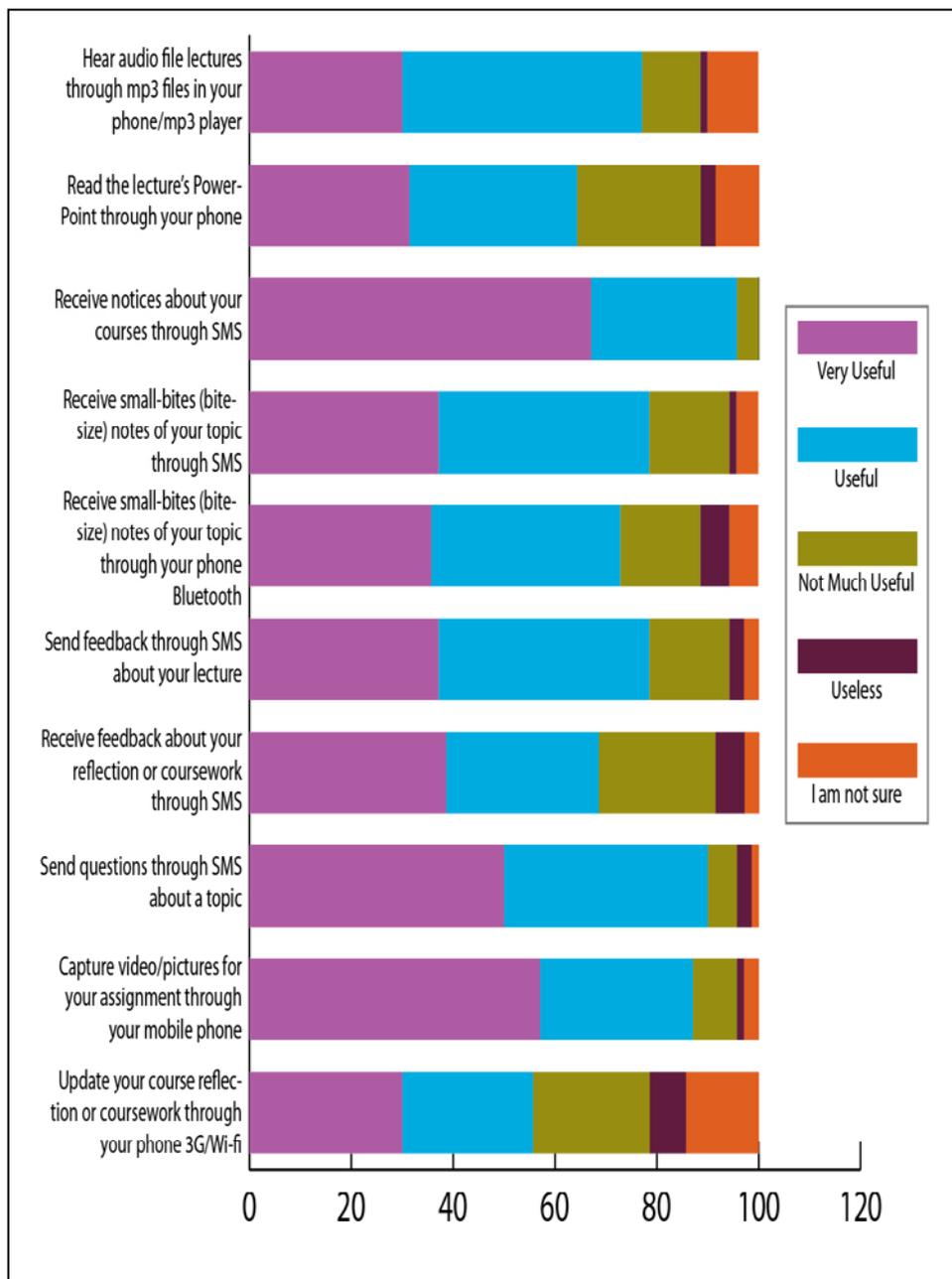
	N	%
The charges are expensive	46	65.7
The connection is too slow	29	41.4
I am not sure how to use the 3G/web service on my mobile phone	13	18.6
I do not feel the need to use the 3G/web on my mobile phone	15	21.4
I do not like to use the web on my mobile phone	9	12.9

The last section of the questionnaire sought the participants' opinions on the possibility of their tutors offering different types of mobile learning activities to support their learning. The results are illustrated in the Graph 3. Receiving updates through SMS is an activity that the students preferred with 47 (67.1%) indicating that this was 'very useful' and none indicating that the activity was 'useless'. SMS was also popular for asking questions and for receiving both feedback (27, 38.6%) and bite-sized notes (26, 37.1%); with the participants indicating these activities were 'very useful'. As was indicated by the questionnaire results, the students' preferred mode of communication was through SMS. Therefore one learning

support activity design involved sending SMS notifications of the forthcoming Mobile Learning workshop to their phones.

Earlier in Graph 2, it appeared that listening to MP3 audio files was a function that the students often used. The question about the possibility of listening to their lectures in the form of MP3 audio files was also well received, as 21 (30%) found the activity ‘very useful’. This means that listening to audio files is an activity that could be designed as part of learning support.

Graph 3: Initial Perception of Mobile Learning Activities (Stage 1)



The participants also seemed comfortable with using the camera feature of their mobile phones, as 33 (47.1%) stated that they ‘always use’ this feature and 40 (57.1%) indicated that videos and pictures taken from their mobile phones were ‘very useful’ for their assignments. Thus, mobile learning activities could involve the use of the camera feature of the mobile phone. The detailed data is presented in Appendix G.

The results of the MReadiness questionnaire were used to gauge the acceptance of mobile learning activities by the participants. The findings of the questionnaire not only provided preferences of mobile usage, but also the initial path to answer this study’s first research question, on students’ acceptance of mobile learning to support their learning. The choice for mobile phone applications and activities introduced to the students in the subsequent Mobile Learning Workshop in Stage 1 were selected through these initial findings.

5.2 Mobile Learning Workshop for Stage 1

The purpose of the Mobile Learning workshop in Stage 1 was to introduce the concept of mobile learning as an educational technology to the students, and then to gather their perceptions on possible activities which would support them in their learning. The aim and structure of this 3 hour workshop are described earlier in Section 4.4. The Mobile Learning workshop for Stage 1 was designed to introduce the mobile learning concept to the participants as part of an education technology course. The results of the MReadiness questionnaire were used to guide the choice of activities and to determine the suitability of the mobile phone applications.

In the pre-workshop phase, reminders were sent to all students via email, instructing them to bring along their mobile phones and cables to connect to their laptops. They were also given instructions to bring their laptops as well as microphones and to download Audacity software. Then an SMS blast was sent a day before the workshop to remind them to bring along the required equipment and software.

There were three main sections of the mobile learning workshop as has been presented in Section 4.3.1.3, which were the introduction of the concept of mobile

learning, the showcase of mobile applications for learning, and hands-on experience. Podcasts were chosen as the hands-on experience as Stage 1 participants indicated that they were comfortable with MP3 song files; hence instead of listening to songs for entertainment, the aim was to introduce podcasts for learning support. After being introduced to the concept of podcasts, the students Audacity software was presented, which allows recording and editing of MP3 audio files to turn them into podcasts. The students were requested to create their own podcasts in groups, on a conversation they had on 'The type of teacher I wish to be'. Then they presented the conversation at the end of the workshop. They were asked to upload this audio file to their respective blogs and reflect on them. There were no guidelines given for the students in terms of commenting on this particular activity. The act to sync their mobile phones to the computer was also discussed during the mobile learning workshop.

At the end of the workshop the students were presented with a future scenario in which mobile learning was predicted to be part of their teaching and learning environment. Finally the students were encouraged to try out a mobile learning application (they could either explore the ones that were mentioned in the workshop or any others not listed) that they anticipate could support their learning and to blog about their experiences.

These reflections on their opinions of mobile learning and also their views of trying the mobile applications they perceived could support their learning were captured in the individual students' blog posts and the interview sessions. In Stage 1, participants were asked to blog two entries during the two weeks after the mobile learning workshop. The workshop was conducted on the 15th week of the course in July 2009. The interview sessions took place after the participants' end of semester examinations, which took place in October 2009.

5.3 Students' Blog Posts for Stage 1

After the Stage 1 Mobile Learning Workshop the students were asked to write their reflections on mobile learning. They were not given any specific instructions for writing their reflections but rather asked to write about their general opinions of

mobile learning as introduced to them through the workshop. All of the students' blog posts on mobile learning were analysed; there were 70 blog post entries i.e. a post from each participant. Participants' verbatim quotes were drawn out through their pseudonym initials such as 'msk' while their true identities remained anonymous with S1 indicating the participants from Stage 1. The verbatim quotes are not presented in this thesis to protect the identity of the participants as explained in research ethics, Section 4.8

Most students had been unfamiliar with the concept of mobile learning, indicating that it was only during the workshop that they were introduced to the concept. There were also students who indicated amazement that their mobile phone could be used as a learning tool, while some wrote that they had embraced this type of learning without realising it. The students also reported their perceptions on mobile learning, mainly reporting that they found it engaging, interactive, and makes learning interesting.

It was interesting to note the revelation of how the mobile learning concept impacted the students which was the purpose of the mobile learning workshop. However the main focus for this study was on the type of mobile learning activities that could support the students' learning and not only the awareness of mobile learning concept.

5.3.1 Mobile Learning Activities

Learning activities in which students perceived that the mobile phone could offer support for their learning appeared in the blog posts. For example, almost half of the students stated that the mobile phone provided them with the ability to access information anywhere and anytime.

The participants appeared to understand the need to cater for differences in students' learning styles. They acknowledged that mobile phones could be used to perform different types of activities using different media in order to cater to the different needs of students. For example a participant described how he dreads reading and prefers listening (S1ct).

Through the social constructivist approach there are four types of mobile learning activities deemed suitable to support HE students' learning, as described in Section 3.5. These are contextual, reflective, collaborative, and multiple-perspective activities. The participants did not explicitly describe their activities through these categories defined in Section 3.5; they were elicited through data analysis. However, there were two other types of activity that emerged through the Stage 1 findings, which were communication and learning-management activities. Hence the following sections describe the six types of mobile learning activities that were extracted from the students' blog posts.

5.3.2 Contextual Activities

As defined in Section 3.5.1, contextual activities are authentic and situated learning activities based in multiple contexts. Participants recognized that using the mobile phone for learning would make the context they are in central to their learning process.

It is interesting to note that within the context they are in, using the mobile phone camera the participants had the opportunity to capture 'learning moments'. The mobile camera allowed them to capture and track authentic situations. A participant explained this situation when she glances and reads information but do not have the time to copy or write down; hence the mobile camera could assist in capturing the information (S1ct).

5.3.3 Reflective Activities

In Section 3.5.2, reflective activities meant that participants were able to analyse their own learning processes and also able to review others' opinions in order to make further judgments on the concept discussed. It was discovered that participants seemed to favour the ability to reflect through the exchange of feedback and opinions through the mobile phone applications, in order to support their learning.

5.3.4 Collaborative Activities

Collaborative activities encourage interaction between learners to maximise their learning (Section 3.5.3). Since the mobile phone is a communicative tool it promotes conversation and discussion amongst the students as stressed by a participant (S1eng).

Students also described this type of activity as providing a space to share. The notion of the sharing of work was possible using the applications on the mobile phone as the capability of the mobile phone to share something instantaneously (S1imd).

The activity of ‘sharing’ as an aspect of collaborative activities was not initially highlighted as an aspect of collaboration. It was found that students repeatedly felt that the mobile phone could allow this.

5.3.5 Multiple-Perspective Activities

In the earlier description of this type of activity in Section 3.5.4, there are two main activities. One activity is the condition in which students need to be exposed to the views of different people as stressed by a participant (S1ct).

I found a lack of evidence in the above description of this type of activity; however the students favoured activities that used different media. Being exposed to multiple representations through different types of media was the other condition for the multiple-perspective activity. It was noted that different types of media provided students with alternative views of a topic that they were learning. The students listed audio podcasts, eBooks and downloaded materials such as PDFs as examples.

In highlighting the students’ interest in supporting learning through different media, the participants proposed the use of the camera phone as a means to do various activities for example, to capture lecture notes instead of writing them (S1saa).

Besides using the camera the students mentioned that the use of audio recording activities was also welcomed in order not to miss facts in lectures through photos taken or to repeatedly listen to lecturers for further understanding (S1*ss and S1alck).

This suggests that the students appreciated content delivered through different media which could also provide different perspectives for them. Thus, visual and auditory activities were taken into consideration in the design of the activities in the following stage.

There were two new activities discovered from the students' blog posts which are outlined in the sections below. The communication and learning management were elicited.

5.3.6 Communication Activities

Almost half of the participants mentioned that communication-type learning activities could be supported with a mobile phone. Although this type of activity was not enlisted originally, this was not a surprise because the main characteristic of the mobile phone is as a means of communication, and this aspect of mobile phone usage was also proposed through the MReadiness questionnaire. The students introduced the idea of connectedness as part of their learning process.

They also voiced the idea of informing one another or getting updates about course-related matters through this type of activity. For instance getting updates and keeping in touch with their classmates are important to them (S1mfi and S1aar).

5.3.7 Learning-Management Activities

Just as found from the results of the MReadiness questionnaire, there were participants who mentioned the ability of the mobile phone to assist them with managing their learning. For example their mobile phones were used as alarms, reminders and also for them to write notes (S1afr and S1eng).

The issue of time was frequently mentioned by the participants. It appeared that students believed the mobile phone could offer them a time management tool as

they could access learning materials and study at their convenience. They particularly mentioned the portability of eBooks (S1ct and S1mhr).

The participants also perceived that the portability aspect of the mobile phone as another contributing factor to support their learning. Besides being practical, the mobile phone was seen as a single device that allowed them to do multiple-tasks (S1aar, S1dsr and S1imd).

Analysing the Stage 1 students' blog posts resulted in six types of activities which I needed to pay attention to during the design and development of the Stage 2 mobile learning activities. However, analysis of the students' interviews activity added further detail and helped me to understand the mobile learning activities perceived as acceptable for the Stage 2 participants. This analysis is described in the next section.

5.4 Student Online Interviews for Stage 1

Three students were interviewed after their final examination at the end of the course. These students volunteered when an email was sent to all students which included the explanation about the interview and the information that the interview would be anonymous. The students who volunteered were between the ages of 21 to 23. There were two females and one male. Their verbatim responses in the interviews were reported as 1A, 1B and 1C in order to preserve their anonymity.

Each of the interview participants had a single mobile phone with internet access, although two of them did not use this function frequently. All three of them stated that their mobile phones were important to them. Only two of them mentioned that they knew the functions on their mobile phone and also know how to use these functions. While the other stated there were some functions of the mobile phone that she did not use. All three of them reported that calls and SMS were the applications they used most frequently. Other than that they also regularly used the phone camera to take pictures, made the most of the phone calendar for reminders, capitalized on the alarm clock for daily management and used the audio player mainly to listen to music.

The students also raised the issue of access to resources and people as being an essential part of their learning. They seemed to appreciate that the mobile phone allowed them to access information or references that they needed at that particular point in time. Provision of content such as references or notes (audio or text) which could be made available to them was conditions that the participants perceived could support their learning.

yes. i already install the english to malay dictionary in my phone (S1A)

(moblog) yup yup that be beneficial as we can read or hear notes any place that we like (S1B)

like instructional videos to teach us how to use wordpress/ yes I can listen anywhere I like (S1C)

There were six activities which were the same as raised through students' blog posts which are discussed in the following sub-sections.

5.4.1 Contextual Activities

Context, as indicated by the participants, provides space for them to think and mull over course topics in whatever surroundings they are in. Therefore the surroundings in which the students were situated could also be a point of reference or a prompt for reflections on topics from the course. One of the participants discussed this factor when she reported that: *yes you can reflect anywhere you want. So this is useful, sometimes things around you can give you a prompt to think. (S1C).*

The others explained that their surroundings generated the conditions to capture visually whatever they see that could assist them in their learning. They mentioned the ease with which they could capture information, particularly pictures that could be later used in their learning or as a teaching aid in their own teaching (as they are teacher trainees).

recording and snapping pictures for my teaching aids such as weather and video that can not be downloaded from the internet. (S1A)

yup! meaning that you see or hear something that you want to capture ...your phone is always with you (S1B)

5.4.2 Reflective Activities

Participants also stated that they could reflect on learning topics using various mobile phone applications. They noted that they could write individual reflections and read and review reflective notes.

[discussion on SMS reflection] writing reflections? yes definitely (S1B)

i mean like when we're waiting or have nothing to do, it's quite productive to blog.read other ppl's blog (S1B)

One of the participants indicated that she listened to podcasts or read 'bite-sized' notes any time anywhere, which provided her the time to reflect on the topics presented during the face-to-face sessions of the course.

More convenient.. actually you can reflect anywhere if you want to (S1C)

I guess hearing a podcast is like hearing another lecture. It gives you time to stop the player or rewind (S1C)

Thus the concepts of portability and time management recurred in the interview themes adding weight to their presence in the students' blog posts. However, the most important observation was the possibility of designing activities to assist reflection through writing or reading using various mobile phone applications.

5.4.3 Collaborative Activities

Two interviewees also acknowledged that mobile phone activities could promote collaboration amongst them. They could exchange thoughts and work on group work assignments through applications such as SMS which was considered a convenient tool:

sometimes... more so if there are lots of group work for a particular semester

Yes, sms is much more easier to reach my friends (S1C)

It was interesting to note that one of the students mentioned that he used SMS to discuss course topics or assignments with his female friends. In Malaysia, HE students are aware that meeting different genders face-to-face, especially when alone, can be frowned upon due to cultural and religious sensitivities. Therefore

using a tool such as SMS meant that they could still discuss their coursework but avoid the complications of a face-to-face meeting.

I mean, female. if male, we come to other houses and discuss it at anytime. if female, it is quite difficult to meet up at late of the nite.so we call and sms each others. (S1A)

5.4.4 Multiple-Perspective Activities

Similarly, as with the findings from the students' blog post, the participants focused more on activities using different media. There was less evidence on being exposed to different opinions to support their learning. It appeared that they favoured different media to help support their learning because they stated preferences for visual, textual and audio materials using mobile applications such as SMS, podcasts and pictures. According to the interviewees these different media could promote different perspectives, as indicated in the participants' excerpts as follows:

listening also is different from reading. (S1A)

Sometimes when you read, you get a point but by listening you get another point. (S1A)

Sometimes listening to the lecture again can give you another idea of the topic (S1C)

The two other activities derived from the students' blog posts are outlined in the sections below. At this juncture it was essential to discover whether the communication and learning-management activities concept also emerged in the interview data and therefore could be used for Stage 2 design.

5.4.5 Communication Activities

The participants acknowledged that they used mobile phones mainly to communicate with their friends and family, with SMS being the main application used: *erm, i use sms-es to keep in touch with friends and family.. (S1B)*

One student stated that he would prefer two-way communication with tutors through SMS as he said: *faster delivery, sometimes, the tutor/lecturer will take time to reply it to also due to their work. (if by email) (S1A)*

Ease of communication and the need for speed were factors that contributed to the preference for the mobile phone for communicating amongst their peers and with their tutors.

5.4.6 Learning-Management Activities

The students also voiced the fact that they perceived that the mobile phone assisted them with the management of their learning. They discussed their busy student lifestyles and the subsequent need for reminders for assignments in order to manage their work better.

yes. i am very okay with it. reminders rite? yes. it is very very acceptable. at least there is somebody to remind me, not only my phone appointment. (S1A)

i mean sometimes we need ppl to remind us to reflect living in a fast pace world often engulfs us and leaving us running and panting rushing to finish what we need to do next (S1C)

All of the six mobile learning activities identified through analysing the blogs coincided with the themes from the students' interviews. Therefore in the design of Stage 2 mobile learning activities these activities were featured as described in the following section.

5.5 Design for Stage 2 Mobile Learning Activities

I was relieved to discover that all of the students in Stage 1 did not mind providing their mobile phone numbers to their institution and tutors as indicated in feedback from the MReadiness questionnaire. I was also given all of the available mobile phone numbers when I requested them at Stage 1 of the research process. This meant that the issue of access to the participants using their own mobile phones was not a problem.

Nevertheless there were some issues that I needed to be aware of in designing the next stage of implementation. Namely, the students would need to explore their own mobile phones, especially with regards to the range of functions. Results of the MReadiness questionnaire indicated a need for the students to know more about their phones. There were 15 participants (21.4%) who claimed to have an email function on their mobile phone but did not know how to use it. There were also 8 (11.4%) out of the 70 participants who had a web-enabled phone but did not know how to use this function to access to the internet. Some of the blog posts supported this notion. A participant in his blog admitted that he did not explore all functions in his mobile phone (S1asy) while another admitted that she knew only 40% of the functions of her mobile phone (S1ska).

This means that there would be challenges in implementing mobile phone activities if it involved using functionality or applications that the students were not familiar with. However, this was not a major obstacle as the participants had admitted through the mobile learning activities implemented in Stage 1, which they had learned more about their mobile phones.

It was also essential for me to be aware of the issues that the Stage 1 students had voiced. There were a few students who wrote in their blog posts that they only had 'ordinary' phones, and that they felt that they could not embrace the mobile learning activities proposed. It was essential for me to stress in Stage 2 that mobile learning could be embraced through simple applications such as SMS or the camera application. It was important to address this issue of inequality as students should not feel left out. As this research centres on the students' own mobile phones which differ not only in brands but also in their range of installed applications, designing mobile learning activities was a challenge.

The other issues that I needed to be aware of were the constraints of the mobile devices themselves. The students raised cost issues especially when they needed to surf the internet. They reported the high cost of the internet through a mobile phone affect their usage of this facility. There were also other problems such as limited memory space, slow internet connection and small screens; however these problems were not highlighted extensively. Nevertheless, I still needed to bear them in mind these in designing the Stage 2 mobile learning activities.

There were also issues of misuse of mobile phones that were highlighted. The students were concerned about cheating in examinations, being disturbed or not concentrating during lectures, and exploitation of their pictures i.e. using their personal photos for an unreputable situation. I needed to create a space for these types of discussion during the Mobile Learning workshop.

As a result of points made in both blog posts and interviews, opportunities for time management activities needed to be provided as part of the Stage 2 workshop. The factors that the mobile phone activities brought about which were stressed by students included ease of use, speed and convenience, and these were considered in the design. For example, using SMS for reflective messages or questions prompting students to think about a course topic were activities to be designed for Stage 2. SMS was indicated to be easy to use; feedback was received faster and it was convenient as the students did not need to switch on their computers to be connected with their friends.

In addition to communication activities where students contacted and networked with their friends, usually on the same course, to seek information and/or organise learning activities, some participants also voiced the need for two-way communication with their course tutors. They felt that communicating through the mobile phone would be a faster way to reach tutors and also a medium that remains private as opposed to the likes of an online discussion forum, hence making the medium more personal. Thus in Stage 2, SMS was a medium of communication to be used not only between the students and as a mechanism for notifications and reminders, but also for respective students to send SMS messages to their individual tutors should they have enquiries.

The other mobile learning activities that were perceived to support the students' learning were reflection-based. There were a number of mobile applications that the Stage 2 students could use for this purpose. They were sent questions via SMS to prompt them to reflect after each lesson. Having a device that manages the participants' time and is portable, as the Stage 1 students had identified, meant that the participants could reflect wherever and at whatever time possible. Moreover the students could blog their reflections on course topics through their mobile phones, and could also enhance their understanding of a topic through reflection on

pictures taken with their mobile phones. In Stage 2, students were encouraged to document their reflection online through pictures as well as blogs, in order to further construct their understanding of course topics.

The provision of multiple media was perceived as a means of support for their learning i.e. to cater for students' differing learning styles. This was made possible with the development, for Stage 2, of a moblog that the students could gain access to anytime and anywhere. Through the course moblog the students could download bite-sized notes and read them. They could also listen online to or download podcasts which would also provided them with the audio content for the course. These different types of media provide different types of activity for students in order to support their learning outside of the lecture hall. For this reason small bite-sized notes and audio podcasts were made available for Stage 2 students through the course moblog.

The students also noted that mobile learning activities could provide them with collaborative opportunities. This meant that the mobile learning phone applications provided a platform for them to collaborate. In Stage 2, students were asked to create podcasts in groups in order to produce content about a topic for the class that could be shared by all students. The sharing angle, previously not highlighted under collaborative activities, was given prominence for the Stage 2 design of mobile learning activities.

The students also perceived that mobile phones could provide them with contextual activities, and that this would assist them with their learning. This meant that the students could interact with their immediate environment to support them in constructing their own learning. Therefore in Stage 2 students were encouraged to take pictures through their mobile phones that would help them to reflect on the content of their course. There would be a virtual repository space for them to upload these pictures to and also space for their peers to comment on them.

Finally, the students reported that mobile phones allowed them to manage their learning. In Stage 1 the students had utilized their mobile phone alarm and calendars as reminders, and had used the note function to record notes as reported through all three data collection methods. Thus, Stage 2 included the sending of

reminders through SMS, and also the introduction of an English mobile dictionary that would be a useful reference for the students.

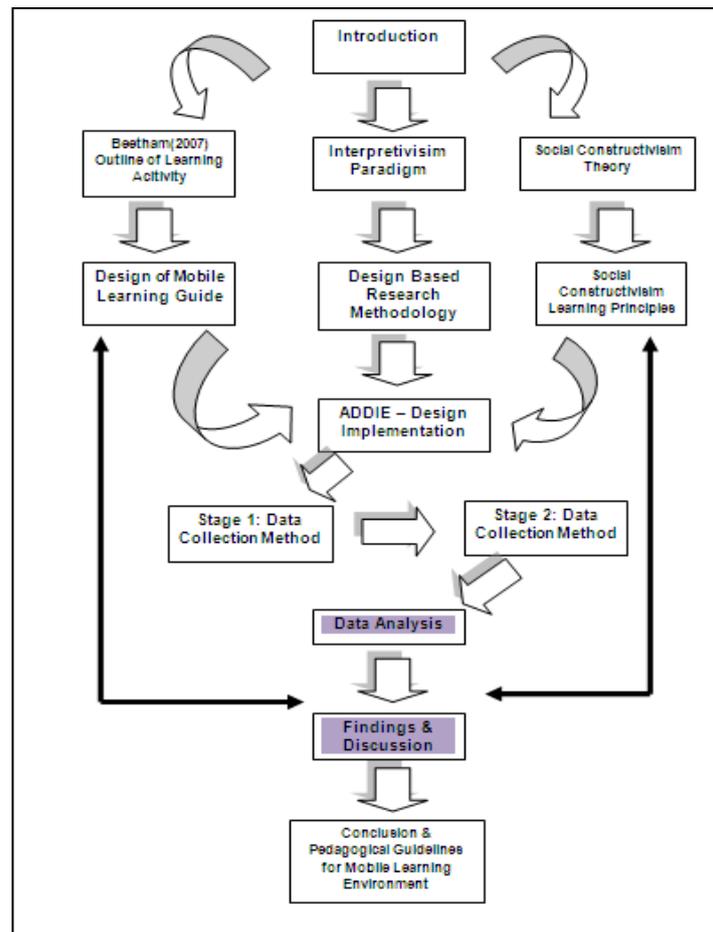
The mobile learning activities discussed were perceived by the Stage 1 participants as being able to support learning outside of the classroom. These findings of Stage 1 formed the basis for the design of Stage 2 to support students' learning.

Chapter 6: Stage 2 Findings

Overview

The findings of Stage 2 are reported in this chapter. Stage 2 of the research was designed to enable more focused mobile learning activities to be implemented throughout the selected HE course. The research process for this chapter is shown in the thesis guide in Diagram 2.

Diagram 2: Structure of Thesis for Designing Mobile Learning Activities for HE Students



The structure of the chapter is similar to that of Chapter 5 Stage 1 Findings. The findings of the MReadiness questionnaire, the students' reflective blog posts, and also the students' online interviews from Stage 2 are all presented. There is also the analysis of the mobile learning workshop that was conducted for the Stage 2 participants. The main focus of the analysis is on the mobile learning activities designed as part of the workshop and also the post-workshop activities. Finally the overall summary of Stage 2 design issues is presented.

6.1 MReadiness Questionnaire for Stage 2

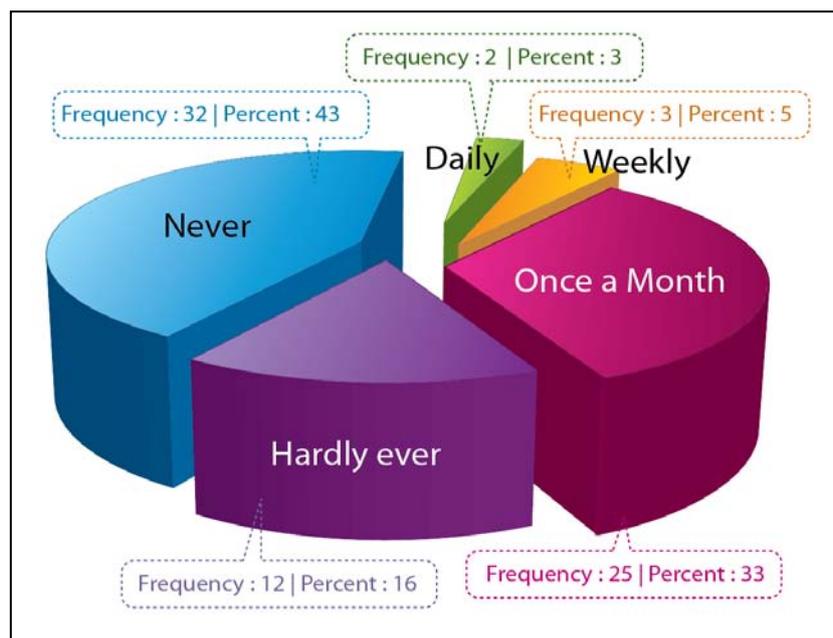
In Stage 2 there were 75 students, 42 (56%) were male and 33 (44%) were female. The questionnaire was distributed through the University's learning management system (LMS), Moodle, during the first day of class. The participants were given one week to complete the questionnaire online and all students answered the questionnaire.

In Stage 2 all students owned at least one mobile phone. Fifty (67%) of participants owned one mobile phone, while 23 (31%) owned two mobile phones and 2 (3%) owned three or more mobile phones. When participants were asked whether they would provide their phone numbers to their lecturers or institutions all of them agreed.

In terms of memory space for their phones, 43 (57%) of the participants had between 60MB and 2GB of space, while 16 (21%) had less than 60MB memory space and 17 (23%) had more than 2GB of memory space. This information was essential for the design as the memory space had to accommodate text or audio files on students' mobile phones.

As to how often the participants sync their mobile phone to their computer, the results are shown in Graph 4 as follows:

Graph 4: Frequency of Syncing Mobile Phone to Computer (Stage 2)

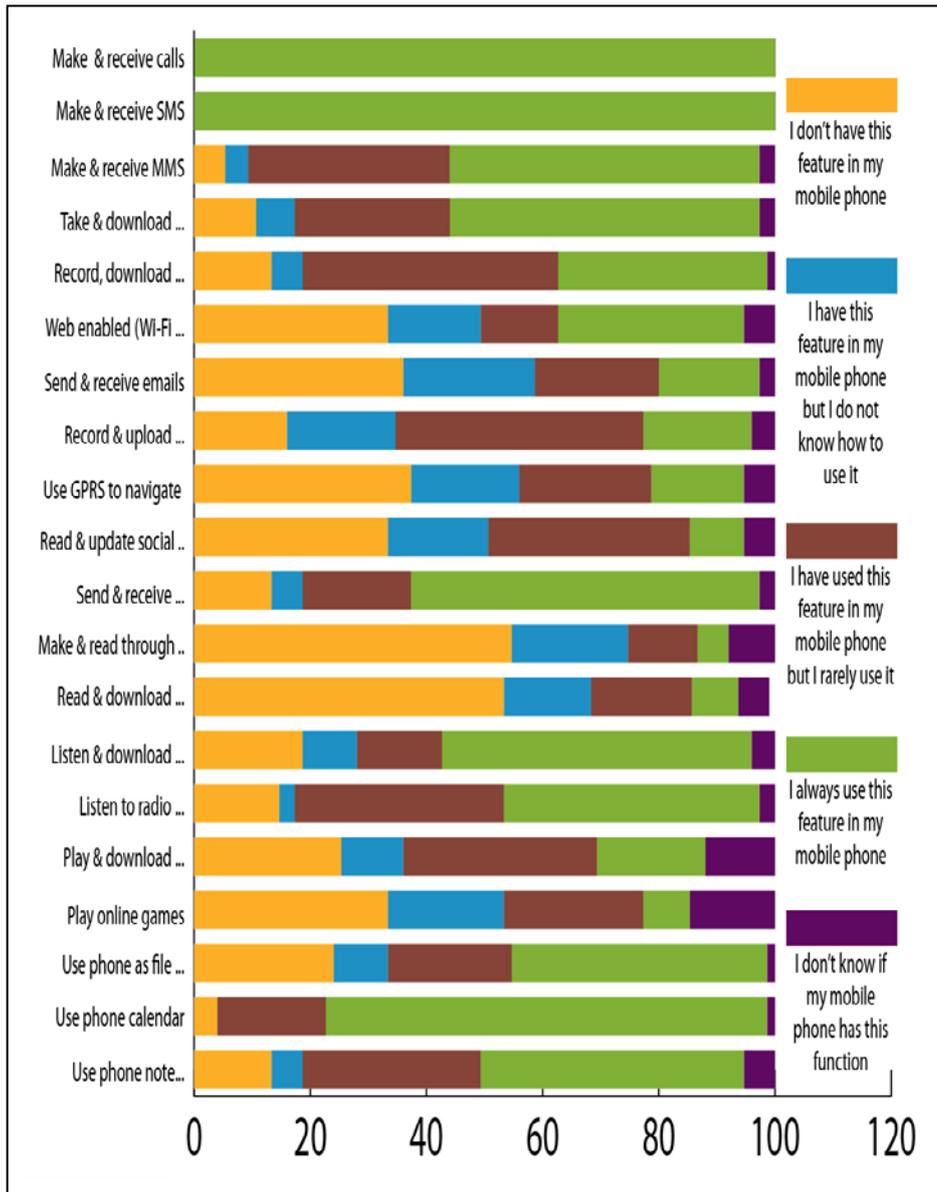


A number of Stage 2 participants (23, 43%) never synced their mobile phone; on the other hand, there were a larger number of participants (31, 41%) who synced their mobile phones at least once a month. Only 2 (3%) and 4 (5%) of them synced their mobile phones with their computers either daily or weekly respectively. This factor was essential for the design of mobile learning activities because some resources such as PDF files of notes were intended for the students to download to their mobile phones. There was also the matter of memory space for uploading photos that were taken from students' mobile phones. Syncing the participants' mobile phones to the computers was a way to ensure that cost was not transferred to the students in this research because students would not then need to download or upload files through the phone's mobile broadband.

Another important factor in the design of mobile learning activities was the participants' levels of comfort with using their mobile phones. This was investigated through a series of questions on applications and activities that they frequently used on their mobile phones in their daily lives. Graph 5 provides a summary of the availability of applications on the mobile phone and the students' frequency of use while Appendix G presents the detailed results.

All of the Stage 2 participants responded that making and receiving calls and SMSes were the most commonly used functions of their mobile phone. There were 40 (53.33%) students who indicated that they 'always use' the MMS function of the mobile phone. Taking and downloading pictures was also another popular activity with 40 (53.33%) of them saying that they 'always use' this feature while another 20 (26.67%) of them 'rarely use' this feature. Only 10 (13.34%) of the participants who reported not having a camera facility or who did not know whether their phone had a camera facility. Forty (53.33%) students also stated that they 'always use' their mobile phone to download and listen to songs while there were 11 (14.67%) who 'rarely use' this feature. The Stage 2 participants also used their phones in ways that corresponded with opportunities to manage their learning. This is derived from the fact that 57 (76%) of them 'always use' the phone calendar, while 34 (45.33%) 'always use' the note-taking capability and finally 33 (44%) of them 'always use' their mobile phone for file storage. These actions were again similar to the Stage 1 participants' mobile phone application usage.

Graph 5: Frequency of Use of the Mobile Phone Applications (Stage 2)



The least common use of a mobile phone application was to ‘create and read Microsoft mobile office’ and ‘read and download documents through PDF viewer’. Only 4 (5.33%) and 6 (8%) of the participants respectively used this application frequently. Many participants, 41 (54.67%) for Microsoft mobile office and 14 (18.67%) for PDF viewer, indicated that they did not have these features on their mobile phones. Therefore these features were not used as part of mobile learning activities in Stage 2 design.

Amongst the participants, 46 (61.33%) had phones that could be connected to the internet, while the rest did not have internet access via their phones or did not

know whether their phone had this capability. The other major findings were that for those who had an internet-enabled mobile phone 10 (13.33%) of participants ‘rarely use’ this capability as compared to 24 (32%) who use it regularly. There were also 12 participants (16%) who had this capability on their mobile phone but ‘do not know how to use it’. Forty six (57.33%) had internet-enabled phones but the rest did not, or did not know whether or not they had this application on their mobile phone. The participants were asked the reasons for rarely or not using the internet function and were given a list of options from which they could mark any number of responses. The reasons that most participants stated for not using the internet via their mobile phone were as follows:

Table 13: Reasons for Not Using Internet in Mobile Phone (Stage 2)

	N	%
The charges are expensive	46	38
The connection is too slow	41	34
I am not sure how to use the 3G/web service in my mobile phone	17	14
I do not feel the need to use the 3G/web in my mobile phone	9	7.4
I do not like to use the web on my mobile phone	8	6.6

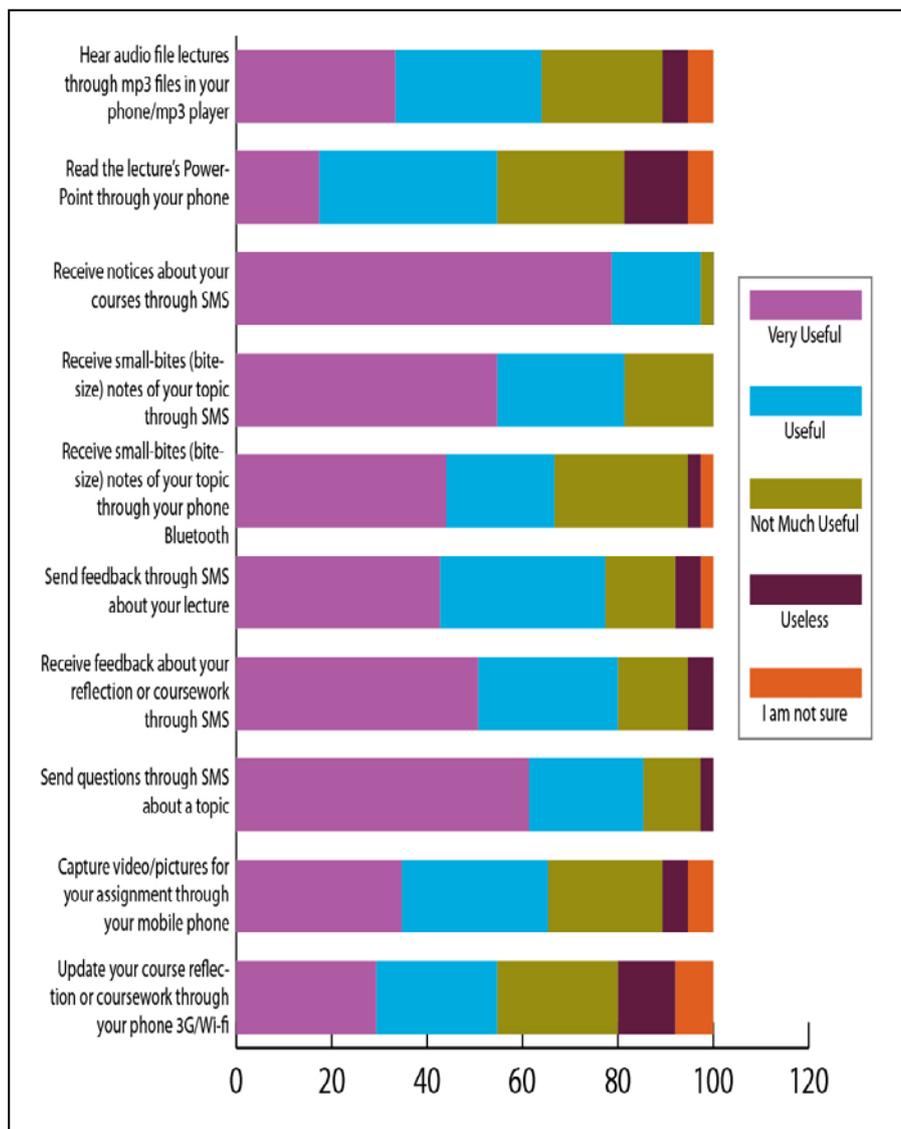
Most of the participants, just as in Stage 1, were aware that charges for internet access via the mobile phone are expensive and that the connection is too slow, which were again the main reasons for not using mobile internet. This is noted as a major challenge for the students' acceptance of mobile learning.

The final section of the questionnaire sought the participants’ opinions about specific different types of mobile learning activity to support their learning. Through the questions in this section, I was able to identify which mobile learning activities that Stage 2 participants expected to be useful to support their learning. It appears that receiving notices through SMS was an activity that the students preferred with 59 (78.67%) indicating that this was ‘very useful’. This was a much higher level of perceived usefulness than for Stage 1 participants. However, 2 participants (2.67%) indicated that the activity was ‘useless’ for them. The Stage 2 participants seemed much more receptive toward activities using SMS because 46 (61.33%) found sending SMS questions, 41 (54.67%) found receiving SMS bite-

sized notes, and 32 (42.67%) found sending SMS feedback ‘very useful’. The results are presented in Graph 6 while the detailed findings are presented in Appendix G.

However, it is quite surprising that only 26 (34.67%) of Stage 2 participants found capturing pictures for assignments through the mobile phone ‘very useful’ while 18 (24%) found them ‘not much use’ and a further 4 (5.33%) found them ‘useless’. As compared to Stage 1 participants, who seemed positive about picture taking through the mobile phone, Stage 2 participants did not appear enthusiastic about this activity as a means to support their learning. Nevertheless I decided to design an activity involving capturing pictures through mobile phones in Stage 2 in order to gauge the possibility that Stage 2 participants would eventually appreciate this activity as a means to support their learning.

Graph 6: Initial Perception of the Use of Mobile Learning Activities (Stage 2)



The result of students listening to audio files and also reading blog posts as part of mobile learning activities remained similar to the Stage 1 participants. Accordingly, Stage 2 participants reported that listening to audio files about lesson topics (25, 33.33%) and reading course blog posts (22, 29.33%) were both rated as 'very useful'. However, for the ability to read PowerPoints of the lecture through mobile phones an exceptionally low rating for 'very useful' was given as compared to Stage 1 participants, with only 13 (17.33%) rating it as 'very useful' while 20 (26.67%) rated it as 'not very useful' and 10 (13.33%) reported it as 'useless'. Because of this and the fact that this activity was not deemed useful by Stage 1 participants, this activity was not designed into the Stage 2 research process.

These insights about the Stage 2 participants' preparedness for mobile learning activities as a means to support their learning were taken into consideration for the design and implementation of the Stage 2 phase of the research process which commenced through the Mobile Learning Workshop described below.

6.2 Mobile Learning Workshop for Stage 2

The design of the Mobile Learning Workshop for Stage 2 involved three hours face-to-face with the participants. The main purpose of the workshop was to introduce the concept of mobile learning to the students. Reminders were sent to all students through an email, asking them to bring along their mobile phones and cables to connect to their laptop. They were also asked to bring along their laptops and microphones. They were instructed to download Audacity software to their laptops and then an SMS blast was sent a day before the workshop as a reminder. The pre-workshop activity did not differ from Stage 1 as it was found that in Stage 1 students appreciated the reminder and followed the instructions given.

The structure for the delivery of the Mobile Learning workshop remained the same as for Stage 1 but there were some content changes. The use of Bluetooth to transmit a PDF file was no longer included. This activity was thought to slow down the delivery of the class during the Stage 1 implementation. It was partly because some students did not know how to use this function, and also the transmission process to a large class took more than 10 minutes of class time.

Hence, text files of class notes were downloaded by participants via computer from the course moblog.

The applications introduced were the same as in Stage 1 (Appendix D); however Stage 2 participants were encouraged to further explore other suitable mobile learning applications that could be used to support their learning and blog about them. For example, information and links on some free mobile eBook websites were given to the students, who were also encouraged to find other similar websites and to discuss their experiences in their blog posts.

The benefits of podcasting were introduced to the Stage 2 participants before introducing them to Audacity, the free software for creating MP3 audio files. In Stage 1 the students were asked to create an audio file of less than a minute on 'the type of teachers they aspire to be'. Even though this was group work the participants each needed to individually produce an MP3 audio file to be uploaded to their respective blogs. Most participants in Stage 1 did not layer the audio files with background music or their voices were monotonous. In Stage 2, I again decided to ask the groups to create MP3 audio files in which their task was to produce a creative sound file that could be useful for their primary school students later on. I knew that they were familiar with storyboarding from their previous lecture; therefore I asked them to use this technique to design and develop the audio file using Audacity. After an hour and a half I asked the groups to present what they produced for the class and for them to explain the use of the audio file. During the presentation some ideas were discussed around how to make the audio files interesting. I asked them to upload the files to their respective blogs and for them to write their reflections to which their friends could add comments. Participants were also requested to download and play their respective audio file on their mobile phones to listen to the quality of it.

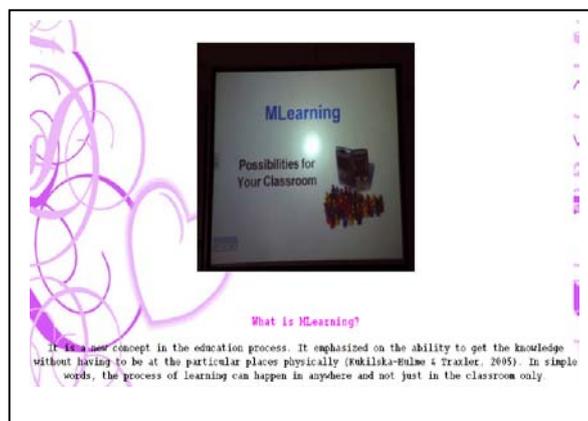
The major difference between Stage 1 and Stage 2 was the mobile learning activities during the post-Mobile Learning workshop. The decision to highlight these activities was because they were indicated by Stage 1 participants as mobile learning activities that could be used to support students' learning.

Other podcast activities not implemented in Stage 1 were introduced, including podcasts being made available to the students as a resource, and asking the students

to create individual podcasts reviewing a course topic. Podcasts comprising audio notes from lectures from educational technologists were made available through the course moblog. These were additional resources for students to listen to during their spare time. The participants were also asked to create their own audio files reflecting on a topic from the course, to be uploaded to their blogs. Other students could download the files to review them and contribute their comments. These activities were introduced because Stage 1 participants indicated that they would want to listen to podcasts on topics from the course. There was also a suggestion that students could create their own podcasts to review when needed, therefore I added this activity in Stage 2. Generally, podcasts seemed to be an activity that were well-liked by Stage 1 participants.

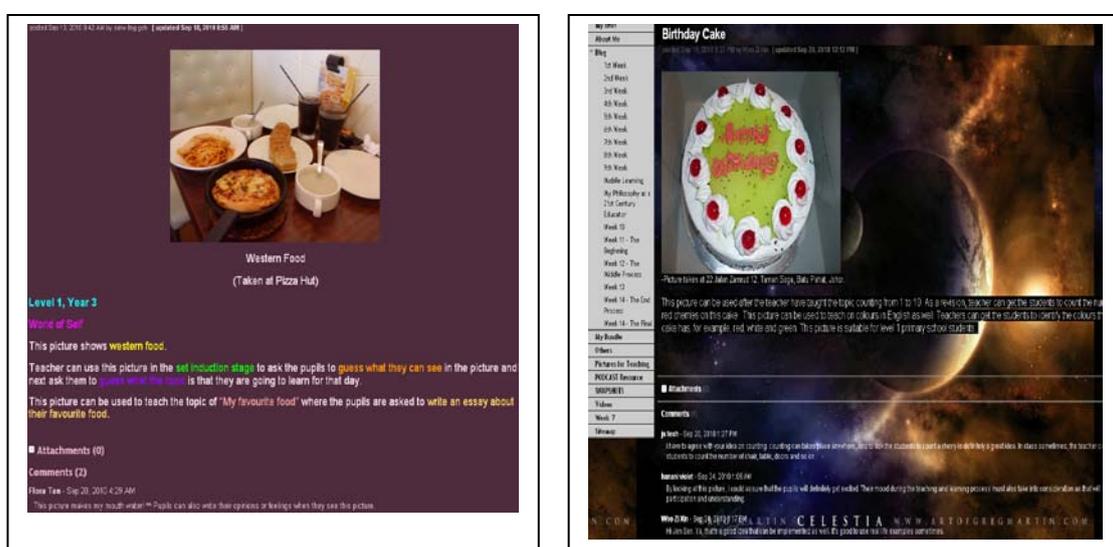
The use of pictures, particularly photos taken using the mobile phone camera, was emphasised in the Mobile Learning workshop in Stage 1. Again, this activity was described as ‘very useful’ by Stage 1 participants. The Stage 2 participants were immediately asked to take pictures of any moments in the workshop that they thought were important for them to reflect upon in their blog later. These pictures were used later by students to enhance their reflections, as seen in their respective blogs. In fact the students continued to take pictures during their lectures throughout the course, as illustrated within their blog posts. The screen-shots below are some examples of how the participants took pictures for use in their blog posts, which were mainly to either show evidence of learning or snapshots of the lecturer’s PowerPoint slides to propel them to reflect in their blog.

Screenshot5: Picture of Mobile Learning Workshop from Students’ Blog
(Example)



Following the Mobile Learning workshop the students were asked to create a Flickr account. They were told that they could upload their pictures from their mobile phones to Flickr, to create an online digital repository. The participants were asked to explore taking pictures that they found useful as teaching aids. The Flickr account could be linked to their respective blog posts. They were also asked to post comments on these pictures about their possible use as teaching aids, whilst their course-mates could also write their comments. Below are some examples of pictures taken and comments made:

Screenshot 6: Pictures Taken by Participants for Online Repository (Example)
(Note: small screen size to protect the participants' identities)



The students were introduced to the class moblog during the final section of the Mobile Learning workshop. The design of the class moblog was presented in Section 4.5.3. There was no class moblog in Stage 1 but as the participants mentioned the need for a mobile resource space, it was decided to create the moblog for Stage 2. The Stage 2 participants were given the URL of the moblog which they could view over their internet-enabled mobile phones. Students who did not have internet-enabled phones were told that they would be able to view the moblog through any internet-enabled computer. The students were encouraged to download either PDF files or podcasts to their mobile phones in order to read or listen to them whenever they had time. I stressed that downloading materials from the internet via their computer to their mobile phone would avoid the cost of data downloads on which the Stage 1 participants had voiced their concerns. Other than

as a space for resources, the moblog was a means for the students to review their learning through quick multiple-choice quizzes on topics from the course. The answers were shown immediately after the students answered the questions in order to get the students to reflect on them.

Finally, the other mobile learning activity that was expanded from Stage 1 was the use of SMS blasts. In Stage 1 the participants only received one SMS reminder prior to the Mobile Learning workshop. These participants found that SMS was a quick and useful means of communication. Hence, in Stage 2 the use of SMS was expanded with several SMSes being sent to the students and tutors on the course. These SMSes were in the form not only of reminders but also reflective questions for students to consider, especially towards the final exams. There were also messages of celebration for Eid and good luck wishes for their final exams.

6.3 Students' Blog Posts for Stage 2

Similar to Stage 1, the participants were asked to write their reflections on mobile learning in their individual blogs. However, as opposed to Stage 1, they were asked to blog not only their thoughts on concepts of mobile learning but also their perceptions of mobile learning activities that could be useful for them. They were also asked to blog their experiences of using an application for mobile learning including whether it supported their learning. These specific instructions were provided as a means to gather much more detailed accounts of participants' opinion of mobile learning activities in order to answer the research questions for this study. Since all of the participants posted on their blogs there were 75 entries in total.

Some students acknowledged that the mobile phone was part of their daily lives, as they specifically indicated that they brought along their mobile phones everywhere they went (S2aas, S2chc and S2gsl).

Even though the mobile phone plays a prominent role in their lives more than half of Stage 2 participants stated that the concept of mobile learning was new to them, which is similarly noted in Stage 1.

Another interesting factor was that there were students who reflected that learning through their mobile phones could also enhance their technical knowledge. They claimed that through mobile learning extra skills could be learnt.

The data went through the same process of descriptive, categorical and thematic analysis as described in Section 4.10. The main focus still remained on the mobile learning activities in which the six categories of activities discovered in Stage 1 are the same as this stage.

6.3.1 Contextual Activities

Participants in Stage 1 reported that contextual activities are derived from the context in which the learning takes place. Usually students capture such ‘proof’ through the use of the mobile phone camera (S2fhar, S2ssai and S2ftpy).

Through the Stage 2 blog posts the students indicated that there were opportunities to act on a learning activity, i.e. to read, review and reflect in whatever context they desired. There is no boundary of space as depicted by S2niak.

Furthermore contextual mobile learning activities also provided participants with the ability to collect data for their course. This type of activity means that students could capture pictures or make audio recordings to contribute to their assignments (S2na and S2nham).

The students also state their preference for the opportunity to take pictures within a context by using the Qipit software. The Stage 2 participants showed how the use of pictures taken and processed using Qipit could assist them in capturing the essence of the situation, be it during their face-to-face discussions or the lecturer’s PowerPoint slides to be able to capture photos of points that they thought were essential (S2hiar, S2namn, S2mns and S2dp).

6.3.2 Reflective Activities

In Stage 1 participants’ reflective activities enabled them to exchange feedback. Again, this type of activity was also discussed as the Stage 2 participants posted

their experience for reflective activities in their respective blogs (S2aml and S2cac).

The Stage 2 participants also mentioned that the mobile phones provided new materials which enabled the participants to review topics and lectures. This review process gave them more time and space to reflect (S2aas, S2ams and S2mns).

It was gratifying that Stage 2 participants emphasised the use of the mobile camera through the narrative in their blogs. Some students said that they took photos to help them with writing reflections for their blog posts. This means the pictures acted as tools for reflection, an observation which the students noted on their course blog (S2mns, S2niak and S2nan).

6.3.3 Collaborative Activities

Collaborative activities described by Stage 1 participants discussed the use of mobile phones as a sharing mechanism of learning materials. The concept of ‘sharing’ was again highlighted by the Stage 2 participants. For example a participant (S2mms) mentioned that sharing of ideas not only helped him broaden his views, but also developed his critical and creative thinking.

The idea of sharing, for Stage 2 participants also extended to the idea of sharing something immediately, as indicated by S2ufms who stated that sharing can happen in a “split second” using the mobile phones.

Moreover, it was found that there were more entries from Stage 2 participants that mentioned the mobile phone as a discussion tool as compared to Stage 1 participants. Therefore it appears that Stage 2 participants could share and discuss information pertaining to their course through their mobile phones.

6.3.4 Multiple-Perspective Activities

Just as in Stage 1 there had been a lack of evidence for one of the definitions of multiple perspectives, which was the generation of alternative views through mobile learning activities. Only one student expressed this idea (S2mms).

Nevertheless, the theme of multiple media that could provide the participants with different perspectives was also repeated in Stage 2 as some participants indicated that various medium assisted them in their learning process (S2cac, S2niak and S2dp).

6.3.5 Communication Activities

As in Stage 1, the participants in Stage 2 also saw the mobile phone as an essential tool for communication with their tutors and peers as a means to support their learning. The main communication use of the mobile phone was to exchange information or knowledge, and also to ask questions pertaining to the course. They also felt that the sense of immediacy was the main reason for using SMS (S2chc, S2mns and S2nhma).

Stage 2 participants more frequently mentioned using mobile Facebook to support their learning. I could only deduce that they were all using this social media tool to communicate with and share information with each other. I was surprised because using mobile Facebook would entail greater costs for students, which I expected they would want to avoid. This was an application that I did not include in the learning design and therefore I was surprised that there were blog reflections about it. Most statements on activities that use mobile Facebook were about tracking updates on their course (S2afad, S2mnhcp, S2uds and s2mss).

6.3.6 Learning-Management Activities

The concept of learning management arose again in Stage 2. In Stage 1 students emphasised that it was convenient to carry the mobile phone around because they were able to access learning resources easily and communicate immediately with their peers. In Stage 2, the idea of getting the latest information and updates via the mobile phone seemed pertinent.

Besides obtaining the latest information and updates, Stage 2 participants also stated that they used their mobile phones to type their notes wherever they were. This was not mentioned in Stage 1; however both Stage 1 and Stage 2 MReadiness questionnaire survey findings reported that participants frequently used the note-

taking facility on their mobile phones. For example a participant stated that note-taking through the mobile phone enabled her to write ideas or reflections wherever something “comes across my mind” (S2mns).

In Stage 1, students mentioned that the mobile phone provided them with access to the internet, which they valued. This ability to access information via the internet on their mobile phones was an activity that was frequently mentioned through their blog posts such as S2km described it as convenient.

Access to the internet is fundamental to students’ lives. There were times that they did not have access to the internet through their computers, for example, when they were in their home town for the vacation break. Hence, the mobile internet would be useful to them back home (S2ssai).

Podcasts that were made available to the students as a resource were intended to provide a convenient way for students to revise lessons anywhere and anytime they wanted. A participant mentioned that this resource is effective as he could download and listen to it anytime and anywhere (S2mhac).

Stage 1 participants brought up the need for a mobile reference type of activity, in which students could access references whenever they need them. This type of condition for an activity was designed through the development of the course moblog, for which the design was described in Section 4.5.3. The students confirmed that the course moblog was a mobile space for them to share and access the resources needed for the course.

However, as one participant (S2rlg) stated, the moblog should only contain short bite-sized notes which are a more appropriate fit to the characteristics of mobile learning as discussed in Section 2.5.2.3 of the literature review.

I would also like to highlight that there were not many entries that reflected on the course moblog. I deduced that this was due to time limitations because the students were expected to write the blog posts within a few weeks of the Mobile Learning workshop, which would not leave them much time to use the moblog to support their learning. The moblog was implemented right through their final examination.

In Stage 1, participants expressed their interest in eBooks, especially a dictionary. This is not a surprise as these students were learning English as a second language in order to teach it, therefore access to a dictionary was essential. In the Stage 2 Mobile Learning workshop the mobile dictionary was not only mentioned but was also discussed in depth with regards to how to download it to a mobile phone, and therefore there was a greatly increased interest in the use of a mobile dictionary to support Stage 2 participants' learning.

6.3.7 Summary of Students' Blog Posts

Some findings from the Stage 2 blog posts were similar to those from Stage 1. However there were a number of new revelations, such as the use of mobile Facebook and reference materials such as the e-dictionary. Besides that the mobile learning activities and mobile applications elicited through the students' blog posts reinforced the finding that there are six types of mobile learning activities that were thought to be suitable to support learning from their own perspective. These six types of mobile learning activity are contextual, reflective, collaborative, multiple-perspective, communication and learning-management activities. The interviews of students that took place at the end of the course provided much more depth as they had had more time after the course to reflect on these activities and the use of mobile applications to support their learning.

6.4 Students' Online Interviews for Stage 2

Six students (five female, one male) volunteered to be interviewed; interviews were conducted after their final exams. The interviews were conducted using their chosen chat platform, for example, Google Talk or MSN Messenger. The students' verbatim quotes were coded as 'S2a' to 'S2f' respectively in order to hide the identities of the students.

All of them stated that their mobile phones were important to them. Nevertheless, there were only two students who were confident in using all the applications on their mobile phones as compared to the rest who reported that there were some applications that either they were not comfortable with or did not know how to use.

For example, there was one participant who stated: *some of the applications I am not familiar with because I seldom use it (S2a)*.

All of their phones had internet capability; however the participants ranged in their use of this facility. There were two students who frequently used the internet capability and three students who only accessed the internet through their mobile phone only when there was a need. There was one student who did not use this facility at all. Basically these four students reported that cost was the main factor that prevented them from accessing the internet through their mobile phones. Nevertheless, two of these students stated that they wanted to buy more sophisticated mobile phones that could have more functionality in the future, as they acknowledged its usefulness to support their learning. This is interesting to note that the students foresee the importance of mobile phones being able to positively impact their learning.

Most students reported that they fundamentally use their mobile phone to make and receive calls, to send SMS or MMS, to listen to the radio or MP3 music, use the calendar, for reminders and alarms, to take pictures and also to take notes. This is very much aligned with the findings of the MReadiness questionnaire in which these activities were reported as the most popular ones.

The themes elicited from the online interviews were the types of mobile learning activities that the students perceived could support their learning. Through the interviews in Stage 2, all of the predicted six mobile learning activities - contextual, reflection, collaboration, multiple-perspective, communication and learning management activities – were found to be embedded in the students' narration of mobile learning experience.

6.4.1 Contextual Activities

Some of the activities from previous Stage 1 findings were reviewing, revising and reflecting content in the students' context. This supported the students' learning, and these activities were defined as contextual. This again had been brought up in the students' interviews through statements such as:

we can reflect on the content of the sms whenever we are free, eg, waiting for bus, or waiting for lecturer to come into class. its like learning can occur at anywhere and anyplace (S2e)

if it is just a simple one, i can reflect anywhere (S2e)

The other contextual activity was the ability to capture proof of learning especially through mobile phone cameras which was also elicited previously in the other students' blog posts data. Again, this notion was found in a student statement as below:

see the nature that is going on in the class i mean the learning process (S2e) (student is referring to authentic situation she sees and reflecting the 'learning' that happens in class, and she want to capture this moment of reflection)

i use camera for concrete evidence, help me to recall what i have learned in the class (S2e)

6.4.2 Reflective Activities

In the interview, participants mentioned the use of applications on the mobile phone as a means of getting instant feedback

yes their comments are constructive and the comments help me to reflect more (S2a)

i learn to improve on my own weaknesses and also strengthen on my own strengths (S2d)

One participant stated that she received feedback on her language through peer comments on her podcast. She reflected that the feedback she received helped her to improve her grammar.

it does help me.. esp from my tlists.. most of my tlists from Korea, China, Japan and US. they give good comments and my us friends always help me to correct the grammar mistakes and the pronunciation i made (S2b)

There were no reviews about SMS blast in the blog posts. This was because during the reflection writing through the blogs, this activity had not been fully implemented. The students were sent a question through SMS blasts that asked

them to reflect on a given topic. There were a few times this was done, particularly after each class and also towards the final course exam. Through the interviews, it was recognised that students appreciated this activity as it helped them to recall and review what they had learned.

The reflective questions actually help me to recall what I have actually learned and it is definitely helpful as the questions sent are specific and there is a scope. This helps me in my examination too as I can refer and reflect the questions before hand. (S2a)

it's good too because i can always think about it anytime anywhere (S2b)

sometimes they make me think out of box (S2c)

it helps me to reflect back on what i've learned. it acts as a reminder for me to look back on what has being taught as i might just forget about it when i'm home if it weren't for the sms.. (S2d)

it helps us to reflect on the lesson that we have learnt helps to recall a lot of things (2e)

it's ok, but i'd prefer if it's not the only way to tell me the reflective questions. It can be a reminder but not the only method to send me the questions (S2f)

It was also noted that pictures taken through the mobile phone were able to elicit reflections from the students, which is again a similar finding to that from the students' blog posts.

The pictures help me to reflect back on what have been taught for that particular week. By looking at the pictures, I was able to recall back what actually happened during the class. Pictures can actually be used as a timeline that describes the whole process of learning (S2a)

For the pictures of teaching aids, I can also get the ideas of what can be used/taught when I go for my teaching practical next sem (S2a)

Pictures taken from the students mobile phones were also used a resource for the students to review later on to assist in their understanding and revision of a particular topic.

These pictures serve as extra information in my academic life as a University student. (S2a)

I can also capture the notes or anything that it is useful for my learning using the handphone camera. (S2a)

There were mixed responses to the creation of podcasts for the review of topics from the blog posts. Nevertheless, the majority of participants in the interview session acknowledged that creating a podcast to review a topic was a helpful way to support their learning.

it's cool because i get to listen to what i recorded. So if i record important notes about something, I can just listen to it from my phone to do a quick revision about it (S2f)

When creating this podcast, I was actually doing my revision. I was able to go through the notes for the topic that were being taught. I found that the recording were really useful as I was able to listen to it when I'm free. (S2a)

creating a podcast for study purposes, i could actually just summarizes the whole thing and put it in a podcast.. i can post it online or just save it anywhere convenient for me to listen (S2d)

One student stated that using podcasts for reviewing a topic was helpful in his learning but would prefer them to be created by the tutor: *listening to podcast given by tutors ok but not creating own (S2c)*

6.4.3 Collaborative Activities

As per the findings from the Stage 1 and Stage 2 students' blog posts, 'sharing' information was an activity the students felt could add support to their learning through activities designed to utilise the mobile phone.

I can ask questions and at the same time I can clarify some of the doubts that my friends have. I will always send sms to my friends when I have questions and so do them. so, we can actually share information through this platform (S2a)

When we were recording we were actually sharing information with our friends at the same time. I think this helps me to improve my knowledge. (S2a)

The participants also acknowledged that they could use their mobile phones for discussion, particularly when the reflective SMS questions were sent to them. The main purpose of the activity was for the students to reflect on weekly lessons; however it was also found that students used the questions to stimulate discussion amongst themselves.

I received it when we were in our respective hometown. So we just discuss the questions via SMS (S2a)

we will have a short discussion and reflect together (S2e)

6.4.4 Multiple-Perspective Activities

It is interesting to note that four of the interviewees discussed the concept of multiple-perspective. There were two definitions of the multiple-perspective activities that were derived at the beginning as in Section 3.5.4. Through the different data collection methods, the concept of learning from various opinions of different people did not arise. However, in the Stage 2 online interview this concept was elicited through the following statements. Participants expressed the idea that there were mobile learning activities that provided them with different opinions in order to help them construct their own understanding.

some agree with me but some have their own opinions which I have never thought of (S2a)

if i go in my coursemates blog, i will see a student a learners' perspective it's amazing (S2e)

it helps to widen my mind actually to see things from different point of view (S2g)

sometimes, cos listening to others' opinions help me to see how others think about the question (S2f)

In the students' blog posts they reported that multimedia resources made available through their mobile phones provided them with alternative views on a topic. This concept was again similar to the definitions given by these participants in the interviews, as they stated:

i agree with that because usually text doesnt provide emotion but oral did.and if there is ambiguous sentence, it's often hard to understand by text (S2b)

creating podcast is definitely different from writing as podcast allows us to listen our own voice writing is a bit dull as it will be wordy (S2e)

6.4.5 Communication Activities

The interviewees all seemed to agree that the mobile phone could be used as a communication tool to support learning, by stating that they could use it to exchange information for example in this statement : *This means that you can exchange info during class (or gossip!)...* (S2b)

The students also reported that the mobile phone applications, particularly SMS, allowed them to ask necessary questions about their lessons amongst their peers. Students also suggested they wanted to be able to communicate with their tutors using SMS, due to its immediacy.

yeah, so that in case of emergencies or when i need help, i can reach them (S2f)

sending email takes time for them to reply i think messages will be more effective. (S2c)

It was during the interviews, particularly with one of the participants, that I became much more aware of the reason the participants in this cohort value using mobile Facebook. Apparently a Facebook group was created by the students themselves and everyone in their cohort was said to be part of this group. It was reported that the students interacted in this space to get information pertaining to their course, posted notes to share others and discussed whatever issues arose. This factor brought several insights, particularly as to the level of interest in mobile Facebook in the Stage 2 students' blog post reflections. These were some of the statements about activities using mobile Facebook mainly to track updates on their courses.

facebook is where i can check any updates from my lecturers and reminders given by my lecturers (S2a)

The most effective is mobile FB : we are always online.. and if there is any update for course.. it will notify us (S2b)

6.4.6 Learning-Management Activities

There were several different activities using the mobile phone that helped the participants to manage their learning. These were discussed in many instances, such as when the students revealed that getting the latest information about the course was considered essential:

well, we do send sms to our group members telling them the latest info and also discussing about lecture notes and events of the uni (S2d)

as we are living with our phone all the time, even sleep, the phone is also beside us, thus, we can get to the latest info even when we are sleeping (S2e)

with regards to amendments of class times or questions about assignments, yes... other than that, nope ^__^ (S2f)

Four of the participants briefly mentioned that they used the note taking application quite frequently. This tallied with the findings of both stages of the MReadiness questionnaire, as indicated through this statement: *i can also use the "write notes" application to jot down important things in class (S2f)*

Similar to the students' blog posts, those interviewed also reported the need for internet access through their mobile phone, to assist with the management of learning because information can be accessed any time and any where they want.

access internet in the university and coffee shops (S2a)

most of us do online 24/7 through the phone .. even in class (S2b)

access: ya if we have it in our handphone then we can open it at anytime n anywhere (S2e)

Participants also proposed the use of mobile phone applications for reminders, to help them manage their learning. This again tallied with the findings of the MReadiness questionnaire. *it can be a reminder as well, as i set the alarm for me everyday so that i wont miss the class. (S2c)*

Furthermore, SMS messages that were sent as reminders and instructions were also appreciated as expressed by the participants. This was especially so when they could not get access to the course's learning management system to note announcements. They also voiced their need for reminders to organise their busy schedules.

Well, i think the SMSes being sent to me definitely works as a reminder. It helps me to prepare myself for the next class. There are times that we need to read up or prepare something before entering the class and this will definitely help me to have a better understanding. As for me, I am not a person who will always check my mail, so I might miss out anything that is sent to me via mail. But my mobile phone is always be with me so I won't miss any SMSes regarding the academic purposes. so, i still prefer sms (S2a)

sometimes we cant access the spectrum... high-traffic or maybe server problem.. and those smses keep us updated (S2b)

It is in this cohort that a course moblog was created. The moblog was intended as a platform to host mobile learning resources that had been suggested by students from Stage 1. There was not much feedback about the moblog through the students' blog posts and this could be due to the fact that they had not experienced the full extent of the moblog deployment at the time of writing the blog posts. Out of six participants, only three visited the course moblog through their mobile phone, while two others visited it through an internet-enabled computer, and one person did not visit the course moblog at all. These were two comments about the course moblog:

Well I think the moblog for the course is simple yet informative. There are definitions for each terms and it is being updated with new information according to the week that we are in. Since it is simple, it actually helps my understanding. (S2a)

i did enter that and it's a good place to read back what has been taught (S2d)

Three participants acknowledged the use of a dictionary on their mobile phones for checking spelling and pronunciation: *for hp, dictionary in my handphone is very useful for language teacher as i can double check the spelling if i have confusion (S2c)*

6.5 Review of Design for Mobile Learning Activities

In the discussion of learning design (Section 2.1), the Design Learning Model from Gorard & Taylor (2004) was presented in Diagram 3. Using the model, it is proposed that the mobile learning activities were designed in order to gauge the affordance of these activities. This not only resulted in empirical findings but also in the building of a theoretical basis for the design of mobile learning activities. It was found through the Stage 1 data that there were six mobile learning activities instead of the four which were derived through an analysis of social constructivist literature. It was also found that some of the original social constructivists learning principles concepts differ after being perceived by the participants. These changes or similarities will be discussed in detail in the coming discussion chapter.

There were many lessons learned in Stage 2 for the future design of mobile learning activities to support this type of participants' learning. In Stage 1 activities perceived as capable of supporting students' learning were elicited; Stage 2 on the other hand was used to confirm or contradict these findings. Stage 2 contained many more activities which were designed based on students' requests from Stage 1. These activities were designed and deployed in order to explore their potential to support the participants' learning.

There were a few issues relevant to the future design of mobile learning activities. Namely, the students acknowledged that there were different learning styles amongst them. This factor was elicited in Stage 1 and was emphasised again in Stage 2.

i'm a visual learner, so i learn things when i see it. A colourful picture will leave a better imprint in my mind so when I take pictures and look at them, I can remember the event that happened better (S2f)

i personally prefer podcast coz I'm so used to listening to music thus, podcast was something good to me. (S2d)

Not many of the Stage 2 students left comments about the course moblog. The reception of it was not as I anticipated it would be. The reasons were perhaps as follows:

put the blame on our schemata.. "blog" sounds heavy (S2b)

we are not familiar with moblog (S2b)

This could also be due to the fact that the students had many choices of resources provided for them, such as the elearning management system and the social networking Facebook page that they had created for themselves. An example of this was when a student reported that when they received the SMS reflective question, she posted the question on the group's Facebook wall for the classmates to discuss. This was an interesting phenomenon as it showed the variety of ways in which students use technology for learning.

when we received the reflective questions from our lecturers via sms.. we will repost it to facebook page.. so everyone will contribute to answer the questions.. and if someone found good resources to answer the questions, he or she will post the link to our own fb page.. (S2b)

It must also be recognised that the design of mobile learning activities was tailored to HE students. The participants stated through their blog posts that they needed help with organising their student schedules between assignments and going for lectures. The students (S2naag and S2nmn) explained how 'hectic' their lives were and that they needed support to manage their learning.

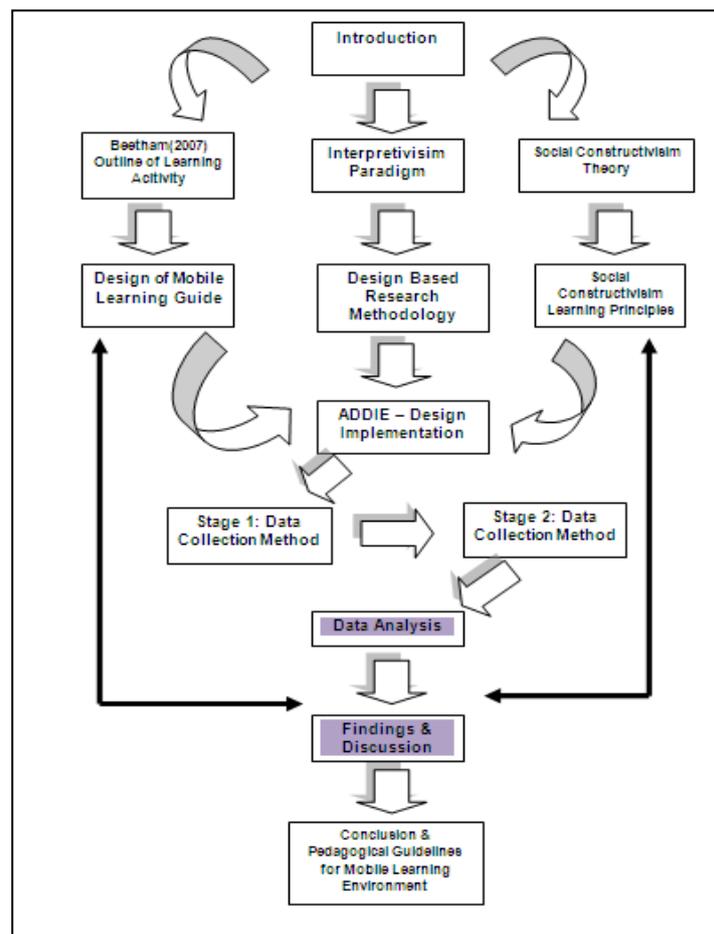
This provides an insight into the HE students' lives. Through these statements it is clear that there is a need to provide support for their learning, particularly through mobile learning activities.

Chapter 7: Discussion

Overview

This chapter discusses the research findings through answering the research questions. The research questions were developed as part of this study's aim to explore the possibility of introducing mobile learning activities to support HE students in Malaysia. This chapter is part of the study's findings and discussion as highlighted in the diagram below:

Diagram 2: Structure of Thesis for Designing Mobile Learning Activities for HE Students



The structure of this chapter is presented through the three research questions of this study. The research questions are answered through sub-sections that present arguments using evidence from both Stage 1 and Stage 2 findings. The first research question seeks to find out the preparedness of Malaysia HE students for mobile learning, while the second question describes and discusses mobile learning activities along with mobile phone applications considered suitable to

support HE students' learning. The latter question outlines learning activities that arise from the experiences of participants through the implementation of designs for mobile learning activities for their course. The final question discusses issues and challenges in the design and implementation of mobile learning initiatives for a Malaysian HEI course. Through this discussion chapter, a pedagogical guideline for the design of mobile learning activities to support HE students in Malaysia are developed and is presented in the conclusion chapter of this thesis.

7.1 Research Question 1 (Preparedness of Students)

How prepared are HE students in a Malaysian university to accept mobile learning activities as part of their course?

In this question, students' readiness was defined through four aspects: 1) students' device readiness; 2) students' skills with mobile phone applications 3) students' understanding of the concept of mobile learning and 4) students' receptiveness of mobile learning activities. The following section discusses each of these aspects in relation to HE students' preparedness to accept mobile learning activities.

7.1.1 Students Device Readiness: Access to Tool

All participants in this study owned at least one mobile phone. This evidence of device ownership is aligned with the MCMC mobile phone penetration report (MCMC, 2012) which states that most Malaysians own a mobile phone. This factor is essential should the management of Malaysian HEIs decides to implement mobile learning campus-wide.

The participants viewed their mobile phones as an essential part of their daily lives. They often discussed the importance of their mobile phones in their daily lives as they carry them everywhere they go. When asked in the online interview how important their mobile phone is to them, most of the participants acknowledged that the device was very important to them. One example was that a student reported she would read an incoming SMS message even during class

time. The 'always-on' characteristics of the mobile phone as a convenient and portable tool allowed this device to be the preferred tool for the students, which is able to reach and support them in their learning. This confirms the views of Colley & Stead (2004) and Ito et al. (2008), whose studies emphasise the importance of the mobile phone in HE students' daily lives. The influence that the mobile phone has over the participants' lives is similar to the digital learner literature such as Zickhur (2010) on the 'Millennial' and also Rainie & Fox (2012) Pew's report that mobile technologies are infused into the lives of those in similar age groups to the participants in this research.

The types of mobile phones that the students owned range from the basic phone to 'smartphone' such as iPhone or a Blackberry. The notion of basic phone or rather 'ordinary phone' as the participants called them has been presented in the findings chapters. Through the data gathered in Stages 1 and 2, it was found that about half of the participants had smartphones with internet capabilities. There were only about 10 participants at each stage who did not have the camera facility on their mobile phones. From the findings it was also found that most students had a mobile phone equipped with enough memory space for resources such as PDF files to be downloaded.

In the literature review the importance of ownership of the mobile phone and its impact on the participants' learning are discussed. Similar to Moura & Carvalho's (2009) study, it was found that participants did not indicate any problems with using their own devices for learning. Currently the issue is not the availability of the tool to implement an initiative such as this study in Malaysian HEIs, but rather the need for a more advanced mobile phone. As suggested by Carroll (2003) students only embrace a tool when they find it adds value to their lives. Through exposure to mobile learning, participants indicated that this new awareness stimulated them to consider upgrading their mobile phone in order to be able to access the internet or download materials like the dictionary, to help their learning.

7.1.2 Student Skills on Mobile Phone Applications

Several mobile phone applications were reportedly being used by the participants. It was discovered that frequent activities involving mobile phone applications were sending or receiving SMS and calls, taking pictures using the mobile phone camera, listening to music through the phone's MP3 player, writing on the note-taking application and using the calendar and alarm, mainly for reminders. Students with internet-enabled phones access the internet either through the free Wi-Fi wherever they are (on campus or in cafes) or through their own paid broadband mobile network plans. Since these applications are already part of their daily lives, students are familiar with them. Hence, the delivery of mobile learning activities through these applications will be easier as course tutors do not need to teach students how to use these applications. Using common mobile phone applications was one of the considerations for the design and development of mobile learning activities for this study.

However, it must also be noted that there were also some students who did not know about a few functions in their mobile phones. It appears that not all mobile applications were explored even though the participants had access to them. Through the MReadiness questionnaire it was found that quite a number of participants were not sure whether their mobile phone had certain functions, such as displaying Microsoft documents or PDF files or allowing the user to listen to radio channels. During the mobile learning workshop for Stage 1 it was discovered that some students did not know how to use the Bluetooth function on their phones. Some students also indicated through their blog posts that they did not know that they could access eBooks through their mobile phones. This revelation only came about after the mobile learning workshops in Stage 1 and 2. Kennedy et al. (2008) found that the majority of students had not used their mobile phones to access the web for information or to access email for the purposes of studying, and this is also evidenced in this study. We cannot assume that even though the students have a mobile device, that they know about all the applications on their mobile phones or know how to use them. Some students claimed amazement after being introduced to certain applications as they said that they did not appreciate the possibilities until they were introduced. This is

probably because students do not see the need to use certain applications in their daily lives. They only learn to use the application when they see the need.

Nevertheless, even when students know about the applications, we can question whether they actually use these applications to assist their learning. According to Kennedy et al. (2008), we cannot assume that since students have access to the technology that means they know “how to employ technology based tools strategically to optimise learning experiences in university settings” (p.14). However there were a few students that were already using some of the mobile phone applications to support their learning. A few of them mentioned that during class they used ‘Google’ and particularly search for Wikipedia to access information when the lecturer mentioned something that they did not understand or when they were questioned by the lecturer on something that they had no knowledge of. There were other examples of mobile phone application usage such as capturing photos of PowerPoint slides to review later. The students seemed to have discovered these activities of their own accord; however we should not leave it to chance that students will embrace the concept of mobile learning on their own.

The literature on digital learners, such as Kazlauskas & Robinson (2012) depicts current HE students as avid users of technology. However, it was found that Malaysian HE students need some form of introduction in order for them to realise the possibilities of mobile learning. Leaving HE students to discover the capabilities of the mobile phone for learning alone would limit their understanding of how these activities could support their learning. Bennett, Maton & Kervin (2008) found that everyday technologies are at times not used for learning activities by digital learners. Even though the students have access to the technology and have the skills to use it, it does not mean that they use a particular application for learning. This means that students need to be exposed to the learning potential of the mobile phone as a tool to support their learning. Therefore, in the design of mobile learning activities, introduction to examples of activities that support learning is essential as part of the implementation plan in any Malaysian HEI.

It was also noted that a large number of students sync their mobile phones to their computer. However the frequency of synching their phones varies, as many did not see the need to do so. As discussed earlier in Chapter 4 (Section 4.5.2) the need for students to sync their mobile phone to their computer enables them to download or upload content in the form of text, audio or visual to support a mobile learning activity. Through this action, reference materials can be downloaded or pictures can be uploaded to support students' learning. It is believed that once the students see the benefit for action, such as syncing their phone, they will act upon it. Learning designers will need to create this need in order for students to learn how to use mobile phone applications that they did not bother to learn before.

Although some students' usage of mobile phone applications was limited, they did not find the introduction of new applications a problem. This supports the literature on Malaysian HE students' acceptance of technology for learning, such as in the studies of Hanafi, Zuraidah & Rozhan (2004) and Lee, Hazita & Koo (2010). For example, the participants did not report difficulties in learning with and using applications such as podcasts which were introduced to them during the mobile learning workshop in both stages of the research process. This concurs with digital learner literature which states that the current digital learner does not have problems with using digital tools. This means that new applications can be introduced to the students, however proper guidance needed to be given. In the mobile learning workshop, hands-on exposure was provided along with step-by-step documentation on how to create a podcast. The participants were also put into groups to jointly create the podcast and this provided space for peer learning.

Students also reported that having a reason to learn using their mobile phones helped them to enhance their technical knowledge and skills. According to James (2007), network infrastructure readiness at a national level is an important agenda item for the public due to the awareness that ICT can help the country to fulfil its national potential and enable a better quality of life for their citizens. Learning new ICT skills would be a step closer to attaining the Malaysian Vision 2020 goals (National Higher Education Strategic Plan 2020, Ministry of Higher

Education Malaysia, 2007). This means that implementing mobile learning as 'worldware', as proposed by Ehrmann (1995), would help pave the way towards delivering the national agenda. Laurillard (2002) also suggests creating learning environments with the use of technological tools that are used in the real-world. Through these findings it seems that the HE students themselves support this notion. The participants expressed their awareness that indirectly they were also learning to use the tools themselves which could be a useful skill for them in their work after graduation.

7.1.3 Student Understanding of the Mobile Learning Concept

More than half of the participants from both stages of the study reported that the concept of mobile learning was new to them while some noted that it was during the mobile learning workshop that they first heard the term. However after the workshop the students seemed to understand the concept, as reflected in their blog posts and also in the online interviews.

Nevertheless, there were some students who stated that they have been actually doing some of these activities without realising that they were mobile learning. For example, they reported that they had been taking lecture notes or taking pictures of PowerPoint slides using their mobile phones to review or reflect on later. This indicates that there can be situations where HE students have embraced mobile learning without being introduced to the activities formally. Just as reported through digital learner literature these students used technologies to support their learning without thinking about it (Strauss & Howe, 1991; Prensky, 2001; Pedro, 2007; Tapscott, 1998 and Rosen, 2010).

Furthermore a major characteristic of mobile learning is that it is seamless, as it interweaves with the students' daily lives between classroom learning and situations where it is needed (Section 2.5.1). The portability of the device, ease of use and always on functionality provides the environment which participants reported they appreciate. It is difficult to draw a clear line between formal activity and informal activity in learning. Mobile learning also provides us with an illustration that there can be both formal and informal learning for mobile learning activities. This is because there is continuity in learning across different

contexts and times. Chan et al. (2006) describe the idea of seamless learning as when students learn whenever they are curious in a variety of situations and they are able to switch easily from one situation to another through using the mobile device. This description of seamless learning using the mobile phone was derived from the findings of this study.

There are two debates from the discussion above. One is whether should there be a formal introduction to mobile learning on such a course. As evidenced through the findings some students picked up the notion of mobile learning prior to the mobile learning workshop. I believe that mobile learning should be introduced formally to the Malaysian HE students to create further awareness. There will be missed opportunities for students to collaborate, reflect, communicate and manage their learning should the students not be guided towards the availability of these types of learning support offered through the mobile phone. Through mobile learning activities lecturers are able to reach out to HE students outside the classroom, while students can bring authentic context into the classroom. These opportunities could be missed should the concept of mobile learning and its affordances not be introduced to the HE students.

The second debate is whether mobile learning represents formal or informal learning. This is because mobile learning moves seamlessly between classrooms and out of classroom learning and it is difficult to tag which is which. This is also supported by Duncan-Howell & Lee (2007) and Hashemi et al. (2011) when they describe mobile learning as a bridge between formal and informal learning. I believe that it is meaningless to debate which form of learning mobile learning needs to be associated with. The more important agenda is that of designing learning activities that students find beneficial to support their learning.

7.1.4 Student Reception of the Mobile Learning Concept

The participants were very receptive to mobile learning and were generally ready to accept this type of delivery mechanism. Although most of the students reported that they were new to this type of learning they commonly said that mobile learning is engaging and makes learning interesting and interactive. This is true for both groups of students from both stages. The students also stated that

they liked the sense of immediacy that the device provides, which crosses time and place. In other words, the findings support the anytime and anywhere characteristics of the mobile phone, in particular the real-time, flexible and dynamic characteristics which the participants found attractive, as established by Klopter, Squire & Jenkins (2002), Leung & Chan (2003), McConatha, Praul & Lynch (2008), and Hashemi et al. (2011).

The fact that the participants of this study were on a course that promotes technology for learning and teaching could have a major influence on their reception of the mobile learning concept. On the other hand, since the course promotes technology for learning, the students were exposed to various technologies which gave them a wider understanding of how technology works in their teaching and learning. They would be able to decide which technology works for what purposes and the actual benefits the technology afford.

There are reports such as those of JISC (2005b) and NUS (2010) and also the literature on digital learners that suggest that HE students are accepting of mobile learning and the findings of this study confirmed this. In the literature on Malaysian HE students, it has been indicated that being exposed to ICT in school or in their daily lives means they are able to accept mobile learning as another ICT initiative. In this study this matter is proven to support the notion that Malaysian HE students are receptive towards mobile learning.

Knowing that students have the tool itself and some knowledge of its applications, and that they are receptive to mobile learning, has helped me in the design of mobile learning activities to support HE students. The findings from research question 1 have assisted me in finding the answer to research question 2 through the design of mobile activities.

7.2 Research Question 2 (Design of mobile learning activities)

How can social constructivism be applied to the design of mobile learning in a Malaysian HEI course?

As illustrated in Diagram 2 on the Design Learning Model from Gorard & Taylor (2004) the ‘intended activities’ which were designed based on the social constructivist learning principles were implemented, resulting in the ‘actual activities’ or functions. This process depicts the affordances (Norman, 1993) of mobile learning activities that were delivered using the mobile phone applications. Learning designers and researchers may predict the outcome of a learning activity, however when it is deployed the affordances of the activities may change (Keinonen, 2003; and Moura & Carvalho, 2009).

In this research four proposed learning activities were conceived through a literature review of social constructivist theory, discussed in Section 3.5. The first stage of the research was to find out whether these activities would be accepted. After the first stage two more mobile learning activities were discovered through the descriptions of participants on mobile learning activities that supported their learning. Stage 2 of the research was designed based on the Stage 1 findings, and its main purpose was to confirm whether these six mobile learning activities would be accepted by the students to support their learning. These findings were cross referenced not only through the different stages of the study but also through the different data collection methods which were the MReadiness questionnaire, the students' reflective blog posts on their experience with the mobile learning activities and also the students' online interviews.

7.2.1 Contextual Activities

In Section 3.5.1, contextual activities are activities based on multiple contexts that promote authentic and situated learning. Students specifically stated that this type of activity allowed them to capture learning moments and to show proof of their learning related to the contexts that they were in.

Students were able to collect data to assist their learning in authentic contexts. In studies such as those of Muyinda (2007) and Cochrane & Bateman (2010), the collection of data by students was incorporated into a specific activity, for example, when the data was needed as part of a project. However, in this study it was found that students collected data voluntarily with the aim of supporting their understanding of a particular topic. There was no specific project that they

needed to collect data for. Students reported that they took photos without any planning; in whatever situations they happened to be in order to help in their understanding of what they were learning, and then posted these in their course blog posts. The students seemed to want to illustrate through the pictures they had taken their representations of a situation. Furthermore, digital learners are believed to prefer image-based rather than text-based learning materials (An & Frick, 2006). The mobile phone functions as a tool to capture authentic data, particularly photos, that the students felt could support their learning. This situated learning depends on how the respective students perceive the context they are in and then translate it into their own understanding.

Students also mentioned that they could use their mobile phone to access different types of information to allow them to be able to read, review and reflect on the situation that they were in. Through the mobile phone they were able to do so from wherever they were. For example, they can read small bite-sized notes or listen to an audio file in whatever context they are in. Hence, any pocket of time the students have or any situations that they are in can be filled by engaging with relevant activities with the ‘portable’ and ‘convenient’ device that the mobile phone is considered to be. This concurs with studies of mobile learning that list the benefits of using the mobile phone as a portable, flexible and convenient tool for learning (Kim, Mim & Holmes, 2006; Maag, 2006; and McConatha, Praul & Lynch, 2008).

Therefore contextual mobile activities are learning moments in the multiple contexts where students are situated. These activities help students to make sense of the environment they are in. It was also found through this study that contextual activities allow for students to collect learning evidence that can be used to revise, review and reflect upon later.

7.2.2 Reflective Activities

The understanding behind this activity is that it is intended to help students reflect on their own thinking and also help them to evaluate their perceptions through the views of others, as discussed in Section 3.5.2. Through the findings participants stated that they were able to receive immediate feedback and this

helped in their reflection processes. It was also noted that the students stressed the need to ask questions and expected immediate feedback from their peers and tutors. Instant feedback and the exchange of opinion with others provided the space for students to reflect, as also reported by Seppala & Alamaki (2002) in their study of teacher trainees who were also similar participants for this study. Reflective activities allow for 'just-in-time' feedback to support students' learning and also allows them to review their thoughts based on others perceptions. An & Frick (2006) and Andone et al. (2005) reported that students need immediate feedback, and therefore by using the mobile phone as a learning support tool this need of HE students is supported.

Participants stated that they could use pictures taken from their mobile phone to reflect on. These pictures were mostly taken in situations that promote reflection on a topic, for example, a page from a book in the library or a photo of a PowerPoint slide during a lecture. They used these photos as prompts for later reflection about their learning. Bednar et al. (1992) suggests that students build an internal interpretation of the active social process. In doing so the participants are internally reviewing content which is based on a communal action. This again supports the concepts of intrapsychological and interpsychological from the social constructivist principles as in Section 3.3. This is because learning is first developed socially (interpsychologically), in this case the authentic context of the photos, and is extended to an intrapsychological process that is transferred within the individual, which in this case is the reflection process of the student.

Furthermore, the students also noted that resources such as podcasts, accessed through their mobile phones could give them more time to reflect because they could review them as often as they needed to at any time and place of their choice. They reported that they reviewed these resources mostly as a means to fill time, hence allowing them not to waste time. Maag's (2006) and Henriques' (2007) studies indicate that students found listening to podcast recordings beneficial as a means to review specific content and expand their discussion, but they do not highlight the element of time as compared with this study. Again, flexibility of time seems to be highlighted by the participants in this research.

Thus, the concept of reflection-based activities developed through this research goes further than the initial definition of this type of activity. As noted, the activities were initially thought of only in terms of giving students the space to reflect on their learning and also to enable the students to review their thoughts on receiving others' perceptions. However, as evidenced through this research, students felt that immediate feedback and prompts for reflection based on their understanding of context were also essential. There is also the idea of freedom and ease to review materials when and where they feel necessary which cannot be offered through other delivery mechanisms such as face-to-face lectures.

7.2.3 Collaborative Activities

Section 3.5.3 describes collaborative activities as those which encourage interaction between and amongst a group of learners in order to maximise each other's learning in any given task. This type of activity helps students to refine their knowledge through discussion and sharing of content. Discussion practices could be created through the mobile phone, as confirmed by the participants of this study. They mentioned that SMS and mobile Facebook were the main mobile phone applications that they use for collaboration purposes. This supports McRobbie & Toban's (1997) study that indicates that the discussion of ideas with peers is essential as a means to support learning for students.

The initial collaborative mobile-based activities were designed on the basis that these activities were delivered through a formal project given to the HE students. This project was to allow for peer discussion and learning. However, the participants indicated that collaborative practices using mobile phones did not stop there. More half of the participants stated that learning with the use of mobile phones encourages sharing practices. Students found that sharing a piece of information, their thoughts or their pieces of work was beneficial to their learning. This agrees with one of the characteristics of a digital learner which is the need to create and share (Brown, 2002; Dede, 2005; and Lorenzo, Oblinger & Dziuban, 2007). There is a strong sense that working collaboratively as added value to the students' learning experiences, and created a positive culture of shared meaning amongst the students.

Group activity and an interactive networking community are the distinguishing features of a digital learner (Tapscott, 1998; Frand, 2002; and Oblinger & Oblinger, 2005). Being part of a community and collaborating together is also a characteristic of Malaysian HE students as they prefer to learn collectively rather than as individuals (Holme & Sharples, 2002; Nurzali & Khairul, 2009; and Lee, Hazita & Koo, 2010). Through this study, a glimpse of this characteristic is seen. A surprising factor is that it was found that the participants had created their own community of practice through the use of Facebook and could communicate and collaborate with ease through the mobile version of Facebook. One of the participants interviewed in Stage 2 commented that SMS could only reach a single person but through Facebook she felt that everyone in her class could be reached. Duff & Cunningham (1996) explain that students are “initiated into the practices of a community by moving from legitimate peripheral participation to centripetal participation in the actions of a learning community” (p.181). This indicates that the students are active learners as they can produce solutions to problems they encounter and create their own learning communities through their participation while developing a shared understanding.

Communal sharing and learning occur when learners take an active part in a community that is willing to support and share in knowledge creation (Shea, 2006). This indicates that meaning and experience are socially produced within a context which entails these students as having a role in their own education. The affordances of mobile learning seem to interconnect with and facilitate students’ linking, creating, producing and sharing information, which thereby produce active participation. The creation of a mobile Facebook page by the students indicates a learning culture that facilitates student ownership through customisation of learning spaces that are linked at times to non-institutional technologies. This potentially provides a basis for an inspiring space for learning, as recognised by Conboy, Hall & Thompson (2009).

7.2.4 Multiple-Perspective Activities

Section 3.5.4 defines multiple-perspective learning principles as having two aspects. The first allows students to be exposed to different viewpoints through different types of source such as peers or even through the internet using the

students' mobile phone. These different viewpoints provide different angles for the students to consider and hence support their learning. However, there was little evidence of this type of activity in either stage of the research process. There could be various reasons for this, but one main factor could be due to the way the activities were designed, in which the focus was given to engagement of viewpoints from different types of media. Honebein, Duffy & Fishman (1993) acknowledge the need to review alternative perspectives as an important aspect of learning. In this study, the participants appeared to generate further viewpoints from these various media which were made available through their mobile phones.

The second aspect of multiple-perspectives is when media provide a range of viewpoints and information for the students. This is because their mobile phones enable different types of media to be sent and received. The findings suggest that the presentation of resources through multiple media is well received by the students as a means to support their learning. This is discussed by Beetham (2007) who states that "different learners have different capabilities with different media" (p.33). Thus, a multiple media based learning activity would be a more appropriate label for this type of activity. It is also noted through the digital learner literature that students prefer interactive modes and multimedia engagement for learning rather than static materials (Adone et al., 2005; Oblinger & Oblinger, 2005; An & Frick, 2006; and Pedro, 2006).

7.2.5 Communication Activities

This type of mobile learning activity was not initially proposed however, in Stage 1 of the study, it was discovered to be appropriate. As shown by Chickering & Ehrmann (1997), use of ICT amongst HE students increases opportunities for interaction, therefore using a communication device like a mobile phone is likely to encourage more interaction amongst peers, tutors and others. The use of mobile phone to communicate was a regular and common practice among participants.

According to the participants, mobile phones helped with their learning because they could always interact with each other. It appeared that being in the loop with

information, especially with peers, is essential, and this is also found by Lorenzo, Oblinger, & Dzibun (2007) who state that students constantly need to connect to information and each other. Participants also mentioned that constant and immediate exchange of information is important to them as HE students. The mobile phone affordances of providing a sense of speed and giving timely access to the latest information seemed to meet the requirement of the participants. This suggests that fast communication, as also suggested by studies from Jones (2002), Caruso & Kravik (2005), Andone et al. (2005) and An & Frick (2006), is a significant factor for the design of mobile learning activities. During the interview sessions, I probed the participants to explain and elaborate further on their choice of SMS to communicate with their friends over and above using emails and instant messenger chats. Their answers indicate that there was a sense of urgency, immediacy and being personal that SMS communication provided them, as shown by this quote from a Stage 2 interview:

For emails, some of us do not check emails frequently and this will affect us to receive the message. As for chatting, some might not online at that time. But for mobile phone, it will always be by our side. So we can get the message instantly (S2a)

The participants also stressed the importance of two-way communication. They believed that one-way communication with the lecturer was not sufficient for them and they want the freedom to communicate immediately with tutors as and when the need arises. According to Beetham (2007), opportunities for communication, especially with lecturers, are considered crucial in most approaches to learning design. In the study from Moura & Carvalho (2010) their participants had a positive perception of tutors using SMS. Students appreciate being personally contacted by their lecturers. This is also demonstrated in this research, for example in the following statement taken from a Stage 2 online interview:

It's very cool.. you're the first lecturer who did that and i think it was something great.. it makes us feel special and also encourage me to get to know better of the course. it also motivates me to learn the things being sent. (S2d10)

Digital learners need convenient access to information (Jones, 2002; Caruso & Kravok, 2005; An & Fick, 2006 and Gaston, 2006). It is also argued by Edelson (2001) that learning design needs to “communicate information to learners in a context that allows them to build the appropriate knowledge structures” (p.378). The mobile phone seems to address this need. Therefore, communication activities specifically for mobile learning are defined as activities that provide immediate information and access to two-way communications between peers and tutors.

7.2.6 Learning-Management Activities

This is also another mobile learning-based activity that was not predicted but was derived from the findings. In the findings it was highlighted that HE students feel that their daily lives are complicated, and therefore a tool like the mobile phone helps them with reminders and so on. Selwyn (2007) acknowledges that there is a lot more that HE students need to do besides learning as they juggle academic and non-academic demands. Furthermore, digital learners are known to stress planning and time management (Howe & Strauss, 2003; and Caruso, 2004), therefore there is a need to consider using ICT within their day-to-day experience in order to manage their learning. The need for access to information is an indication of one of the digital learners’ characteristics as discussed in the literature review. As explained by Edelson (2001), the “presentation of information can help provide learners with knowledge that they need in order to initiate or conduct investigations, and it can provide them with additional knowledge to make sense of their investigations” (p.378). There were three pieces of evidence captured through the data that were found to support this type of mobile learning activity.

The first is that participants perceived some mobile phone applications to be tools for accessing content-type information, references and the internet, in order to manage their learning. The students appreciated the ability to have information at their fingertips. There were several ways in which access to information was delivered. The first was through the course moblog, while the other was through information from the internet. A specific course moblog was created for the study’s course, as suggested by Wilen-Daugenti (2009), which was intended to

be the focal point of access learning materials through the mobile phone. Although it was not as well-received as expected, it did impact the participants because some commented on the usefulness of the moblog. There were participants who indicated that internet access from their mobile phone greatly assisted in their learning. The students also stated that mobile references, particularly the mobile dictionary which is always available on their mobile phone, helps them to easily find definitions of words. It is noted that the English language is only the country's second language in Malaysia, and most HE courses are delivered in English. Thus, the need for a dictionary is relevant to the daily lives of Malaysian HE students.

The second type of learning-management activity is the messages sent as reminders to the students. Notifications, such as reminders of assignment dates, help them to organise themselves. Reminders and notifications are management helpers that can support HE students' learning. Holme & Sharples (2002), Sharples et al. (2003) and Wishart, Ramsden & McFarlene's (2007) studies supported the use of the mobile phone as a learning organisation tool. More than half of the participants in this study said that this type of activity was beneficial for them. They stated that the notifications and reminders received throughout the course through SMS were appreciated and some requested that this service be rolled out to their other courses.

Finally the participants also stated that the note-taking capabilities of their mobile phones allowed them to write their reflections, or jot down reminders in order to revise later. In the MReadiness questionnaires there were indications of high usage of the note-taking facility on the mobile phone by participants in both stages. This factor was again raised by the participants in their blog posts. Although there was no specific activity in relation to this application in the research design, it was noted that the participants had been using it frequently to support their learning.

Therefore, designers need to create a platform which enables access to information, notifications and mobile notes to be embedded in the mobile learning activities. These activities could help support both course delivery and the students' learning.

7.2.7 Review of Mobile Learning Environment

From the findings in Stage 1 and 2 there were a few revelations that need to be highlighted. In Stage 1 it was found that students expressed the need for mobile learning resources and two-way mobile communication. After much thought, especially on issues such as cost, I decided to develop a course moblog as described in Section 4.5.3. However, it was discovered during Stage 2 that the students did not access the course moblog as frequently as expected. It seems that they found an alternative platform to fulfil this need, which was using mobile Facebook. I was surprised with the lack of popularity of the established course moblog and the embracing of Facebook by the students. This was probably due to the fact that students were familiar with and was more comfortable using Facebook than the course moblog. During the Stage 2 online interview, a participant expressed her feelings about the course moblog, which she said was too formal, whereas using Facebook was something that came naturally to her. Therefore this means that familiarity with technology does have a resounding impact on the acceptance of the application for learning. We do know that students embrace technology when they think it has value (Carroll et al., 2002); students also embrace technologies that are familiar to them.

Furthermore that it was noted that most students have access to the internet while they are in the vicinity of the university. However, when they return to their hometown during their semester break they probably do not have internet access. This was stated by a few participants in the Stage 1 and 2 data. However, they said that they could still be contactable through their mobile phones. Hence, SMS messages could be sent to students in order to avoid isolation. Comments made that SMS is the primary choice of mobile learning communication as had been concluded in the mobile learning literature. However, applications such as Facebook Mobile and Twitter were seen to be gaining in usage by the students due to the ability of these applications to reach more of their friends as compared with the one-to-one nature of SMS. Nevertheless, SMS application for personal communication still remains important, especially when in places without mobile internet connection as advocated by Roschelle (2003).

Finally, it must also be noted that activities were designed that arose as an unexpected result of discussion on the affordances of learning using technology (Norman, 1993; and Hannafin & Land, 1997). The most profound difference of affordances was through the reflective questions sent via SMS. This activity was initially aimed at getting the participants to reflect on their own when they received the questions after class. However, what some participants did was that they re-posted the questions on their Facebook page and started to discuss it with their friends. Clough et al. (2009) recognise that “participants adapted their devices to suit their learning needs, writing new applications or tailoring existing ones, and adapted how they learned to suit the functionality available with their devices” (p.110). This indicates that the students collaborate and use technology to meet their needs as suggested by the digital learner literature (Frاند, 2000; Dede, 2005; and Lorenzo, Oblinger & Dziuban, 2007).

There were also instances when the participants accessed mobile materials through computers. For example, participants reported listening to podcasts created by their friends using their mobile phone or personal computer. When probed two students in Stage 2 online interview explained that listening and commenting on the podcasts depended on the context of the situation that they were in. It could be when they were at home and had dedicated time to review the podcasts (therefore, listening to the podcast through a personal computer) or when they were outside the home (therefore listening to the podcast using their mobile phones). One particular student said that she listened to podcasts through the mobile phone in the library during breaks from studying. The students were able to seamlessly cross between devices. This is a strength of mobile learning as it can provide students with choices on how and when they want to access learning materials (Weekes, 2007).

In the 2012 NMC Horizon Report (Johnson et al., 2012) it was reported that learners expect to work, learn and study anytime and anywhere. It is believed that there is a need for an immediate approach to learning support that enables easy and timely access. Throughout the findings in Stage 1 and 2, the notion of beyond space and sense of time for learning is very much highlighted by the participants. According to Traxler (2010) mobile devices are eroding physical

place as a predominant attribute of 'space'. This is because there is an extension of physical space to create 'social space' for learning. In terms of time, Sørensen, Mathiassen, & Kakihara (2002) state that "Our sense of time need not necessarily be strictly governed by linear time, but can instead be socially negotiated" (p.3). Hence, physical space and time are translated into a social space where learning activities are based. The focus of using technology in education is to enhance space by expanding it to include factors beyond hardware, software, applications and networks, thus the notion of social space for mobile learning helps to achieve this focus. Through social space it appears that learning switches between formal and informal and inside and outside the lecture hall. Mobile learning activities could be said to allow for continuity of learning across different contexts and times.

Barron (2006) introduces the concept of learning ecology, which is a "set of contexts found in physical or virtual spaces that provide opportunities for learning" (p.195). Learning ecology entails that (1) individuals are simultaneously involved in many settings; (2) individuals create learning contexts for themselves within and across settings; and (3) interest-driven activities can span contextual boundaries and be self-sustaining given adequate time, freedom and be self-sustaining given adequate time, freedom and resources (Barron, 2006, pp.199-201). This means that learning can manifest itself across settings and time, and can cross boundaries of formal and informal learning so that both can enhance each other in the social space that the students are in. Mobile learning activities based on the notion of learning ecology can further expand the understanding of mobile learning.

7.3 Research Question 3 (Issues and Challenges)

What are the issues and challenges in implementing mobile learning activities in a Malaysian HEI course?

There were issues that need to be taken into consideration in order to implement mobile learning in a Malaysian HEI. I have categorised them into issues related to HE students, the learning designer who is to design mobile learning for a particular HE course, and to the HEIs which are considering launching mobile

learning initiatives as part of a delivery mechanism to support HE students' learning.

7.3.1 HE Students

7.3.1.1 Malaysian HE Students' Culture

In the findings, the participants provided some scenarios relating to their lives as HE students. They stated that they have hectic schedules to follow and that they felt that learning using the mobile device helped them to manage their study. It was further discovered that students used various mobile phone applications to help support their learning. These applications were either discovered by the students themselves, such as the note-taking application or the applications introduced to them during the mobile learning workshop, such as the mobile dictionary. With the latter, it was found that mobile applications that were introduced to the students could be adopted widely should they feel a need. For instance the mobile dictionary was a popular application because the participants were English language teacher trainees and therefore the application was a necessity for their learning. It is essential to understand the need of the HE students for any particular activity or application to be used widely.

In designing mobile learning activities there is a need to take into account how students' learning culture suits their needs. With the Facebook experience described earlier (Section 7.2.3) it was found that the learning context had pushed the acceptance of the technology. Since the students were familiar with social media applications, particularly Facebook, they stated that they used the application frequently on their mobile phones to support their learning. The students were already using Facebook, therefore the extension to using mobile Facebook fits in with their lifestyle. Frand (2000) recalls Metcalfe's law that stresses connectivity whereby the argument is that the more people who are involved; the more valuable the tool is, which explains the creation of the well-received informal Facebook group.

Learning using the mobile phone is also considered suitable for Malaysian HE students as culturally it promotes collaboration across genders. Malaysia is a multicultural country with the Muslim Malays representing a large proportion of

the population. Asian culture, particularly in an Islamic society frowns upon close proximity of different unmarried genders, especially at night. A student raised this issue when he stated that it was easier to have a discussion through SMS if such a need arose. He felt that he could contact his female friends on the course to discuss course related matters. According to him, he would meet his male peers personally for discussion but felt that it was more 'proper' to contact female counterparts through SMS.

In designing mobile learning activities, besides the context the students are in it is also essential to understand the tools that the students are already using to support their needs. Generating needs based on the students' context will ensure the adoption of the tool to support learning is further embraced by HE students. According to Fowler & Mayes (2000) learning design should be a high level heuristic because the design is not the description of learning but also how people learn together. Thus, a learning designer needs to employ design principles which consider the various contexts of the learners and also which tools are familiar to them in order for the learning activities to be meaningful to the students.

7.3.1.2 Inappropriate Use of the Mobile Phone

The participants brought up issues of inappropriate use of the mobile phone. They highlighted inappropriate usage of the mobile phone such as cheating during examinations and not paying attention in class whilst texting instead of listening to the lecture. There were also other concerns, especially the exploitation of pictures posted online. Goundar (2011) previously stated that teachers are concerned about disruptions due to mobile phones in classes, but in this study it was found that students had also highlighted this issue. Since participants in this study raised this issue of inappropriate use.

In the digital learner literature, there is little attention given to the issue of digital citizenship. This is the ability to participate in an online society (Mossberger, Tolbert, & McNeal, 2008). Being a digital citizen means that digital learners understand how to operate socially in the virtual environment (Maitles, 2005 and Oxley, 2010). The do's and don'ts in life extend at times to the virtual world; where there are social nuances that the students need to learn. Malaysian HE

students are digitally literate in terms of using the application but they are not exposed to the ethical issues. However as highlighted by Maslin, Zuraini & Ramlah (2008) Malaysian HE students need to be exposed to the ethical dimensions and need help to prevent and protect them from inappropriate use of the digital environment.

7.3.2 Learning Designer

7.3.2.1 Different Types of HE students

There is no doubt that there are different types of student. They vary in attitude and motivation to learn, their background experience with technology, their socio-economic background and their learning styles. Nevertheless, the aspects being highlighted by the participants are the learning styles. Some students reported listening to audio recordings helped them in their learning but other students thought that this was boring. There were also instances where the students reported that pictures supported their learning while others said that text helped them.

It was found that the participants were active participants in their own learning as they chose whatever technology suited their learning needs. This is similar to a study by Smith, Salaway & Caruso (2009) which found that HE students use different types of technology for a range of academic and non-academic activities. Learning designers need to understand students' learning experiences and preferences when designing.

There is a need to use different types of delivery mechanism and different types of media in mobile learning activities. This supports research that digital learners cannot be generalised as there is no homogenous use of a specific tool or application but rather a variety of uses (Kennedy et al, 2009, Bennett, Maton & Kervin, 2008, Jones & Cross, 2009, and Jones & Shao, 2011).

7.3.2.2 Different Types of Phones and Problems Surrounding Common Mobile Phone Issues

Moura & Carvalho (2008) reported that their study faced problems due to cost issues. Cost was an issue in this research, particularly the cost for students of

accessing the mobile broadband network for the internet through mobile phones. However, it was found that this issue is not as severe as was being depicted in the literature. Malaysian HE students still accept mobile learning if they think it is essential for their learning, as in the case with mobile Facebook which participants embraced regardless of cost.

In designing mobile learning activities, McConotha, Praul & Lynch (2008) and Goundar (2011) discuss the difficulty in deploying the design on a variety of mobile phone platforms, especially with smartphones such as the iPhone, Blackberry and android phones. However, this is not an issue as participants were able to access mobile resources there were designed in this research. There are many mobile phones are considered as enabling mashup applications, which can be used on various mobile phone platforms. Mashup applications are those that combine functionalities of different types of application from two or more sources to create a single service that can be used on various mobile platforms, as suggested by Bonk & Cunningham (1998) and Willen-Daugenti (2009). The advancement of mobile phones to date and as predicted in the future does not foresee different types of mobile platform as a major issue in design for mobile learning activities.

7.3.3 Higher Education Institutions

7.3.3.1 Infrastructure

Mobile networks in the form of mobile broadband are still problematic in Malaysia. The participants with internet capabilities on their mobile phones expressed dissatisfaction in the MReadiness questionnaire about high cost and slow downloads as key reasons not to use this service. In the students' blog posts there were participants who noted that they used free Wi-Fi either on campus or in cafes. Nevertheless, participants also stated that they wanted better and faster Wi-Fi in the campus as they experienced interrupted service and slowness of the current Wi-Fi on campus.

According to James (2007), digital preparedness includes infrastructure encourages ICT penetration that includes education, affordability and policies. He proposed various types of digital preparedness including an opportunity

preparedness (percentages of population with mobile phone cover, internet access tariffs and mobile phone tariffs), infrastructure preparedness (mobile phone, internet access and mobile internet subscriptions), and utilization preparedness (proportion of individuals that use the internet, ratio of fixed broadband, mobile broadband, phone subscribers) amongst other proposals. These are matters that HEIs need to take into consideration if they are to implement mobile learning initiatives.

7.3.3.2 Device Support

Although there was no problem with participants using their own mobile devices for this research, some students stated that they felt that they missed an opportunity to learn as they only owned basic phones. This suggests that the students were concerned about the possibility of not being included in the mobile learning environment because of the type of phones that they have. They understand the usefulness of the device to support their learning. A few students blogged and others stated in the online interview that they wanted to purchase better smartphones so they would not be excluded from the mobile learning activities. They generally stated that they understood the benefits of the mobile device to support their learning after being exposed to mobile learning benefits through the course.

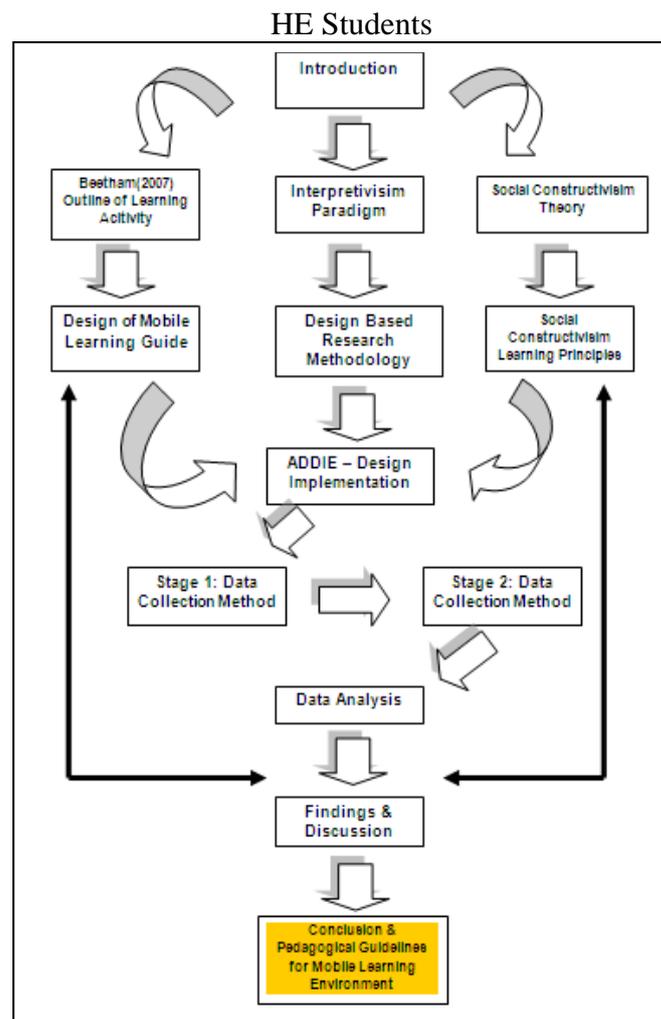
The high cost of purchase of smartphones was discussed in Lubega et al. (2004) and Shen, Wang & Pan's (2008) research. In Malaysia most HE students, especially in public universities are funded under the National Higher Education Fund (NHEF). It was in the late 1990s that the Malaysian government established the NHEF to provide educational loans to students who are in need of financial help (Benjamin et al., 2011). As part of this fund, HE students are also given an allowance to purchase a personal computer either in the form of a desktop or a laptop. Similarly there could also be funding for smartphones in order to ensure better delivery of mobile learning.

Chapter 8: Conclusion, Limitations and Recommendations

Overview

In this chapter, the research discussion in the previous chapter is considered in the form of design review of the mobile learning activities, and the outcome is pedagogical guidelines for a mobile learning environment. This final chapter is represented in this research thesis guide as illustrated in Diagram 2.

Diagram2: Structure of Thesis for Designing Mobile Learning Activities for



The limitations of the study followed by the evaluation of the design and research processes are presented in this chapter. Recommendations for the design of mobile learning activities and future research are also presented. Finally, a review of the contributions of the research sums up the chapter and the thesis.

8.1 Review of Mobile Learning Activities Design

Dabbagh (2005) emphasises the importance of providing supportive assistance to HE students. Edelson (2001), Naismith et al. (2004) and Herrington & Herrington (2007) acknowledge that learning support activities are those that assist in the coordination of learners and resources for learning activities. Due to the importance of learning activities to support students' learning, research for the design of learning, as in this study, is considered essential, especially for the continuation of easy and pervasive access to information outside of formal campus resources. Therefore there is a need for this study on how best to support a dynamic and complex HE students' learning environment.

The study sets out to explore the usefulness of applications on the mobile phone to support mobile learning activities based on Malaysian HE students' perceptions of them. The main outcome for this research is to establish pedagogical guidelines for mobile learning activities using social constructivism as the theoretical foundation. Investigating students' perceptions of usefulness bridges the gap in instructional strategies to provide what is useful learning support from the students' perspective. The three research questions discussed in the previous chapter (Chapter 7) are intended to assist in achieving this aim.

It was found that Malaysian HE students do own mobile phones. The issue is not in relation to access to the device but access to the type of mobile phone that the students considered could enable mobile learning more readily. Students are keen to upgrade their mobile phones to those classed as smartphones. It can also be said that not all students know how to use all applications on their mobile phone and that even if they have been using certain applications that they did not know that they could be used to support their learning. Thus, it can be concluded that not all students know the mobile phone applications' capabilities to support their learning. Usability issues with the mobile phone, such as listed earlier by Zhang & Adipat (2005): learnability, satisfaction, readability and others are not a major problem for Malaysian HE students. It could be said to be said that Malaysian HE students are receptive to the mobile learning concept.

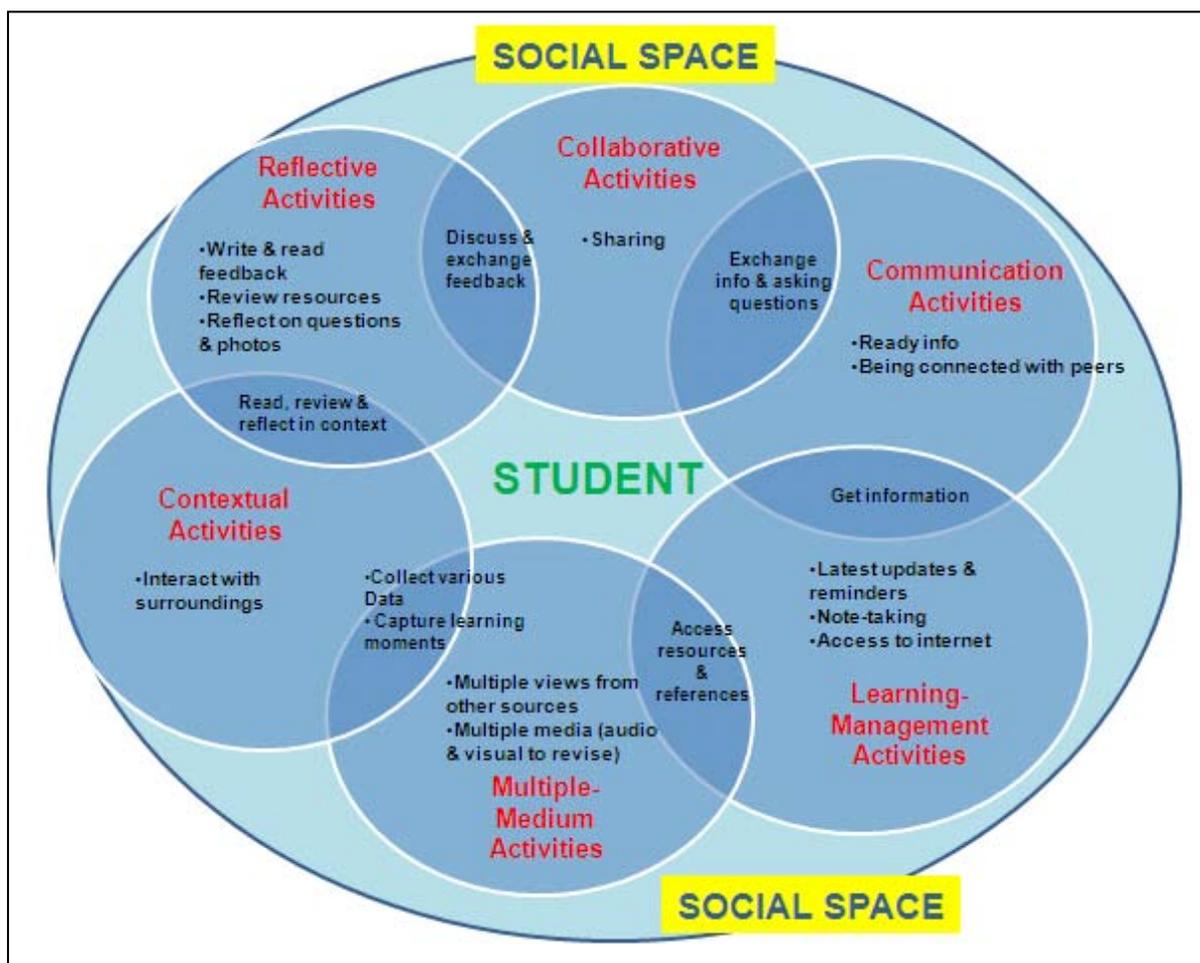
Learning support through learning activities can engage students (Edelson, 2001; Naismith et al., 2004; and Herrington & Herrington, 2007) and through learning design these activities can be created. Using the theoretical principles of social constructivism four initial learning principles were created. The mobile learning activities initially proposed were categorised through these four social constructivist learning principles. However, two additional categories of social constructivist learning principles were discovered and these formed appropriate mobile learning activities. These principles are pedagogical guidelines that can be used to design mobile learning activities, and are summarised as follows:

- Contextual activities: are activities that collect learning evidence and the ability to read or review in the multiple contexts the students are in
- Reflective activities: are activities that review students' own learning through immediate feedback and prompts for reflection
- Collaborative activities: are activities that promote interaction through creating and sharing practices
- Multiple-medium activities: are activities previously known as multiple-perspective which now emphasise the ability to offer various media to engage learning which enable students to be exposed to different perspectives
- Communication activities: are activities which enable students to interact with their friends and tutors which can be deployed in various forms of relations for example one-to-one, one-to-many and many-to-many.
- Learning-management activities: are activities which enable students to access information, receive notifications and capture notes.

There is a sense of lost boundaries between students' learning and their lives. Learning can happen formally and informally and learning can happen anywhere and anytime depending on students' needs in mobile learning. As discussed in Section 7.2.7, these activities are based on a social space that cuts across the students' time and space.

These activities overlap with each other. For example, taking pictures to be reviewed and reflected on later comes under contextual activities, and can also be categorized as a reflective activity. Thus, there are activities that are interrelated. It must be noted that in designing mobile learning activities that it is not about **designing the content but designing a mobile learning environment**. As discussed in the literature review (Chapter 2), content indicates static material for a course, while a learning environment denotes a more versatile environment that encourages the students' active engagement of the students in the activities. There are other guidelines for the design of mobile learning activities; however comprehensive pedagogical guidelines based on a theory remain to be found. The following diagram provides a visual representation of the pedagogical guidelines taking into consideration for the respective categories of learning activities.

Diagram 10: Pedagogical Guidelines for the Design of Mobile Learning Environment



In Diagram 10, the students are central to all the activities because they tried and decided which activities are beneficial for supporting their learning. The results of the study indicate that social constructivist learning principles suited to mobile learning activities are not separate entities but rather supportive of each other. For example, contextual activities are activities that capture proof of learning is also activities that are multiple-medium activities. Activities that allow for reading, review and reflection in multiple contexts under the category of contextual activities can also be classified as reflective activities. Activities that centred on feedback are considered not only reflective activities, but also collaborative. Meanwhile the activity of exchanging information is both collaborative and communicative activities. Finally, learning-management activities are similar to multiple-medium activities in the access of resources. All of these activities are all founded on the notion of time and space as elicited through the result of the findings identified as social space.

According to Jonassen (1994) the nature of social constructivism defies the use of models as they would constrain the students' learning environment. Furthermore knowledge is considered context-specific, hence not able to produce generic models. However, Young (2003) argues that a model is used to create flexible guidelines and not mandated principles, while Lefoe (1998) explains that learning design concepts are proposed to provide principles or general concepts in the form of models that can guide the learning environment in their planning for technological initiatives. Therefore, social constructivism can take the form of a generic model or flexible guidelines derived from research, as in this study. Diagram 10 represents a set of pedagogical guidelines for designing mobile learning activities to be used in a learning design process. This is an important outcome of this research. The respective activities can be adjusted to fit other contexts as they are not one-size-fits all guidelines. The challenge of the guidelines is representing a complex mobile learning environment in a blueprint as illustrated in Diagram 10, that can be adapted to the various contexts of an HEI course. The pedagogical mobile learning design guidelines are a means rather than an end, as the overriding aim of the design guidelines is to support HE students' learning through the use of a mobile phone.

In designing and implementing mobile learning activities for HEI courses there are bound to be issues. It was found that there is no single or specific mobile application that can enhance the whole learning experience but rather a variety of tools and also a variety of uses for any single tool. For example, the camera function of the mobile phone can capture learning moments but it also captures photos to be reflected upon. It was also found that there were various mobile phone applications that could be used for learning support such as the use of eBook, calendar and podcast which fulfilled the different learning support for the HE students.

In Jones et al.'s (2009) study, email is found to be less used than other forms of communication such as the SMS and instant messaging. They perceived this is due to the fact that HE students have replaced email with other means of communication. As supported by the mobile learning literature, SMS is a mobile application favoured by students. However, in this study there is also a move to use mobile versions of social media tools such as Facebook and Twitter as a more favoured form of communication. This means learning designers need to be aware of social and cultural trends as these trends can also influence the use of tools for learning. It is also apparent that these social media tools provided flexibility. As noted by Hannafin & Land (1997) integrated "platforms are now commonplace, providing powerful systems for developing and using highly sophisticated learning environments" (p.171), hence integration of desktop applications and the mobile phone applications could provide this seamless effect between formal and informal learning or in classroom and out of classroom learning experiences.

Other issues appeared to be concerned with the ethical parameters of using technology for learning such as the potential for exploitation when putting students' photos online. This is not a surprise, as HE students in Malaysia are not exposed to information on being a digital citizen. In order to overcome this for mobile learning implementation, aspects of being a digital citizen need also to be included as part of the design of the mobile learning induction.

It was predicted that the issue of cost would be a major challenge in terms of the HE students accepting mobile learning initiatives. However, it was found that if

students are offered learning activities that they think could assist in their learning; they would not mind spending money. The issue of cost was a prominent factor in the decisions about learning activity design; therefore this could also be a reason for the positive reception of mobile learning by participants in this study.

Although the issues that affect HEIs are not the central focus of this research, some issues were highlighted by the participants of this study. The need for better infrastructure for faster and stable Wi-Fi especially in the university is a pertinent issue. HEIs in Malaysia need to provide better wireless hotspots that might enhance the take up of mobile learning and also the liveliness of campus life for HE students.

Klopfer, Squire & Jenkins (2002) suggest that learning tools lead to a learning culture. This was discovered through the findings of this research because students decided which mobile applications and activities provided them support for their own learning. Student preferences for tools and learning activities stem from their familiarity with and comfort using the tool. The selected tool/s could then shape the learning culture of the students. This is depicted through the use of Facebook Mobile in this study in which classmates used the tool as a means to communicate and collaborate. Thus, technology is not the focus for learning designers but how the mobile applications can serve to promote learning engagement of the students. This factor is essential in any mobile learning design activities.

The main aim of this study was to explore the possibility of introducing mobile learning activities for Malaysian HE students. As a consequence of the design and implementation of mobile learning activities, an understanding of how students react to initiatives was also captured. The study also derives a better understanding of Malaysian HE students' acceptance of learning through ICT. The study has produced deeper understanding of Malaysian HE learner practices and potential insights about how to support and design for more engaging media-rich learning support and also expanded contexts for learning.

8.2 Limitation and Further Research

This is not a generalisation or evaluation study but rather a development of a design guide for future mobile learning studies. I acknowledge that there are issues that need to be focused on such as socioeconomic factors, differences between students' technical knowledge (tech-savvy capabilities), or even learning styles that could significantly vary students' preferences in learning activities. These factors were not the focus of this research but future mobile learning design research could take them into account.

This study seeks to understand the possibility of exploring suitable mobile learning activities as a means to support HE students' learning. The research was conducted on a single course at a specific university. The course is an introductory course in educational technology which promotes the use of ICT for teaching and learning. It would be interesting if the different types of learning activities were adapted for other courses that do not focus on technology, and also other courses from different fields. This would be particularly intriguing if the learning activity could be adapted to a science course instead of a social science course. Another interesting avenue for future research would be to design these learning activities in another university. This is because the university that this research is based upon is situated in Kuala Lumpur, which the capital city of Malaysia. It would be beneficial to deploy the study in another university that is situated somewhere not in a city. It would be also be compelling to explore the possibility of using the social constructivist learning guidelines in another developing country to gauge how mobile learning can be implemented in an HEI course.

This research did not seek to measure the effectiveness of the specific types of mobile learning activities. It concentrated on the development of mobile learning activities deemed suitable by the participants. Nevertheless, it would be constructive to evaluate the impact of each mobile learning activity proposed to support HE students' learning. For example, how effective were the contextual mobile activities in supporting HE students' learning and so on.

This research did not design in elearning as part of the learning activities. Elearning for the course in this study was based on the university's learning

management system and also the establishment of the participants' individual blogs as described in Section 4.6. The design for learning support only took into consideration activities that were not offered through these delivery platforms such as the use of eBook and podcasts. The seamless learning experience between elearning and mobile learning was noted by the participants in this study. It would be advantageous to explore the relationship between mobile learning and elearning especially in terms of how they could reinforce each other better in supporting HE students' learning. It is proposed that a study on the blend of these two delivery platforms would be intriguing, and could expand both fields for better learning support for HEIs students.

This study is also limited by my capacity as a researcher, a guest tutor and also a learning designer. Even though there are checks and balances within the research as discussed in Section 4.10, it would be useful to create a team of individuals carrying out this set of roles in future research. The research could then be deployed on a wider scale.

According to Hammond et al. (1992), the most challenging aspects of design research are large scale initiatives in order to test effectiveness in the context of real implementation. This would raise the profile of mobile learning initiatives to ensure that the same ingenuity goes into the evaluation as into the learning design. It is also proposed by Herrington, Herrington & Mantei (2009) for research to look strategically at the implementation of mobile learning in HEIs on a broader scale. They argue that mobile learning will require second generation pilots or large-scale trials across institutions and across subjects if its wider potential is to be realised. Hence, it is suggested that the pedagogical mobile learning design guidelines created in this research should be implemented on a larger scale in an HEI.

8.3 Reflection of Design Process

Mobile learning activities redefine what is possible and stimulate new perspectives on the learning process for Malaysian HE students. The challenge for learning designers is to capitalise on emerging technologies based upon existing mobile phone applications, while generating designs for learning

activities rooted in pedagogical theory. For such shifts to occur foundations related to teaching, learning and technology and the features related to those foundations need to be aligned. In this research, the alignment came in the form of the Outline of Learning Activity (Diagram 4).

There were four factors adapted from Beetham's (2007) Outline of Learning Activity, which were focused upon this study. These were the learning environment, the learners, the tool and also the theoretical principles which laid the foundations for this research's design of mobile learning activities. While the literature review of the learning environment and the learners provided the context for this research, the tools discussion, in the form of mobile learning characteristics and previous studies of learning activities provided the understanding to shape the design of mobile learning activities. Meanwhile, the theoretical principles review in Chapter 3 produced the social constructivist learning principles that the design learning activities are based upon. The changes made to these factors not only provided better understanding necessary to design mobile learning activities, but also provided the platform to discuss the findings of this research.

There were many forms of design guidelines for mobile learning. I have summarised the key points to produce a 9-step linear guide shown in Diagram 5. The design guide serves as a practical guide which was mapped against the research process and which also provided the groundwork for the design of mobile learning activities. The clear steps as proposed in the design guide provided a comprehensive step-by-step procedure to implement mobile learning initiatives. The guide starts from evaluation of available devices through to evaluating the initiative with the students and includes administration matters such as obtaining institutional support. However, the guide did not state the stakeholders that would be involved in each step. Through the experience of applying the guide for this research, it is suggested that the main stakeholders be included for each step, as in Table 14 Revised Mobile Learning Design Guide. It is recommended for those interested in mobile learning design to adopt this practical design guide, as all key components are in place to assist in implementing their initiative.

Table 14: Revised Mobile Learning Design Guide

No.	Design Component	Stakeholders
1 ↓	Evaluate available device and applications (of students)	Learning designers; researchers; students
2 ↓	Obtain institution support	HEI practitioners (lecturers, head of department, HEI's educational technology centre etc.)
3 ↓	Review mobile learning technical and pedagogical affordances (benefits and limitations of mobile phone applications and possible mobile learning activities)	Learning designers; researchers
4 ↓	Review learning environment (understand context)	Learning designers; researchers
5 ↓	Review curriculum (analyse learning activities to match specific learning objectives of the course)	Learning designers; lecturers
6 ↓	Review technical matters (technical protocols, usability issues of the mobile phone, available resources etc.)	Learning designers; HEI's educational technologies
7 ↓	Review pedagogical matters (learning strategies)	Learning designers; researchers; lecturers
8 ↓	Provide technical support (to students)	HEI's educational technologies; students
9	Evaluate with students (feedback)	Researchers; students

Note: The arrows in column 1 show the linear progression of the development of the design for mobile learning. This table is presented in another style (See Diagram 5, Section 2.5.4).

Since most of the mobile applications were user-friendly and did not need in-depth technical knowledge I was able to exploit them effectively. There was software that I needed to learn to use, such as Audacity, and also I needed to learn to use the moblog templates, however this did not present problems as there were step-by-step guides including video guides. However, it must be noted in this research that essentially learning support activities are designed not for new learning but to provide an environment to support students' construction of

knowledge. The mobile phone applications were based on what participants commonly used, while the mobile learning activities were core to the design.

I did not only concern myself with the usability aims of the mobile learning activities but also students' perspectives to gauge whether the outcome of these activities could meet their purposes. I have reflected on design decisions in the summary of the review of each stage in both Chapters 5 and 6 in order to provide a better understanding of the design process. Since this research aims to provide the participants with the environment for selecting mobile learning activities and applications to support their learning, my voice as a researcher and learning designer remained in the background through the research process.

8.4 Reflection on the Research Process

Interpretivism as the paradigm of the research laid the foundation of the research process. Using learning design, this exploratory research aimed to understand the participants' perspectives on the deployment of mobile learning activities. Gorard & Taylor's (2004) design learning model, a foundation for this research, calls for the understanding between the intended designs for mobile learning activities as in Diagram 3. The interpretive perspective allowed me to investigate the context in which the design was implemented, and study how this informed students' action. A learning designer can only predict the preferred learning support; however students as in this study had different perspectives. Through the flexibility of the research process as permitted through interpretivism, I was able to not only explore the actual affordance of the design of mobile learning environment in a naturalistic setting, but at the same time make relevant changes to the learning designs as advocated by Klein & Myers (1999) and Oates (2006).

DBR as a research methodology was an appropriate choice. The 'messiness' of mobile learning research, as described by Traxler (2010), needs a methodology that is flexible. DBR needs to be based on a real world context and is therefore suitable for this study as the focus is on giving HE students autonomy to choose the support for learning in their own contexts. Van den Akker (2005) recognises DBR as a solution type of methodology, which means a methodology that solves real-world problems. Through DBR, I was able to understand how HE students

use their mobile phones to support their learning providing researchers and learning designers with a better understanding of how to design mobile learning environments. DBR has a dual purpose, which is to understand learning and to inform better design practices. However implementing DBR is complex (Barab & Squire, 2004) because it does not have a definite process or step-by-step guide and this led me to choose the ADDIE model to translate DBR's iteration process. The ADDIE Model provided a transferable structure for the research process, as each phase in ADDIE also enhanced the design process of the research in conjunction with the mobile learning design guide (Diagram 5).

There were various data collection methods used for the different phases of this research which had different aims to the main objective to answer the research questions. The MReadiness questionnaire was deployed to provide a glimpse of the participants' digital lifestyles, however should there be more time it would be interesting to understand more about Malaysian HE students' general adoption of ICT in daily life, for example through focus groups. Besides the MReadiness questionnaire, a focus group could also provide additional information on the students' usage of ICT in their daily lives. This information can provide a better understanding of ICT usage to design any technological initiative for the students.

In an effort to embrace the potential of mobile phones to support student learning, it is essential to investigate the devices owned by HE students, the mobile phone applications they are familiar with, and their receptiveness to mobile learning activities. A detailed study is required on the affordances of various mobile phone applications appropriated, resisted or repurposed by the participants that would have a significant impact to the mobile learning initiative before any intervention commences. It requires a careful observation and documentation of everyday practices of the participants in the setting before, during and after the introduction of the intervention. Documentation of daily practices gives rise to emergent practices derived from the cultural worlds of the participants that cannot be anticipated by researchers. Therefore, it is proposed that this type of research be undertaken to further advance understanding of not only how Malaysian HE students use their mobile phones, but also the affective aspects of the mobile phone in the students' daily life. It is not this research aim to focus on this issue;

however it is felt that understanding of Malaysian HE students' social usage of mobile phones in their daily life is research that needs to be conducted for further understanding of Malaysian HE digital lives.

The students' blog posts were deemed a suitable data collection method. Through this method, it not only gave the students time to reflect on the mobile learning concept but they were also able to experience using mobile applications that could support their learning. If there were issues in the blog posts that were not clear, I was able to email the students to seek further explanation. I found that students were able to write freely on their reflections about the concept of mobile learning and about learning activities, indicating a depth of analysis. There was also feedback received by students from their peers and other tutors through comments on the students' blog posts. In making the decision concerning the best data collection method, I was afraid that participants would not be truthful about how they felt about the mobile learning activities because Malaysian HE students are characterised as being respectful of their teachers, as described in the literature review. However, this did not happen as there were students who raised issues with the implementation of mobile learning initiatives as reported in research question three.

The online interview was a convenient method due constraint of time and restriction of physical space. However, to get students to volunteer was not easy, especially the timing of the interview. This is because in both stages the interviews were done after their final examination, hence most students returned to their home towns and some were not able to connect to the internet for the chat session. Therefore the students who volunteered had to have internet access for the interview to take place. There were no issues with internet connectivity during the chat sessions as the interview went rather smoothly without interruption. It was interesting to note that two of the participants in the online interviews stated they liked 'chatting' with tutors as this gave them the experience of a personal touch. I felt that I was able to research the students further and personalise the interactions during the interview as they were conducted in a virtual space, which the students were comfortable with. In addition to the time allocated for the interview, these students chatted with me on other matters when they found me

online. Relationship building fosters better interaction amongst the participants. Furthermore the chat forum was deemed non-stressful or intrusive as indicated by the participants.

It would also be interesting to capture the views of the learning designers and also the tutors on a course. In this research only the HE students' perceptions were gathered as the aim of the research was to highlight the voices of HE students to gauge their reception of the mobile learning initiatives implemented. Nevertheless, it is proposed that other research initiatives for mobile learning activities should identify and capture other stakeholder perspectives.

As a researcher that took an active role in this research, I had multiple roles, in that I designed, researched and participated in the learning environment on which this study focuses. Being a single research designer embedded in a team of practitioners, it was essential to be able to communicate well in order to produce efficient and fast iteration. Design solutions and design changes were able to be made in-situ which is necessary in a natural and complex situation. In addition, critical feedback was essential. I had to ensure that the participants were honest in their feedback which was ensured through validity research procedures, such as member checks through participants and the peer review with tutors on data interpretation process. This also ensured that I was socially constructing knowledge for this research, as the findings were derived, through close interaction with the participants of the research. This complies with the interpretivist view that the role of the researcher is to understand meaning through the participants' perspective and the social reality in which they are inserted (Orlikowski & Baroudi, 1991)

The emergence of the online environment as a field for harvesting data for research is faced with ethical dilemmas. More importantly, decisions were made to preserve the identity of the participants in an online environment and to get their informed consent (Anderson & Kanuka, 2003). There were steps taken to ensure the process of anonymity as reported in Section 4.8.

Nevertheless, it was found that another ethical challenge was the use of the students' private social network space that may have an 'intrusive' element to it, especially when I needed to be actively involved with the students (Eysenbach &

Till, 2001). What would be the potential harm? I had informed consent from the participants but not the consent from their own friends, to which, I could also gain access over the internet. These were elements that the participants were informed and made aware of during the briefing session. I overcome this challenge by briefing the participants that should there be any issue concerning this matter, the participants were to alert me. This reduced the potential of harm as also suggested by Anderson & Kanuka (2003).

8.5 Recommendations for HEIs for Mobile Learning Initiatives

This research makes a contribution to policy in that it highlights practical aspects for an HEI in Malaysia to offer mobile learning as a learning support mechanism.. There are a few recommendations for mobile learning activities to be implemented in a Malaysian HEI through the findings of this research which namely are:

- It is discovered that mobile learning understanding in Malaysian HEIs is still not fully developed. There is a need to implement this at policy level so that educators in HEIs can exploit this new medium for teaching and learning in the 21st century. A Mobile Learning Strategy will allow for educators in Malaysian HEIs to perceive the value of such emerging learning trends and thus implement as part of their teaching and learning approach.
- It has been established that for mobile implementation to be successful support for the use of (smart) mobile devices and free high-speed Wi-Fi within campus is crucial. . Thus, infrastructure policy is another essential element for the successful implementation of mobile learning initiatives for Malaysian HEIs.
- It was discovered that even though the students are competent users of the mobile phone, this does not mean that they use the available applications for learning. Support in terms of induction sessions, whether face-to-face or online, could also be an implementation strategy that Malaysian HEIs need to consider.

In the induction programme, the issue of ethics as a part of digital literacy needs also to be presented and discussed by the students.

- It has been pointed out that mobile learning in HEIs is dependent on users' ability with such devices and educators design of contexts for learning. The professional development of staff regarding mobile learning is not only necessary but critical for its successful implementation. Hence, the pedagogical guidelines for the design of mobile learning environment (Diagram 10) produced by this research will enable HEIs to provide opportunities for the professional development of their staff and students. Besides that the mobile learning design guide (Table 14) provides step-by-step processes to design mobile learning activities.

Although this research is a student-focused study, policy and practical strategies for implementation of mobile learning activities in Malaysian HEIs were also revealed which could benefit HEI policy makers and practitioners.

8.6 Review of Research Contributions

Walsham (2006) argues that in the conclusion of an interpretivist research, there is a need to focus on the claimed contributions. He suggested four ways that could be useful to discuss this research contribution.

Firstly, Walsham (2006) proposes that it is important to identify the audience who may benefit from the contributions of interpretivist research. It is felt that the findings and recommendations of the study are valuable for HEI practitioners who want to reach their students and engage them further outside the classroom, especially for those who subscribe to social constructivist practices. Researchers interested in learning design and also those in the field of mobile learning are also possible audience for this thesis.

In addition, Walsham (2006) suggests to explain the contribution to literature derived from the research. The literature from this research could generally enrich mobile learning in the Malaysian HEI context, and specifically add to the literature on the design of mobile learning activities to support HE students'

learning. Through this research, the literature concerning the use of students' own mobile phones as a means for learning support has also evolved.

There is also the need to clearly declare the research claim in interpretivist research (Walsham, 2006). There are a few contributions derived from this research. The study produced a set of pedagogical design guidelines for mobile learning for HEIs which are informed through the students' own perspectives and experiences, on which to base the HEI's choices of mobile phone applications and activities to support the delivery of an HEI course. The pedagogical mobile learning design guidelines, and also the mobile learning design guide created in this study can provide some initial direction for learning designers and lecturers who want to adopt mobile learning in their HE course.

Finally, Walsham (2006) requires for an explanation on how others could use this research. There are several findings from the research, namely this study has found that the mobile phone is generally a convenient tool for Malaysian HE students, which can fulfil the need for speed and immediacy of connection with their peers or resources needed. The anytime and anywhere affordances were highlighted by the participants in this research. The convenience of the tool provided the flexibility of time and space to aid students' learning. This concurs with Maag's (2006) study that emphasises convenience as an enabler for learning support for HE students. Bearing this in mind, it is suggested that HEI practitioners use the findings to explore the possibility of designing further mobile learning activities. Policy makers could also use the findings to produce a more student-centred guide for ICT implementations in HEIs.

In summary, this research contributes to the body of knowledge by providing a rich insight into mobile learning design and development in HEIs in Malaysia. In addition, it provides tactical advice for HE practitioners consider implementing mobile learning in their own institutions. Furthermore, it enriches the field of learning design based on social constructivist pedagogy. Finally, this research also extends conceptual benchmarks in the field of mobile learning for other future studies. Mobile learning does not seek to replace the use of computers to support learning, but rather to supplement it with the use of preferred mobile phone applications increasingly available to students at affordable prices and

already widely used. There is no doubt that technology moves fast in the mobile phone world with new applications or widgets that emerge having the potential to be used for learning activities.

Nowadays HE students and lecturers carry connected devices; we need to think differently about where and how learning takes place as the age of ICT introduces a new lens for examining learning spaces. This is indicative of the digital learner who communicates, accesses information, and links with their peers, their lecturers and others in their learning community. New conceptions of learning spaces for mobile learning provide new opportunities outside the traditional classroom. Reaching HE students outside the classroom and getting them to bring in authentic learning into the classroom could be seamlessly done, should the mobile device in the hands of the students be fully exploited. A move towards mobile learning in HEIs will be a move to reach our students beyond the four walls of the lecture classrooms.

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Appendix A : COURSE INFORMATION

 UNIVERSITI MALAYA KUALA LUMPUR	COURSE INFORMATION FOR CURRENT SEMESTER/TERM
Academic Year Semester/Term	2009/2010 Semester 1(Intermediate Level II)
Course Code Course Title Credit Hours Medium of Instruction Course Pre-requisite(s)/ Minimum Requirement(s)	PKEY3101 Technology in Primary Education 3 English
Main Reference	<p>Brennan, P. (2002). <i>ICT in the Primary School Curriculum: Guidelines for teachers</i>. Retrieved July 8, 2006 from http://82.195.132.36:5050/j/pdf/Publications/ICT%20English%20for%20web/ICT(English).pdf</p> <p>Newby, T. J. et al. (2000). <i>Instructional technology for teaching and learning: Designing instruction integrating computers and using media</i>. Upper Saddle River, New Jersey: Prentice-Hall, Inc.</p> <p>Smaldino, S. E., Russell, J. D., Heinich, R. & Molenda, M. (2005). <i>Instructional Technology and Media for Learning</i>. (8th Edition). New Jersey: Pearson Prentice Hall.</p>
Teaching Materials/ Equipment	Notes, books, handouts, and materials from the Internet.
Learning Strategies	Lectures, active learning and individual work face-to-face or online using the latest technology such as Moodle, wiki and blog.
Student Learning Time	Face to face: 40 hour Guided learning: 58 hour Independent learning: 11 hour
Soft Skills	Communication skill, higher level of thinking skill, team

	work, life long learning, ethical and leadership
Lecturer	Profesor Dr. Raja Maznah Raja Hussain ● Education Tower, Floor 5, Room141 rmaznah@gmail.com
Room	Chin Hai Leng ● Block B, B3 ● hlcum@yahoo.com Ng Huey Zher ● nhzher@gmail.com
Telephone/e-mail	Wan Muhamad Hafiz ● apih04@gmail.com Marsyitah Ismail ● marsyitahismail@gmail.com Sakina Baharom . sakinasofia@gmail.com
Lecture Session: Day/Time Venue Tutorial/Practical Session: Day/Time Venue	Wednesday, 12.00-3.00 MK1 and MK2
Important Dates	Assignment 1: Online and ongoing. Assignment 2: Assignment 3: Test:

Teaching Schedule

Week	Lecture/Tutorial/Assignment Topic	References/Teaching Materials/Equipment
1 060709-100709	<p>Introduction to Technology in Primary Education: ICT and the learning principles of the primary school curriculum.</p> <p>Teachers' belief and readiness</p> <p>Dealing with Digital Citizens</p> <p>Introduction to assignment 1 & 2 – Eportfolio & Reflection</p>	<p>Brennan, Chapter 1.</p> <p>ICT for literacy and numeracy</p> <p>http://www.tda.gov.uk/upload/resources/pdf/t/ta00-07.pdf</p>
2 130709-170709	<p>Integration of ICT in the Primary School Curriculum</p> <ul style="list-style-type: none"> - Creating physical and virtual workplaces <p>Classroom management</p> <p>Personalized learning</p> <ul style="list-style-type: none"> Engaging learners Involving learners in their own learning <p>Introduction to assignment 2 - Video</p>	<p>Brennan, Chapter 2</p> <p>Smaldino, et al. Chapter 5</p>
3 200709-240709	<p>Instructional Design Principle</p>	
4 270709-310709	<p>Instructional video in teaching and learning</p>	<p>MySchoolNet Website</p> <p>MOE Website</p>
5 030809-070809	<p>Interactive Whiteboard Skills</p>	<p>SmartTechnology, Learners' workbook</p>
6 100809-	<p>Interactive Technology:</p>	<p>SmartTechnology, Learners' workbook</p>

140809	Hands-on activity	Samples of content
7 100809- 140809	Supporting anytime, anywhere learning Internet tools Free online tools	Brennan, Chapter 4 Smaldino, et al., Chapter 8
MID SEM BREAK		
8 240809- 280809	Interactive Technology: - Development of IWB materials using Smart Notebook Hands-on-activity	SmartTechnology, Learners' workbook SmartNotebook
9 310809- 040909	Interactive Technology - Presentation of IWB learning materials	
10 070909- 110909	Interactive Technology - Presentation of IWB learning materials	
11 140909- 180909	Designing lessons integrating Teaching and Learning courseware - Content-free software - Content-rich software - Teaching courseware - Learning courseware - Ministry of Education (MOE) Courseware PPSMI CDI E-Bahan MyCD	Brennan, Chapter 3 Smaldino, et al., Chapter 6

RAYA HOLS		
12 280909- 021009	MOE ICT initiatives Smart School Computer labs SchoolNet PPSMI Educational TV and Radio	
13 051009- 091009	Classroom Management - ICT in the classroom Managing computer lab Troubleshooting LCD Notebook and PC Network	Smaldino, et al., Chapter 3
14 121009- 161009	Assessment for learning	
15 191009- 231009	Submission e- portfolio	
STUDY WEEK		

Appendix B

M-Readiness Questionnaire

This is a survey on university/college students' mobile learning readiness. Your voluntary participation is requested so we may learn more about the type of mobile device and the mobile features that most students are comfortable with. The survey also aims to gauge students' common virtual practices in order to facilitate further studies on this matter. This questionnaire will take approximately 10 minutes. Your name will not be recorded on the questionnaire and your responses will be anonymous. Your participation is voluntary and you may choose to not answer all of the questions on the questionnaire. Completing this questionnaire means that you have consented to the use of the information provided for research purposes. If you have any questions pertaining to this study, please contact **Sakina Baharom, Graduate School of Education, University of Bristol** at edssb@bris.ac.uk

Thank you for your assistance.

A) Background

Mark (X) in the appropriate row.

1. Age Group:

18-20	
21-23	
24 and above	

2. Gender:

Male	
Female	

3. Course:

4. Year of Study:

Year 1	
Year 2	
Year 3	
Final Year	

B) Mobile Device Usage

1. What kind of mobile device do you have access to? Please mark **(x)** if you have access to the device

DEVICE	YES
Mobile Phone	
PDA (Personal Digital Assistance)	
MP3/4	
iPods	
Notebook/Laptop	
Portable broadband	
E-book reader	
Digital camera	
Digital video camera	
Gaming device (Handheld game device eg PSP/ Nintendo DS/ GameBoy)	

Please answer questions 2 till 9 if you have a mobile phone. Please mark **(x)** at the appropriate box.

2. How many mobile phones do you currently use?

One	
Two	
Three or more	

3. What is the memory capacity of your mobile phone?

Less than 60mb	
60mb till 2gb	
More than 2gb	

4. Do you know your mobile phone operating system (e.g Symbian OS etc)?

Yes	
No	

If yes, please state: _____

5. Do you sync your mobile phone with your PC/Notebook?

Nearly Always (Daily)	
Often (Weekly)	
Seldom (Once a month)	
Hardly Ever	
Never	

6. What type of features do you have in your mobile phone? What activities are you using these features for? Please mark (x) in the appropriate statement against each listed feature.

MOBILE FEATURES & ACTIVITIES	I don't have this feature in my mobile phone	I have this feature in my mobile phone but I do not know how to use it	I have used this feature in my mobile phone but I rarely use it	I always use this feature in my mobile phone	I don't know if my mobile phone has this function
Make & receive calls					
Make & receive SMS					

Make & receive MMS					
Take & download pictures					
Record, download & view videos					
Web enabled (Wi-Fi or 3G) to surf for information					
Send & receive emails					
Record & upload voice recorder (audio file)					
Use GPRS to navigate					
Read & update social network sites					
Send & receive Bluetooth information					
Make & read through Microsoft Mobile Office					
Read & download documents through PDF Viewer					
Listen & download songs through MP3 player					
Listen to radio channels					
Play & download offline games					
Play online games					
Use phone as file storage					
Use phone calendar					
Use phone note-taking/task capability					

7. What other feature/s or usage of your mobile phone that you are comfortable in using (besides the list of features in Question 3)?

8. If you have a 3G/web enabled mobile phone but do not or rarely use the service, please state the reason for this (You may mark (x) more than once).

The charges are expensive	
The connection is too slow	
I am not sure how to use the 3G/web service in my mobile phone	
I do not feel the need to use the 3G/web in my mobile phone (*), please explain _____	
I do not like to use the web on my mobile phone (*), please explain _____	
Others, please specify _____	

Note: (*) if you mark (x) this option, please explain further

C) Mobile Features for Learning

1. Would you provide your mobile phone number to your lecturer or education institution for purposes of your course?

Yes	
No	

2. Please rate the features/services that could be provided to you through the mobile phone that you think might be useful in your own learning. Mark (X) at the appropriate column.

	Very Useful	Useful	Not Much Useful	Useless	I am not sure
Hear audio file lectures through mp3 files in your phone/mp3 player					
Read the lecture's PowerPoint through your phone					
Receive notices about your courses through SMS					
Receive small-bites (bite-size) notes of your topic through SMS					

Receive small-bites (bite-size) notes of your topic through your phone Bluetooth					
Send feedback through SMS about your lecture					
Receive feedback about your reflection or coursework through SMS					
Send questions through SMS about a topic					
Capture video/pictures for your assignment through your mobile phone					
Update your course reflection or coursework through your phone 3G/Wi-fi					

Thank you for your participation

Appendix C: GSOE Ethical Form

GSoE RESEARCH ETHICS FORM

It is important for members of the Graduate School of Education, as a community of researchers, to consider the ethical issues that arise, or may arise, in any research they propose to conduct. Increasingly, we are also accountable to external bodies to demonstrate that research proposals have had a degree of scrutiny.

The GSoE's process is designed to be supportive and educative. If you are preparing to submit a research proposal, you need to do the following:

- 1. Arrange a meeting with a fellow researcher**
The purpose of the meeting is to discuss ethical aspects of your proposed research, so you need to meet with someone with relevant research experience, perhaps from your CLIO centre. A list of prompts for your discussion is given below. Not all these headings will be relevant for any particular proposal.
- 2. Complete the form on the back of this sheet**
The form is designed to act as a record of your discussion and any decisions you make.
- 3. Staff: send a copy of the completed form to Jean Pretlove/ Valerie Aspin, Research Office.** You should also keep a copy for yourself. The forms will be kept until your research project has been completed. Forms may be looked at by the GSoE's ethics forum in order to identify training needs, for example.

Students: send copy of completed form to gsoe-ethics@bristol.ac.uk

If you need formal 'clearance' for a prospective funder, please contact the GSoE's ethics co-ordinators (Wan Ching Yee and Frances Giampapa).

Please ensure that you allow time before any submission deadlines to complete this process.

Prompts for discussion

You are invited to consider the issues highlighted below and note any decisions made. You may wish to refer to relevant published ethical guidelines to prepare for your meeting. See www.bris.ac.uk/education/ethicnet for links to several such sets of guidelines.

- | | |
|--|---|
| 1. Researcher access/ exit | 11. Data Protection Act |
| 2. Information given to participants | 12. Feedback |
| 3. Participants right of withdrawal | 13. Responsibilities to colleagues/
academic community |
| 4. Informed consent | 14. Reporting of research |
| 5. Complaints procedure | |
| 6. Safety and well-being of
participants/ researchers | |
| 7. Anonymity/ confidentiality | |
| 8. Data collection | |
| 9. Data analysis | |
| 10. Data storage | |

Be aware that ethical responsibility continues throughout the research process. If further issues arise as your research progresses, it may be appropriate to cycle again through the above process.

Name(s): Sakina Sofia Baharom

Proposed research project: Designing Mobile Learning Activities to Support a Higher Education Institution Course in Malaysia

Proposed funder(s): None

Discussant for the ethics meeting: Mahani Mokhtar

Please include an outline of the project or append a short (1 page) summary:

The introduction of mobile learning in higher educational institutions (HEI) in Malaysia appears to be a natural course of action with the precipitate increase in rates of mobile phone ownership amongst HEI students. This study aims to identify the learning opportunities that different features of a mobile learning environment developed to support a HEI course afford as well as recognizing issues and challenges in designing mobile learning activities. There are several types of mobile learning activities are to be implemented during an introductory course of educational technology and evaluated for their usefulness by the students. These mobile learning activities design is based on a constructivist learning environment principles and that the students are central to the design process. In building the foundation of this study, a more pragmatic underpinning research philosophy is adopted in order to bridge between theory and practice. The study's methodology is based on design-based research (DBR) which emphasizes the need for cyclic intervention and analysis of the research process. Hence, there are a pre-stage and two main stages of the research process whereby a mixed methods data collection framework will be designed and implemented. This study will result in a more holistic view on recommendations of a proposed model to design and implement a mobile learning environment deemed acceptable by for Malaysian HEI students.

Ethical issues discussed and decisions taken:

1. Researcher access/ exit

Not only I am a researcher for this study, but I am also one of the five tutors designated for the course, which brings to the issue of power relations. However, I will explain in the beginning of the class the purpose of this research and ensure the participants that their evaluation for the course will not be effected due to this research. There are also other qualified tutors that can ensure balance between the objective of the course and the aim of my research.

2. Information or Feedback given to participants

The participants will be informed (briefing and debrief sessions) that they can read about the study upon completing the research. The participants that volunteer for the online interview can also check their chat session transcripts for verification purposes. In the questionnaires for this study, participants will be informed of the purpose of the study and also the purpose of the questionnaire

3. Informed consent & rights to withdraw

The participants will need to fill in an informed consent form through the two different questionnaires. Through the course website, there will also be a statement to inform the students

about this research and seek their consent for their blog posts to be quoted for research purposes. The participants will also be made aware of their rights to withdraw from the research.

4. Complaints procedure

In the HEI that the context of the study is based on, participants/students are able to submit complaints to the dean of the faculty. There is also evaluation form at the end of the course, whereby the students can place any comments or remarks with regards to the course or tutors of the course.

5. Anonymity/ confidentiality

Both questionnaires that will be deployed in this study will not identify names of participants, hence ensure anonymity. However, I will recognize the students from their blog posts and also through those who volunteered for the online interviews. The students will not be named individually in the findings or the discussion of the thesis in order to guard their confidentiality.

Since some data will be collected virtually through online chats and participants blog posts, there is the issue of privacy as a 'search' function from the internet can be traceable. However, since the chat session and the blogs built are around a closed password protected group, hence it is highly unlikely that these items can be found.

6. Data collection

- One of the issues to be highlighted for the data collection will be the issue of cost of some mobile learning activities. I will brief the students on how to reduce the issue of cost such as download can be done through their desktop or notebook computer and then transfer the file to their phone, instead of downloading through the mobile internet.
- There would not be any internet cost for the blog posting and also the online interviews as the students could easily do so either in their HEI hostel or within the HEI's campus.

7. Responsibilities to colleagues/ academic community & reporting of research

The research findings will be reported through the thesis, conference paper or journals.

If you feel you need to discuss any issue further, or to highlight difficulties, please contact the GSoE's ethics co-ordinator who will suggest possible ways forward.

*Signed: Sakina Sofia Baharom (Researcher) *Signed: Mahani Mokhtar(Discussant)

Date: 12th April 2010

**By writing your name here, this is equivalent to a signature*

July 2009

APPENDIX D

List of Mobile Learning Applications introduced in Mobile Learning Workshop:

Available Content Any time Any where

<p>BBC Bitesize http://www.bbc.co.uk/schools/gcsebitesize/audio/english/</p>	
<p>Math For Mobile http://www.math4mobile.com/</p>	
<p>MLearn Language http://www.lttcom.com/v3/index.php?mod=public&opt=product</p>	
<p>Open University Malaysia – Study Skill http://mlearn-oumh1103.blogspot.com/ OR http://mlearn.oum.edu.my/index_m.htm</p>	

Athabasca University - English Language

<http://eslau.ca/>



Introduction

This is a course of lessons and practice on the system of English. It is divided into sections. Each section covers an area of basic grammar and contains a number of exercises. The exercises are not all the same length. Some exercises have only five questions, but others have up to nine questions. This is because some areas of grammar are more important than others. The course teaches your knowledge of English grammar and, more importantly, it gives you practice in using your knowledge to read a context and appropriate sentences. When you do this exercise, you will see that grammar is not just a game. Grammar has meaning - if you change some of the grammar in a sentence, you also change its meaning.

About This Athabasca Learning to Prepare ESL Adult for the Workplace

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<http://www.wattpad.com/download>



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<http://www.openculture.com/>

<http://www.hno.harvard.edu/multimedia/videos.html>

<http://uc.princeton.edu/main/>

<http://globalvoicesonline.org/>



CONTENT CREATION

Mobile Digital Story

<http://yodio.com>



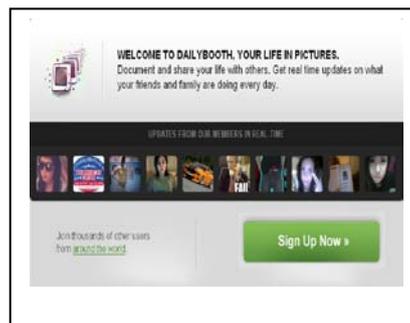
Mobile Digital Story

<http://365project.org>



Document Pictures Daily

<http://dailybooth.com>



Mobile Diary

<http://m.livejournal.com>



Mobile Blog

<http://www.blogger.com/mobile-start.g>



Mobile Applications

Mobile Browser

<http://www.shozu.com/portal/index.do>



Mobile Browser

<http://www.wikitude.org>



Windows Live Mobile

<http://explore.live.com/windows-live-mobile>



Facebook Mobile

<http://www.facebook.com/mobile/?settings#/mobile/>



Mobile Micro-Blog

<http://twitter.com/devices>

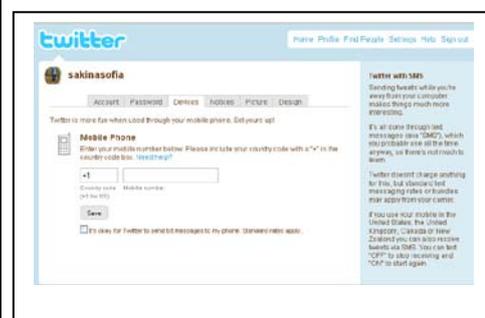


Photo & Video Hosting

<http://m.flickr.com/#/home>



Bulletins and Class Reminders

<http://www.textmarks.com/>



Mobile Classes

<http://winksite.com/site/index.cfm>



Mobile Website Authoring

<http://www.wirenode.com/>



Capture Notes

<http://www.qipit.com/>



Capture Impromptu Reflection?

<http://jott.com/default.aspx>



Ipadio

<http://www.ipadio.com/default.asp>



Video Log

<http://12seconds.tv/>



Live Video Streaming

<http://qik.com>



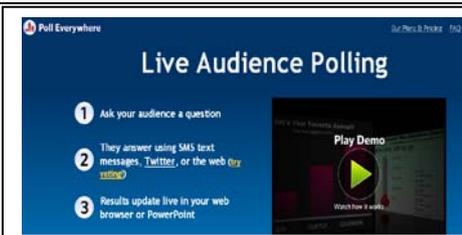
Mobile Quiz

<http://www.mobilestudy.org/home/>



Surveys & Polls

<http://www.poll everywhere.com/>



APPENDIX E : Part 1 - Descriptive Codes

NO	CODE	MEANING	Target RQ
1	Mobile learning preparation	Any form of evidence of preparation to accept mobile learning through statement of: understanding the concept of mobile learning wanting to explore mobile phone applications for learning	Q1
2	Mobile learning acceptance	Any form of evidence of acceptance of mobile learning through statement of: positive experience trying of application/s for learning wanting to explore further the application for learning wanting to use the application to teach in the future	Q1
3	Mobile learning non acceptance	Any form of evidence of acceptance of mobile learning through statement of: negative trying of application/s for learning doubting the applications for learning	Q1
4	Contextual activities	Indication of support and constructing learning through authentic and situated context (location and surroundings)	Q2
5	Reflective activities	Indication of support and constructing learning through reflective acts (feedback, comments)	Q2
6	Collaborative activities	Indication of support and constructing learning through collaboration acts (sharing practices, discussion)	Q2
7	Multiple-Perspectives activities	Indication of support and constructing learning through different perspectives acts (actions, thoughts) or use of different media to review thoughts	Q2
8	Other activities	Indication of support and constructing learning through activities not categorized between 4-7 (access information, communication and time management)	Q2
9	Benefits (advantages)	Indication of perceived benefits of implementing mobile learning	Q3
10	Problems (disadvantages)	Indication of problems of mobile learning implementing mobile learning	Q3
11	Issues of acceptance of mobile learning	Matters that are raised on implementing mobile learning	Q3

APPENDIX F : Part 2 Categories Codes

(verbatim quotes from the participants were selected to illustrate the identified categories) (Example of Microsfot Excel Page)

	A	B	C	D
1	Contextual Activities	Reflection Activities	Collaboration Activities	Multiple Prespect Act
2	upload photos or share videos with others from my handphone (aar)	give us feedback for our teaching by asking them to comment through texting (alck)	upload photos or share videos with others from my handphone (aar)	MLearning is one of the multiple paths... (ct)
3	, learners can use the mobiles to capture images, record the teaching process (dsr)	imagine how fast you can get a feedback through m-learning in order to enhance your lesson. (alck)	Mlearning aims to help the learners to share and collaborate. (ct)	pupils can read stories, news and everything with just their hand phones.(dsr)
4	Even nowadays mostly all d phones has a camera and they provide them with cables, Bluetooth or infrared....and guess what u can do wonders by just using that when it comes to learning through mobile phones (gr)	to revise and listen accordingly when they are free (dsr)	encourage children to work in groups (eng)	can get many information (fham)
5	it copies even from whiteboard and hand written notes using just the camera in our mobile phones. Like how we use to do...write all of our lecture notes as fast as we could before she/he goes to the next slide...at times even our hands will be so painful and the best part of it... when we turn on to our notes to do revision, WE CAN EVEN READ OUR OWN HANDWRITING (gr)	I can revise and reflect back what have been taught. (ct)	also encourages collaborative learning. As a result, pupils will learn better as well as monitor their progress in learning through podcasting (eng)	Mlearning will provide many kind of tools for us to search for many kind of information (fham)
	It is very convenient especially for a student like me as I can save more time to write down	for them to revise and listen accordingly	M-learning also offers a powerful and practical solution to many learning and training challenges, such as in collaborative projects and fieldwork	, they can learn through what they put interest in. they have handphones, so, we should manipulate the sitaiaonto a positive way by

APPENDIX G: Raw Data from MReadiness Questionnaire

Graph 2 : Frequency of Use of Mobile Phone Applications (Stage 1)

MOBILE FEATURES & ACTIVITIES	I don't have this feature in my mobile phone		I have this feature in my mobile phone but I do not know how to use it		I have used this feature in my mobile phone but I rarely use it		I always use this feature in my mobile phone		I don't know if my mobile phone has this function	
	n	%	n	%	n	%	n	%	n	%
Make & receive calls	-	-	-	-	2	2.9	68	97.1	-	-
Make & receive SMS	-	-	-	-	3	4.3	67	95.7	-	-
Make & receive MMS	6	8.6	2	2.9	27	38.6	35	50.0	-	-
Take & download pictures	12	17.1			25	35.7	33	47.1	-	-
Record, download & view videos	12	17.1	1	1.4	27	38.6	30	42.9	-	-
Web enabled (Wi-Fi or 3G) to surf for information	23	32.9	8	11.4	23	32.9	14	20.0	2	2.9
Send & receive emails	21	30.0	15	21.4	27	38.6	3	4.3	4	5.7
Record & upload voice recorder (audio file)	14	20.0	2	2.9	35	50.0	19	27.1	-	-
Use GPRS to navigate	28	40.0	12	17.1	18	25.7	9	12.9	3	4.3
Read & update social network sites	26	37.1	11	15.7	23	32.9	9	12.9	1	1.4
Send & receive Bluetooth information	12	17.1	2	2.9	18	25.7	37	52.9	1	1.4
Make & read through Microsoft Mobile Office	37	52.9	9	12.9	15	21.4	2	2.9	7	10.0
Read & download documents through PDF Viewer	38	54.3	8	11.4	13	18.6	2	2.9	9	12.9
Listen & download songs through MP3 player	13	18.6	3	4.3	15	21.4	39	55.7	-	-
Listen to radio channels	13	18.6	-	-	19	27.1	38	54.3	-	-
Play & download offline games	22	31.4	6	8.6	19	27.1	21	30.0	2	2.9
Play online games	28	40.0	11	15.7	25	35.7	3	4.3	3	4.3
Use phone as file storage	21	30.0	5	7.1	15	21.4	27	38.6	2	2.9
Use phone calendar	8	11.4	1	1.4	8	11.4	51	72.9	1	1.4
Use phone note-taking/task capability	14	20.0	2	2.9	18	25.7	33	47.1	3	4.3

Graph 3 : Initial Perception of Mobile Learning Activities (Stage 1)

	Very Useful		Useful		Not Much Useful		Useless		I am not sure	
	N	%	N	%	N	%	N	%	N	%
Hear audio file lectures through mp3 files in your phone/mp3 player	21	30.0	33	47.1	8	11.4	1	1.4	7	10.0
Read the lecture's PowerPoint through your phone	22	31.4	23	32.9	17	24.3	2	2.9	6	8.6
Receive notices about your courses through SMS	47	67.1	20	28.6	3	4.3	0	0	0	0
Receive small-bites (bite-size) notes of your topic through SMS	26	37.1	29	41.4	11	15.7	1	1.4	3	4.3
Receive small-bites (bite-size) notes of your topic through your phone Bluetooth	25	35.7	26	37.1	11	15.7	4	5.7	4	5.7
Send feedback through SMS about your lecture	26	37.1	29	41.4	11	15.7	2	2.9	2	2.9
Receive feedback about your reflection or coursework through SMS	27	38.6	21	30.0	16	22.9	4	5.7	2	2.9
Send questions through SMS about a topic	35	50.0	28	40.0	4	5.7	2	2.9	1	1.4
Capture video/pictures for your assignment through your mobile phone	40	57.1	21	30.0	6	8.6	1	1.4	2	2.9
Update your course reflection or coursework through your phone 3G/Wi-fi	21	30.0	18	25.7	16	22.9	5	7.1	10	14.3

Graph 5 : Frequency of Use of Mobile Phone Applications (Stage 2)

MOBILE FEATURES & ACTIVITIES	I don't have this feature in my mobile phone		I have this feature in my mobile phone but I do not know how to use it		I have used this feature in my mobile phone but I rarely use it		I always use this feature in my mobile phone		I don't know if my mobile phone has this function	
	n	%	n	%	n	%	n	%	n	%
Make & receive calls							75	100		
Make & receive SMS							75	100		
Make & receive MMS	4	5.33	3	4	26	34.67	40	53.33	2	2.67
Take & download pictures	8	10.67	5	6.67	20	26.67	40	53.33	2	2.67
Record, download & view videos	10	13.33	4	5.33	33	44	27	36	1	1.33
Web enabled (Wi-Fi or 3G) to surf for information	25	33.33	12	16	10	13.33	24	32	4	5.33
Send & receive emails	27	36	17	22.67	16	21.33	13	17.33	2	2.67
Record & upload voice recorder (audio file)	12	16	14	18.67	32	42.67	14	18.67	3	4
Use GPRS to navigate	28	37.33	14	18.67	17	22.67	12	16	4	5.33
Read & update social network sites	25	33.33	13	17.33	26	34.67	7	9.33	4	5.33
Send & receive Bluetooth information	10	13.33	4	5.33	14	18.67	45	60	2	2.67
Make & read through Microsoft Mobile Office	41	54.67	15	20	3	12	4	5.33	6	8
Read & download documents through PDF Viewer	40	53.33	12	16	13	17.33	6	8	4	5.33
Listen & download songs through MP3 player	14	18.67	7	9.33	11	14.67	40	53.33	3	4
Listen to radio channels	11	14.67	2	2.67	27	36	33	44	2	2.67
Play & download offline games	19	25.33	8	10.67	25	33.33	14	18.67	9	12
Play online games	25	33.33	15	20	18	24	6	8	11	14.67
Use phone as file storage	18	24	7	9.33	16	21.33	33	44	1	1.33
Use phone calendar	3	4	0	0	14	18.67	57	76	1	1.33
Use phone note-taking/task capability	10	13.33	4	5.33	23	30.67	45.33	45.33	4	5.33

Graph 6 : Initial Perception of Mobile Learning Activities (Stage 2)

	Very Useful		Useful		Not Much Useful		Useless		I am not sure	
	N	%	N	%	N	%	N	%	N	%
Hear audio file lectures through mp3 files in your phone/mp3 player	25	33.33	23	30.67	19	25.33	4	5.33	4	5.33
Read the lecture's PowerPoint through your phone	13	17.33	28	37.33	20	26.67	10	13.33	4	5.33
Receive notices about your courses through SMS	59	78.67	14	18.67	0	0	2	2.67	0	0
Receive small-bites (bite-size) notes of your topic through SMS	41	57.67	20	20.67	14	18.67	0	0	0	0
Receive small-bites (bite-size) notes of your topic through your phone Bluetooth	33	44	17	22.67	21	28	2	2.67	2	2.67
Send feedback through SMS about your lecture	32	42.67	26	34.67	11	14.67	4	5.33	2	2.67
Receive feedback about your reflection or coursework through SMS	38	50.67	22	29.33	11	14.67	4	5.33	0	0
Send questions through SMS about a topic	46	61.33	18	24	9	12	2	2.67	0	0
Capture video/pictures for your assignment through your mobile phone	26	34.67	23	30.67	18	24	4	5.33	4	5.33
Update your course reflection or coursework through your phone 3G/Wi-fi	22	29.33	19	25.33	19	25.33	9	12	6	8