**Open Source Implementation of M-learning for Primary Schools in Malaysia**

By

Mohamad Izzriq bin Ab Malek Foad

Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Information and Communication Technology)

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CERTIFICATION OF APPROVAL

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Approved by,

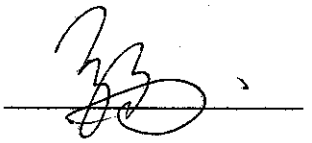
_____

(Mr Mohammad Noor bin Ibrahim)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
January 2007

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons



MOHAMAD IZZRIQ BIN AB MALEK FOAD

# ABSTRACT

This project named "**Open Source Implementation of M-learning for Primary Schools in Malaysia**". It focuses on learning using mobile devices by attempting UPSR (Ujian Pencapaian sekolah Rendah) Mathematics' quizzes for year 5 and 6 primary schools' students which were posted by the teachers, plus the ability to track the students' quizzes progress regularly. Students tend to avoid doing academic exercises because of the problem on the weight of the exercise books, as well as the limited time for both students and teachers to monitor the academic progress. This project solved the problems by implementing a learning environment using small and portable mobile devices as well as the implementation of automated mobile graph on the system itself for the purpose of progress tracking. Completed system were tested by the selected target users (primary school students) where the result showed that the students who use this system perform well in the test conducted (75 % of the group scored 80% to 100%), compared to the one who used traditional learning approach (50% of the group scored 80% to 100%). As a conclusion, this project had created a new exciting learning environment in Malaysia as well as being accepted based on the users' response.

## ACKNOWLEDGEMENT

First and foremost, Praise Be upon to Allah S.W.T for His Mercy has given me the strength and ideas to successfully complete this project within the time given.

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# CHAPTER 1
# INTRODUCTION

## 1.1 BACKGROUND

Education is the instruction or teaching that one receives or gains. It involves activities through which knowledge is imparted, usually at schools, colleges or universities. Educators are discovering that computers and multi-based educational tools are facilitating learning and enhancing social iteration. With the used of mobile devices such as smart phones and PDAs (Personal Digital Assistant) to facilitate learning processes, the new trend of learning process had changed from E-learning (electronic learning) to M-learning (mobile learning). M-learning is becoming popular with the implementation of its content using the Open Source technology.

Open Source refers to a program in which the source code is available to the general public for use or modification from its original design free of charge. Technology such as PHP and MySQL are the examples of the Open Source technology. The development cost using the Open Source technologies being reduced with its free of charge policy. The government of Malaysia had recently moved forward in promoting the use of Open Source technologies in any content development.

The government of Malaysia, under the MSC (Multimedia Super Corridor) had included the establishment of smart schools as one of its six flagship applications. Those six flagship applications were meant to accelerate the realization of Vision 2020. The establishment of smart schools includes the use of advance learning process such as the implementation of M-learning in the schools to replace the traditional based learning environment. Mathematics' subject for Malaysian primary school students is the best subject to be implemented in M-learning since it is one of the core subjects to be mastered by the students aged 10 to 12 years old, who is preparing to sit for the UPSR (Ujian Pencapaian Sekolah Rendah) examinations.

### 1.1.1 E-Learning

E-learning is an all-encompassing term generally used to refer to computer-enhanced learning, although it is often extended to include the use of mobile technologies such as PDAs and MP3 players. It may include the use of web-based teaching materials and hypermedia in general, multimedia CD-ROMs or web sites, discussion boards, collaborative software, e-mail, blogs, wikis, computer aided assessment, educational animation, simulations, games, learning management software, electronic voting systems and more, with possibly a combination of different methods being used (Koike, Akama, Chiba, Ishikawa and Miura, 2005). In cases where mobile technologies are used, the term M-learning has become more common.

### 1.1.2 M-Learning

In the short space of 5 years, mobile learning has moved from being a theory, explored by academic and technology enthusiasts, into a real and valuable contribution to learning which enable everybody learn while they are on a move. The evolution of learning paradigm from traditional classroom based learning and electronic learning had give birth to the new learning paradigm based on mobile devices which is known as M-learning (Stead, 2006).

A mobile technology have become pervasive, many researchers have questioned whether they can enhance learning experiences. Arguably, it could be thought that M-learning is an approach to E-learning that simply utilizes mobile devices, yet it can also be viewed as a quite different learning experience (Parson, Ryu and Cranshaw, 2006). It is because E-learning and M-learning are totally different in terms of its mobility and interaction among the students, as well as the teachers.

The development of M-learning is not intended to replace the classroom or PC based (E-learning) learning content, but to strengthen and harmonize overall learning strategy. M-learning offers another way to deliver content and to embed learning into

daily life by developing learning materials in small and consumable byte of format which can be delivered through wireless network (Liang Ting, 2005).

The background of both E-learning and M-learning are provided to give a gist of what is actually defined by both learning technologies which are widely used today in the 21st century. These backgrounds will be used to stimulate any arguments for the next section (Problem statements). The problem statements will explain the points on the need to migrate from E-learning based technology to M-learning based technology.

## 1.2 PROBLEM STATEMENTS

Even though the government of Malaysia had established MSC (Multimedia Super Corridor) to spearhead the six innovative Flagship Applications where one of them is to implement smart schools application; there are still a large number of schools and educational institutions that implement the same old teaching and learning process that does not used the technologies available. There are 4 main problems in the current learning system in Malaysia that inspires the author to work on this project. The problems mainly dwell around the current learning environment which is too rigid that limit the students' potential in their learning processes.

### 1.2.1 Heaviness of the textbooks used

One of the problems is in the aspect of the students' psychology itself. The 'bring book anywhere' culture could not being implemented to the students even though it is important to them to keep a close contact with the books. The thickness and heaviness of the books that the students need to carry regularly is the main factor of these problems. The mentioned factor had eventually making the students uninterested to do their academic exercises on the books regularly.

### 1.2.2 Students and teachers' hectic daily schedule

Time constraints for both parties, which are the students and the teachers, had limited the potential of a learning process to improve. The students' hectic daily schedules after their normal school hours had reduce their time to revise or do extra academic exercises. Most of the parents nowadays try to fill their children's time after school by enrolling their children to religious classes, music or swimming classes, for example, and this eventually had lead the children, who has the responsibility as students to have limited time to revise their schools' work. A lot of seminars that need to be attended by teachers had limited the teachers' precious time to monitor the academic progress of their students.

### 1.2.3 Unnecessary and confusing E-learning functions

Typical e-learning system nowadays offers a lot of functions to be used. Most of the people perceive this as an advantage to the e-learning system. In the real implementation, students will perceive this as a barrier for them to use the system at its fullest since the students could easily get confused of the functions offered which many of them are not being used.

As an example, the 'forum' function that had been included in most E-learning system could be seen as unnecessary to the students. Not all students and teachers use this function since they have no time to deal any matters in the forum room. Some of them do not even know the existence of the function. This eventually turns them off to use the existing system.

### 1.2.4 High cost in commercialize system and desktop use

The last problem which is important is in term of cost in implementing a learning environment. Schools that implement E-learning system might have to incur high cost if they are using commercialize system. Commercialize system use commercialize

software that need license before any development could be made using the software. Examples of commercialize software are Microsoft and Oracle based software. The cost of the E-learning infrastructure which includes desktops is much higher than M-learning infrastructure which used personal mobile devices. It is because, by implementing M-learning, the cost of infrastructure that need to be spend by the schools could be reduced since personal mobile devices are used instead of the public schools' desktops.

## 1.3 SIGNIFICANCE OF THE PROJECT

This project which entitled 'Open Source Implementation of M-Learning for Primary Schools in Malaysia' eventually had solved the problems of the current learning system which had been mentioned above. The solutions for the above problem statements are as follows:

### 1.3.1 Implement a new learning concept (related to 1.2.1)

It is human nature to be attracted to any appealing things and same goes to the primary school students as well. Students at the age of 7 to 12 are attracted to fun and new activities using new devices. It is practical to implement a learning environment for that age group using the ever appealing mobile devices. They could be tempted to involve in the learning process dynamically if the medium is appealing to them in term of the devices' weight itself which is multiple times lighter than their mathematics textbook.

### 1.3.2 Implement automated progress tracking using graph (related to 1.2.2)

The hectic schedule faced by both students and the teachers could demoralize them to participate in the learning processes dynamically. The implementation of automated progress tracking using graph could solve the problem of time constraints faced by both students and teachers. The students, as well as the teachers can easily monitor the students' progress after the students had attempted the quizzes using the mobile devices.

The progress could easily be monitored without any intervention and use of paper. The students and the teachers can take necessary actions to improve the students' performance after analyzing the automated graph displayed on the mobile devices.

### 1.3.3 Enable ubiquitous and simple learning processes (related to 1.2.3)

Everybody likes to stay connected with their devices at any time and at any place in order to ease their work. The confusion that happened by using the unnecessary functions on the current E-learning system can be solve by implementing learning processes using mobile devices. The limited amount of memory in the mobile devices had urged the mobile content developers to include minimum amount and easy to use functions in their product. The nature of M-learning which includes only necessary functions could make the students feel easy to use the system to its maximum to enhance their learning processes.

### 1.3.4 Use Open Source technology for content development (related to 1.2.4)

Personal M-devices are used instead of public desktops, that need to be funded by the schools themselves, had make M-learning more appealing in terms of cost issue. The implementation of M-learning using Open Source Software (OSS) will reduce the implementation cost. PHP and MySQL, which are the examples of Open Source technologies, are the main technologies being used in the development of this system. The solutions that had been mentioned conform directly to this project's objectives.

## 1.4 OBJECTIVES

Before the development of this system took place, the author had come out with 3 objectives that had to be met upon the completion of this project. The objectives mainly focus on the research of the M-learning implementation in Malaysia for the

mathematics subject in primary schools' syllabus. Below are the points which represent the 3 objectives of this project:

- To perform a small scale of study regarding M-learning implementation from the literature review including the implementation of WAP (Wireless Access Protocol).
- To design a framework of M-learning focusing on its implementation on the learning environment in primary schools in Malaysia.
- To develop an efficient M-learning prototype which includes mobile quizzes, which will be attempted by the primary school students, and the function of progress tracking using automated graph.

## 1.5 SCOPE OF STUDY

In order to ensure the system meets its requirements, several scope of study had been defined. The scopes of study for this project are stated as below:

- To study about M-learning implementation concept and functionality. For the project, the author had studied on how M-learning manages to increase the efficiency and standard of education in Malaysia, mainly primary school, focusing on the subject of Mathematics. The target users are the primary school students aged 10 to 12 years old.
- To study about the possibility of implementing mobile quizzes and progress tracking in the system. This project focus more on implementing mobile quizzes where the students could attempt the mobile' quizzes online and monitors their progress as well.

# CHAPTER 2
# LITERATURE REVIEW

## 2.1 WHAT IS M-LEARNING

M-learning is the term given to the delivery of training by means of mobile devices such as mobile phones, PDAs and digital audio players, as well as digital cameras and voice recorders, pen scanners etc, as opposed to E-learning which uses wired medium in transferring the content (Liang Ting, 2005). M-learners are seeking lessons in small, manageable formats that they can undertake when it suits them. There are a relationship between M-learning, E-learning and D-learning (distance learning).

M-learning is the follow up of E-learning which for its part originates from D-learning. Researchers had agreed that the emergence of M-learning is from the face to face traditional learning environment and the E-learning, which is also known as D-learning (Liang Ting, 2005). M-learning is the delivery of learning to students who are not keeping a fixed location, as stated by Liang Ting (2005). The rapid growth of information and communication technologies (ICT) makes it possible to develop new forms of this education using various mobile communication mechanisms.

Liang Ting (2005) stated that there are various mobile communication mechanisms that support M-learning such as voice communication, access of learning portal on the internet and learning through SMS. This clearly shows that M-learning could be interactive with the convergence of audio, web and mobile technologies in one package.

## 2.2 FROM E-LEARNING TO M-LEARNING

Researchers had agreed that M-learning is going to be the new trend of learning paradigm with the emergence of mobile and wireless technologies usage among the learners. Even though some of the countries, especially the developing countries are still in the first phase or perhaps in the research and development phase in implementing this type of learning environment, Kyun Baek and Uk Cheong (2005), Barker, Krull and Mallinson (2005) had proved that developing countries as well will soon catch up with this new learning paradigm. This shows that this new learning paradigm will evolve with the rapid usage and ownership of mobile devices such as hand phones and PDAs among the users where the usage of those devices, as an example, the hand phones could be extended to create the new learning environment to the owner instead of using it for the sake of making or receiving a call and SMS (Short Massaging System).

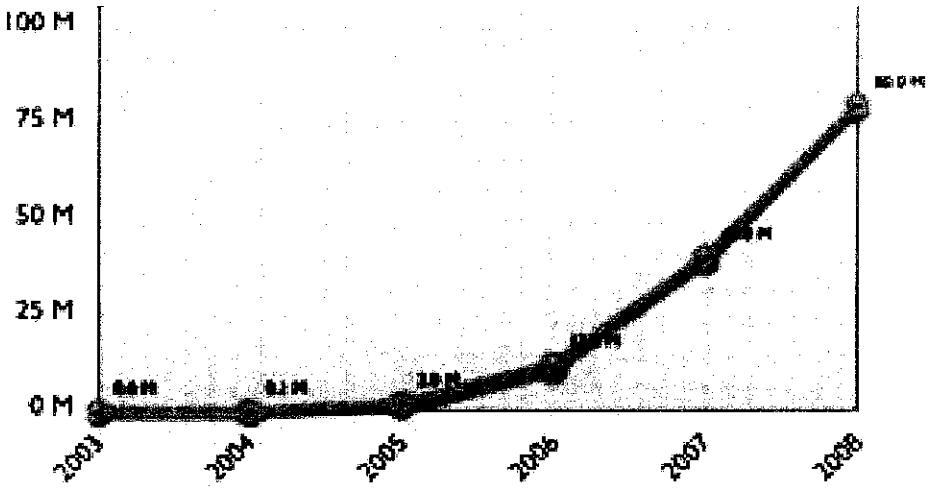



**FIGURE 2.2.1: Graph of the wireless usage trends. (Source: Harbourresearch Inc, San Francisco)**

Kyun Baek and Uk Cheong (2005) stated that the future of M-learning in Korea is bright since the rate of mobile phones subscription has been increase rapidly since

1999 and on September 2004, the role of wireless internet use was at 40.2% and increasing.

According to Barker, Krull and Mallinson (2005), Africa has potential for implementing M-learning with more people in Africa have mobile phones, in comparison to fixed lines and the most appropriate mobile devices for learners in Africa are mobile phones. To support the facts that M-learning will be the future learning trend, Stead (2005) had stated that, in the short space of 5 years, mobile learning, which is also known as M-learning, has moved from being a theory, explored by academic and technology enthusiasts, into a real and valuable contribution to learning.

The future of M-learning seems bright since new types of wireless communications services such as wireless collaboration will be widely available soon with wireless and wired internet services are popularized. The development of mobile semiconductors such as flash memory will even make the mobile devices smaller and this will give impact on the usage group of wireless services where students use wireless internet more than graduates (Kyun Baek and Uk Cheong, 2005).

M-learning will be a successful trend currently and in the future because currently, PDA and tablet PCs are more popular among users because of several factors (Black and Hawkes, 2006). One of the factor is that the mobile devices are inexpensive compared to PC. Besides that, the devices are mobile, durable and convenient for the worker on the go and lastly, the familiarity among younger users makes them an attractive mechanism for incorporating M-learning into the curricular.

## 2.3 BENEFITS OF IMPLEMENTING M-LEARNING

The benefits of mobile learning, as stated by Kyun Baek and Uk Cheong (2005) are the possibility of implementing ubiquitous learning environment, the possibility of lifelong learning and the possibility of education through entertainment 'edutainment'.

Ubiquitous, according to Oxford Advance Learner's Dictionary means seeming to be everywhere or in several places at the same time. With the development of M-learning environment, one will be possible to learn everywhere at any time. A student who is on a holiday could still read the lecture notes and doing the exercises using his or her mobile devices. Collaborative learning could be possible even if the learner is not in the classroom.

With the government currently is emphasizing on the knowledge work force, it is crucial for everybody to instill the lifelong learning philosophy. M-learning could be the best platform for everybody, with any age to keep on learning. Short and small courses for distance learning could employ M-learning in transferring the knowledge and providing an interactive yet valuable experience for the learners everywhere at any time.

Games had always been the favorite activity of the youngsters. Even mobile technology companies such as Nokia and Motorola had equipped their products, which is the hand phones with various mobile games. If learning materials could be integrated with that type of entertainment, the youngsters will be more eager to learn and understand the contents of their learning. The technicality and increasing functionality of mobile devices such as hand phones and PDA's could attract learners in learning efficiently.

According to Stead (2005), M-learning could be a bridge into Information Technology (IT). It means that the users of M-learning will be more confident in dealing and working with IT technology such as mobile phones and PDA's. Currently, there are lots of people, particularly with socially disadvantaged groups had no confidence in IT at all. Thus, with the implementation of M-learning at young age could overcome this problem which faced mostly by developing countries.

## 2.4 SUITABLE SUBJECT TO BE IMPLEMENTED IN M-LEARNING

According to Barker, Krull and Mallinson (2005), short courses and mainly theory and information type courses are better suited to the M-learning environment. As an example, subject like Mathematics for UPSR which requires objective-type-questions is suitable to be implemented in M-learning environment since the subject require only thorough understanding of certain basic mathematical concepts before attempting to answer the objective-type-questions

One of the challenges of implementing M-learning environment is because of slow file retrieval from server to client, in this case the mobile devices, could be overcome by implementing such assessment such as the objective-type-questions (Black and Hawkes, 2006 and Kyun Baek and Uk Cheong, 2005). It is because, this type of processing requires only small number of computations compared to essay or subjective-type-questions which require high amount of computation which eventually make the response from the server slow.

## 2.5 CHALLENGES OF IMPLEMENTING M-LEARNING

According to Barker, Krull and Mallinson (2005), the challenges of implementing m-learning are the limitations of the devices, pedagogical issues problems, safety and security issues, training and support issues and the cost considerations.

In term of limitations of the devices, the devices being used in implementing this type of learning environment might not give the same layout or interface of the content as the emulator. This had been agreed by Black and Hawkes (2006) where they had stated that the different output or layout of the content might be differed to the one that is appear in the emulator. This problem should be considered as technical problem since several adjustment to the codes or settings of the devices should be made in order to ensure the same outcome appear to the devices as well as the emulators. The example of

limitations of the devices also include the mobile device capability in executing the program used in M-learning, whether it manage to give response on time or not.

Pedagogical is a learning model where focus on teachers who control the learning process. According to Keough (2005), a new learning philosophy which is called mobigogy which integrate pedagogy (teacher centered learning) and andragogy (learner oriented) should be adapted to M-learning environment. This is because; M-learning is no longer being controlled by teachers fully in the classroom, but also makes it possible for learners to learn anything that they want to learn, at any time and at any places eventhough outside the school area.

In terms of safety and security issues, many schools are reluctant to let learners take home the hand held devices since to avoid them from lost, damage and etc (Barker, Krull and Mallinson, 2005). This will eventually made the learners who earn low income have the difficulty in owning the devices to facilitate them in M-learning environment. In terms of safety, the usage of the wireless internet without any supervision might lead to the learners to join negative group which might threaten the learners' safety.

In every new technology, training and support are very important and M-learning implementers need to take extra consideration about it. Learners and teachers, as well as the parents should be taught on how to use the devices to fully utilize the M-learning environment. Any problems such as troubleshooting services should be ready anywhere and at anytime if the stakeholders, in this case the learners, teachers and parents, faced any problems in using the technologies. Eventhough these are quite a dawn tasks, it should be taken extra considerations to ensure the stakeholders' could benefits fully from this new learning environment.

The cost of the technologies and infrastructures in implementing M-learning environment without any doubt will be very high. The cost of the mobile devices itself still being considered as expensive since there are prove that the devices price is

reducing. The term technologies refers to the programs or systems used to develop mobile based system while the term infrastructure refers to the wireless network hardware and devices used to create the framework of mobile communication.

According to Liang Ting (2005), the challenges of implementing m-learning are in terms of location oriented learning content, cognitive effectiveness of information and the effect of instant interaction upon learning interaction. In implementing M-learning, learning content should be designed to adapt to learners profile and personal needs such as location. The architecture of the mobile devices itself is small and this eventually limiting the text display in supporting the learning process. Instant communication in mobile network is very important in making the learning process more exciting and this is based on the location and the response time. Slow response time will demoralize the learners' learning process (Kyun Baek and Uk Cheong, 2005).

Kyun Baek and Uk Cheong (2005) agreed that the requirements for future mobile learning implementations are m-learning can only be accepted only based on acceptance of the beliefs that learning can happen everywhere and at any time when there is a need for it, the adaptive learning strategies implies that learning should be flexible and specific to the learner's style, the establishment of infrastructure and the standardization of the contents.

Black and Hawkes (2006) stated the challenges of implementing m-learning using J2ME technology are the lack of documentation on J2ME itself, different interface from emulator and the actual device, slow file retrieval from server to client and because of security and reliability issues. Black and Hawkes (2006) statement refers to the technical challenges in employing M-learning with the inclusion of the technologies and infrastructures such as Java 2 Micro Edition (J2ME) and the wireless communication infrastructure.

Based from the research arguments, we can divide the challenges in implementing M-learning environment to 2 aspects which are the management aspects,

which includes the pedagogical, training and support issues and the technologies and infrastructures aspects, which includes the cost, compatibility and limitation of the elements.

## 2.6 TECHNOLOGY USED IN M-LEARNING

The term m-learning is applied to learning with many different technologies, and an equal variety of learning contexts. Different combinations work for different purposes in different places.

M-learning system developers need to consider which technologies to be used which suits the purpose and the objectives of learning activities. The widely used technologies are Short Massage Service (SMS), PDAs, MediaBoard, Multimedia Message Service (MMS) and VoiceXML.

### 2.6.1 SMS

Text messaging is the simplest of all the technologies, and interactive learning activities can be devised with very basic equipment. All mobile phones, including the cheapest, most basic models, can send and receive text messages, so this is by far the most widespread of the technologies (Silander and Rytkonen, 2005).

Partly because of its widespread use, and partly because of the limited length of text messages, it has developed its own etiquette and social protocols for use. The language of text messaging (characterized by the use of abbreviated and phonetic spellings and unconventional use of capital letters) may already be familiar to some learners, and their interest in this form of writing could be exploited. Activities based around the content of text messages (e.g. 'translating' them into standard English to convey the same message to a different audience in a different format) can be done in class with no expense.

Activities which require learners to send messages could be of two types: Learners interacting with their tutor, such as for extra hints, reminders, revision tips or homework questions in between classes. Learners interacting with a computer that sends automated replies.

Interacting with a tutor need not require the tutor to use a mobile phone to send text messages. A number of web sites exist which allow tutors to receive text messages from learners on their PC using an interface similar to an e-mail program. These allow you to send a text message to a number of learners at once (e.g. one question simultaneously to all members of the class) and view or print learners' responses easily.

Alternatively, learners could use text messaging to get automated feedback from a computer on their answers to questions, freeing the tutor from any additional workload. Typically, the learner reads a flier, poster or brochure that has some learning resources on it, as well as some questions to check their understanding. They send their answers for instant feedback. In some cases they may also receive follow-up messages. This is already being used for a variety of purposes, such as to deliver health information, for drugs support and advice across the UK, and for learner drivers to practise driving theory questions.

### 2.6.2 PDAs

There are many competing products and technologies in this area. PDAs (personal digital assistants) originally targetted business users. They are also called 'palmtops' or 'handhelds'. They have functionality that is fast approaching the PC. 'SmartPhones' are PDAs that are also phones, often with onboard cameras, web-browsers, e-mail and MP3 music players (Black and Hawkes, 2006).

Almost all of the m-learning case studies that have funded the handhelds themselves have gone with one of these devices because of their potential to be used for

a wide variety of m-learning activities, with scope to cater to different learning styles and provide relatively media-rich learning materials, such as animation and music. However, these are often best suited to scenarios where the learning provider also supplies the technology since few learners currently have a PDA or SmartPhone of their own.

### 2.6.3 MMS

MMS is 'picture messaging', the system by which camera phones and PDAs can send images, audio clips and even video clips as well as text to other phones and to e-mail addresses (Brown, 2003). This opens up a vast range of potential learning. A number of web sites are available which allow you to set up a web page and send text, images and audio to it directly from a picture message. A variety of collaborative active learning activities have been tried out in a number of contexts (ESOL, family learning, numeracy) and in different countries (UK, Sweden, Italy, Australia) using this technology as part of the m-learning project, the NRDC's ICT Effective Practice study and the Maths4Life Pathfinder.

MMS, used in conjunction with a web-based platform such as Ploggle, MoblogUK or mediaBoard, provides learners with a very simple tool for publishing to the web. Ploggle and MoblogUK are attractive and easy to use but most of the trials to date have used mediaBoard which was specifically developed with educational activities in mind. MediaBoard offers a number of exciting features that the other sites do not.

### 2.6.4 MediaBoard

MediaBoard is a virtual 'place' (held on a web site) where learners and tutors can set up an image or map as the front page of their web site, and send text, pictures and audio messages to different locations on the image or map. One use for this in the m-learning project has been to set up live events. For example, students are set tasks individually or

in teams, and send in text and picture messages to prove they have been accomplished (e.g. find a specific building and take a picture of it to prove you are there). Although very popular, this requires an enthusiastic tutor to facilitate and moderate the process.

Many potential applications for this technology have emerged as a result of extensive experimentation, demonstrations and discussions of this technology with teachers and learners. They include:

1. Collecting and sending in evidence for vocational or other qualifications
2. Supporting people in work experience placements
3. Supporting tutors and mentors in outreach situations.

### 2.6.5 VoiceXML

VoiceXML is a way of talking to a computer via your phone, like an automated telephone answering system. It can be used to simulate real-life dialogues, which is very popular with ESOL or LDD learners because they can practise a dialogue, as an example for job interview and doctor's appointment as many times as they wish. It combines:

1. real-voice recordings
2. speech recognition
3. speech generation (computer voice)
4. conversation-flow logic.

### 2.6.6 Beaming

Almost all PDAs have infrared, bluetooth or both. These allow one device to send and receive files to and from another for free. The devices need to be fairly close by, and in the case of infrared they need to be in line of sight of each other. Several teachers, as

well as software developers, have used these features for some interesting collaboration activities and tools. The best example of this is Hi-Ce (Centre for Highly Interactive Computing in Education at the University of Michigan) who connects students using PalmOS together to share writing across devices.

### 2.6.7 Geocache

Ability to access to any GPS devices (global positioning), will enable the geocaching technology being implemented. Global Positioning System receiver or other navigational techniques will be used to hide and seek containers (called "geocaches" or "caches") anywhere in the world

### 2.6.8 Podcasting

As the craze that is iPod has grown, so has the terminology that surrounds it. Podcasting is an iPod word for downloading audio files and it is the method of distributing multimedia files, such as audio or video programs, over the Internet using syndication feeds, for playback on mobile devices and personal computers. The term, coined in 2004, is a blend of the terms "iPod", a popular portable audio device, and "broadcasting". Even BBC Radio is in on the act. The good news is that it is easy to get involved and make your own MP3 audio files. Several language learning schools are giving MP3 players to their students so that they can download and listen to spoken audio tracks.

## 2.7 SAMPLE ARCHITECTURE OF M-LEARNING

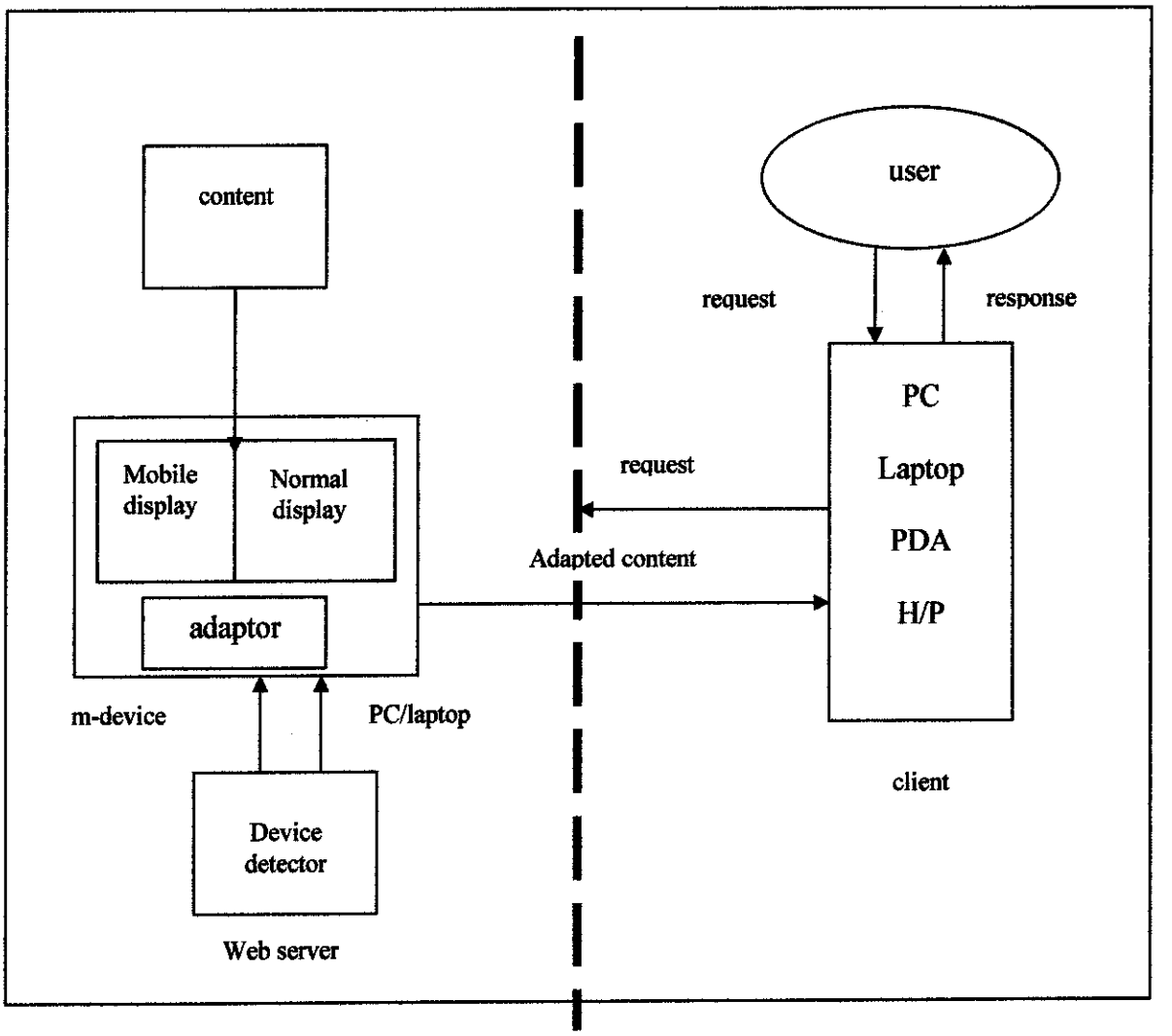



**FIGURE 2.7.1: Design of the AU Library website adapted display**

### 2.7.1 Background of the system

This system is a mobile library system which has a significant relationship with M-Learning (Cao, Tin, McGreal, Ally and Coffey, 2006). It is owned and implemented in Athabasca Universiti, Canada which is an Open University. It means that none of the students are on campus.

The system was implemented because of the growing ubiquity of mobile devices, particularly among young people which presents new possibility for the university to make use of them as potential learning resources.

### 2.7.2 System design

The function of this system is that it can auto detecting user's devices and bring them to the appropriately formatted version (mobile or desktop) of the site. The system provides Wide range of digital resources and library services including digital reading room or e-course reserve, the digital reference centre, the digital thesis and project room, a help centre, a search engine, journal databases, Airpac, which is a mobile library catalogue application and library services through WWW.

The website was implemented in PHP server side scripting language where different client browser were detected by a server side script by passing HTTP_USER_AGENT, where it enable the server to identify the client's platform whether it is Windows CE or Palm OS. The system will choose the appropriate stylesheet and display the model to the client.

## 2.8 PREVIOUS PROJECTS DONE BASED ON M-LEARNING

### 2.8.1. Alykko- Intelligent mobile tutoring tool

Alykko is an intelligent mobile tutoring tool for teachers, developed by Silander and Rytkonen (2005). It enables interaction and tutoring dialogue via mobile devices like mobile phones and PDA's. The tool contains semiautomatic and automatic guidance for learners' learning process, enabling automatic individualization of a learning process. In addition, Alykko contains ready-made-tutoring expressions and a documented tutoring dialogue for teacher's use, in order to reduce the teacher's cognitive load, needed just for memorizing. The tool is created based on the examination of the teacher's pedagogical needs. The development of this system is based on AEFIRIP pedagogical model for M-learning.

This tool is specifically to help teachers to manage the tutoring activities via web and mobile technologies. It also enables communications between teachers and learners via either web system or mobile devices. The technologies used are mainly open source technologies which are PHP, MySQL database, agent modules and SMS gateway. SMS is used to communicate between the learners and the teachers.

### 2.8.2. A prototype interface for collaborative mobile learning

This project was done by Black and Hawkes (2006) where it emphasizes on using PDA usage to collaborate on mobile learning tasks. This system uses the client server approach for wireless communication where it is also designed to take advantage of mobility, as students can be in different areas of the classroom or even in different locales altogether and still participate in collaborating mobile learning activities. This project was done to prove the importance of integration between collaboration learning, reading comprehension and Question –Answer relationship in M-learning implementation.

The technologies used for this project are divided into 2 which are the server side and the client side. The database and Java Servlets are used at the server side, while Java 2 Micro Edition (J2ME) technology is used at the client side. Client side refers to the ends devices used which are mobile phones, PDA's and other mobile devices.

J2ME development package along with Wireless Toolkit 2.1 were used as the software components of this system. The codes were written in Java. Upon completion, the application can be packaged into a JAR file that can be ported to and executed on the target device. The application environment was hosted by the PocketPC OS, which is Microsoft Windows for Mobiles where HP iPAQ PDA was selected for this poject purpose.

The server was implemented via a Linux network upon and all of the servlets were constructed in Java, enabling the environment to be easily ported to a variety of platforms and devices. The J2ME networking API and the Java networking API are used to enable the communication between the mobile devices and the servers.

To use the system, learners have to key in his or her ID and password to enter the system. The main page will then appear where the learners need to click the 'Begin' button to start the system. After reading and understanding the text or notes, he or she will need to attempt to answer the questions related to the text that had been read previously and they could also use the chat functionality within their peers and teachers.

# CHAPTER 3
# METHODOLOGY

## 3.0 DEVELOPMENT METHODOLOGY

Chapter 3 explained the detailed description of the System Development Life Cycle (SDLC) methodology which had been selected as the method in running this project. This chapter explained in detail the 4 phases of the SDLC and the actions taken under each phases, together with its expected deliverables. The last section of this chapter covers the tools required for the project. The methodology, as detailed by step by step guide, provides a systematic way in managing the project efficiently.

The SDLC is a framework for describing the phases involved in developing and maintaining any Information System (IS). This system development methodology which had been widely used consists of 4 phases namely the project initiation and planning phase, the system analysis phase, the system design phase and the system implementation phase.

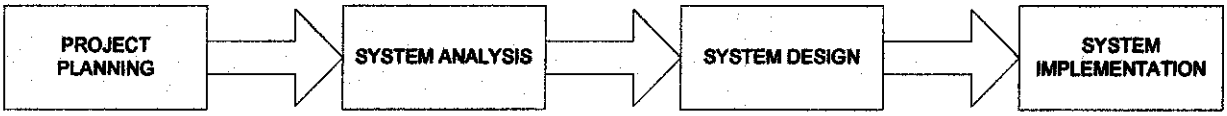



**Figure 3.0.1: SDLC Process Flow**

## 3.1 PROJECT INITIATION AND PLANNING

In this phase, the author focused on the problem arises in the current learning management system. In order to gather the data on the learning process flow, the author had read through several articles and journals pertaining to the study of the learning management process. The author also made an observation on the usage of E-learning system in UTP in order to get the idea of the common functionalities provided in most learning management system.

A rough timeline for the project was developed as well as a draft of the scope. The author has estimated about 1 month for data gathering and research, 3 months for system development and 1 month for system testing and modification. Deliverables for this phase are the problem statement, the project scope, the objectives of this project and the project work plan.

## 3.2 SYSTEM ANALYSIS

In this phase, the author begun to identify the requirements that the system must be able to meet in order to address and resolve the problems identified in phase1. The requirement must describe what the system must do in order to meet the system's objectives. The techniques used in defining the requirements are through conducting interviews with the potential users. The output for this phase is the system's Use Case diagram.

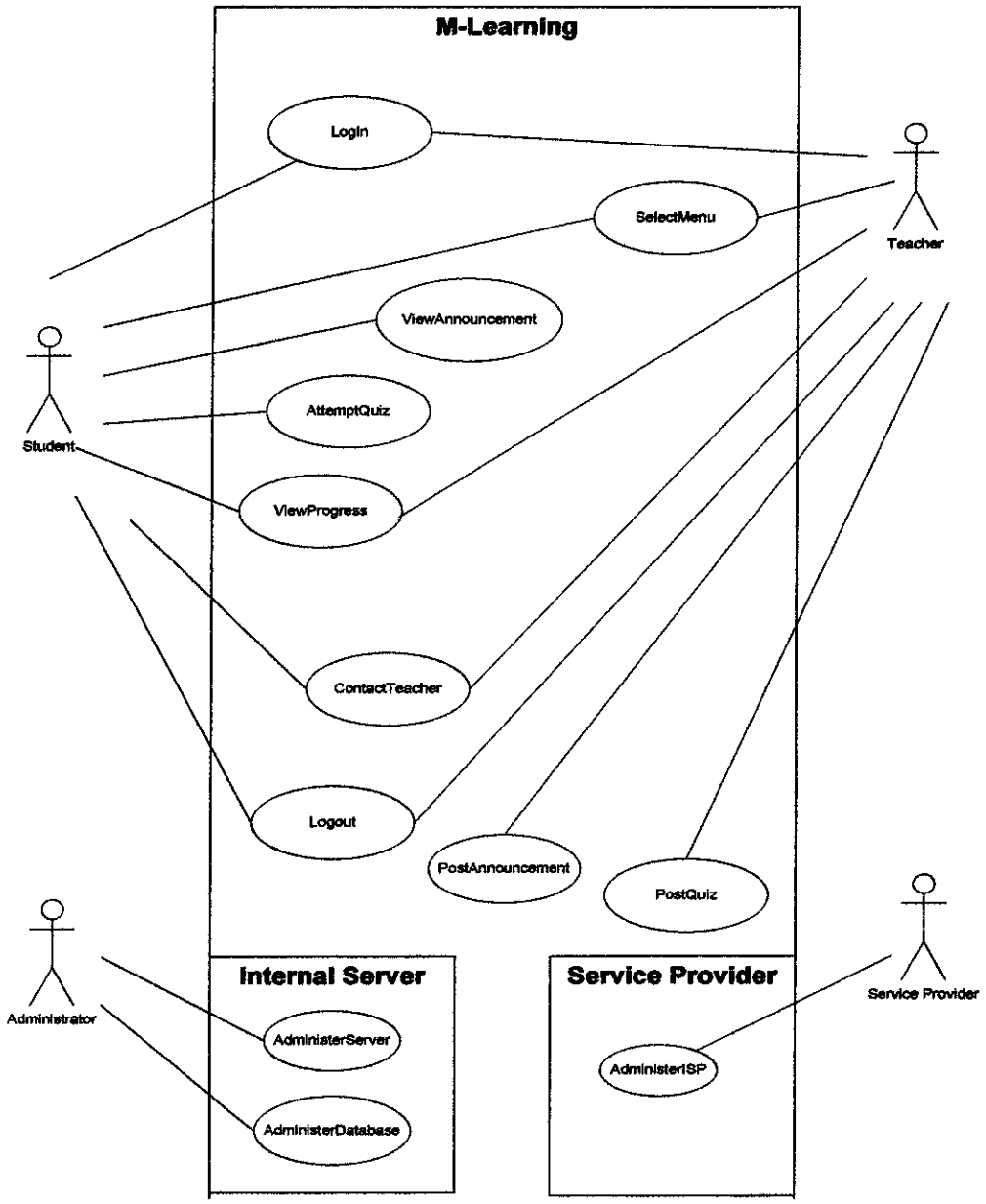



**Figure 3.2.1: The Use Case diagram of the proposed M-learning system**

## 3.3 SYSTEM DESIGN

The author started designing the proposed system based on the requirements gathered in the previous phase of the SDLC. The design phase was split into the following sub stages, which are the database design, architecture design and the interface design.

### 3.3.1 Database Design

After all business requirements have been gathered for a proposed database, they must be modeled. Models are created to visually represent the proposed database so that business requirements can easily be associated with database objects to ensure that all requirements have been completely and accurately gathered. The outcome for the database design is the Entity Relationship Diagram (ERD).

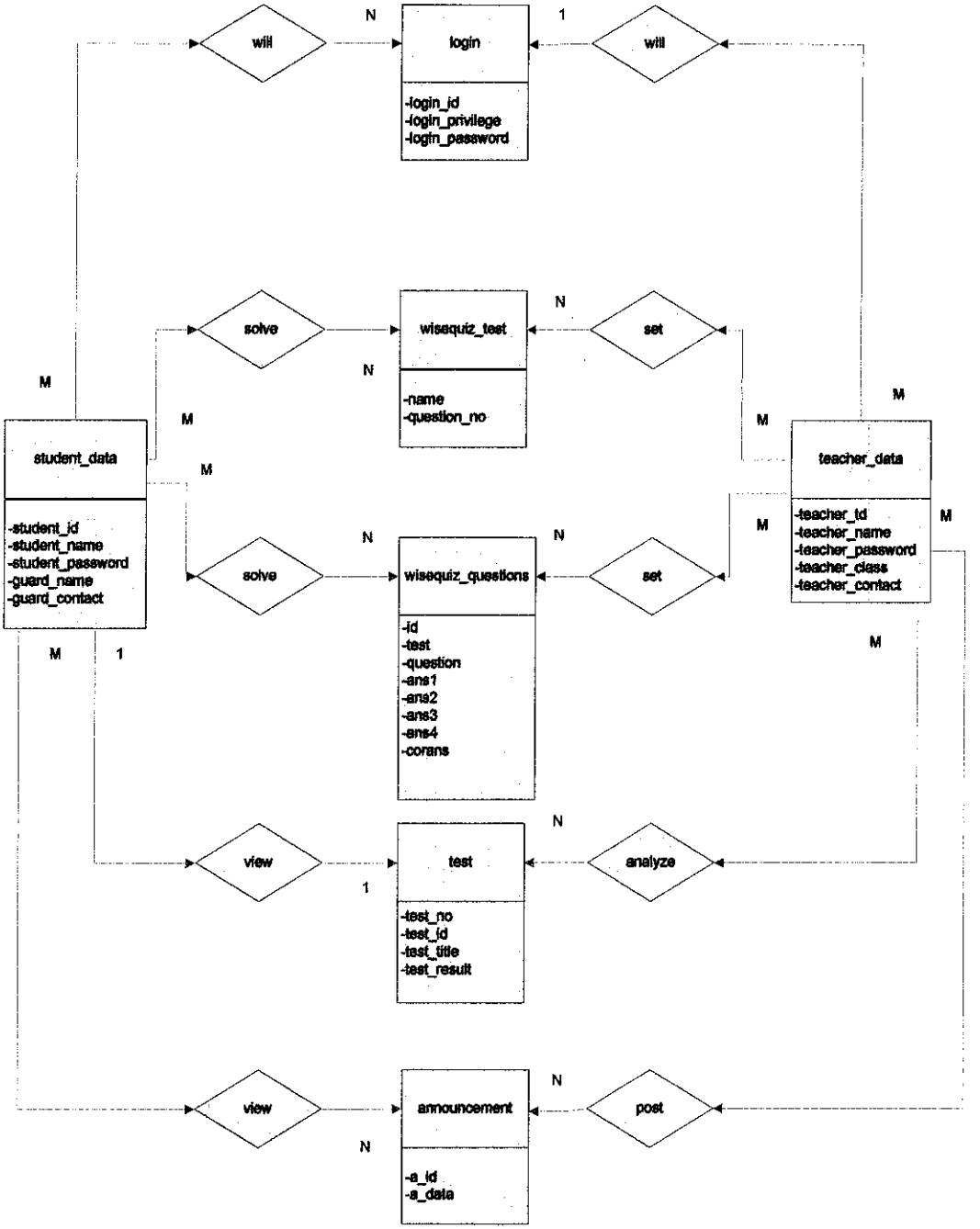



**Figure 3.3.1.1: The E-R Diagram of the M-learning system's database**

### 3. 3.2 Architecture Design

Architecture design deals with the system flow of this M-learning system. This is very important since all of the conceptualize data gathered before this were put into actual physical model. For this purpose, the author came out with the system's flowchart and the system's architecture as below:

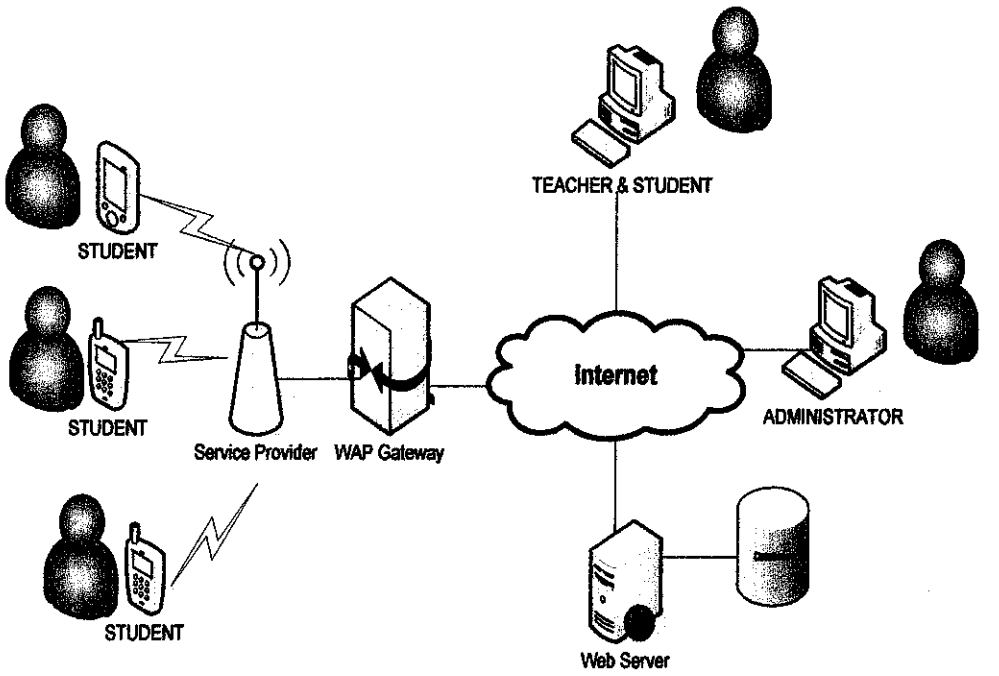



**Figure 3.3.2.1: The architecture of the M-learning system**

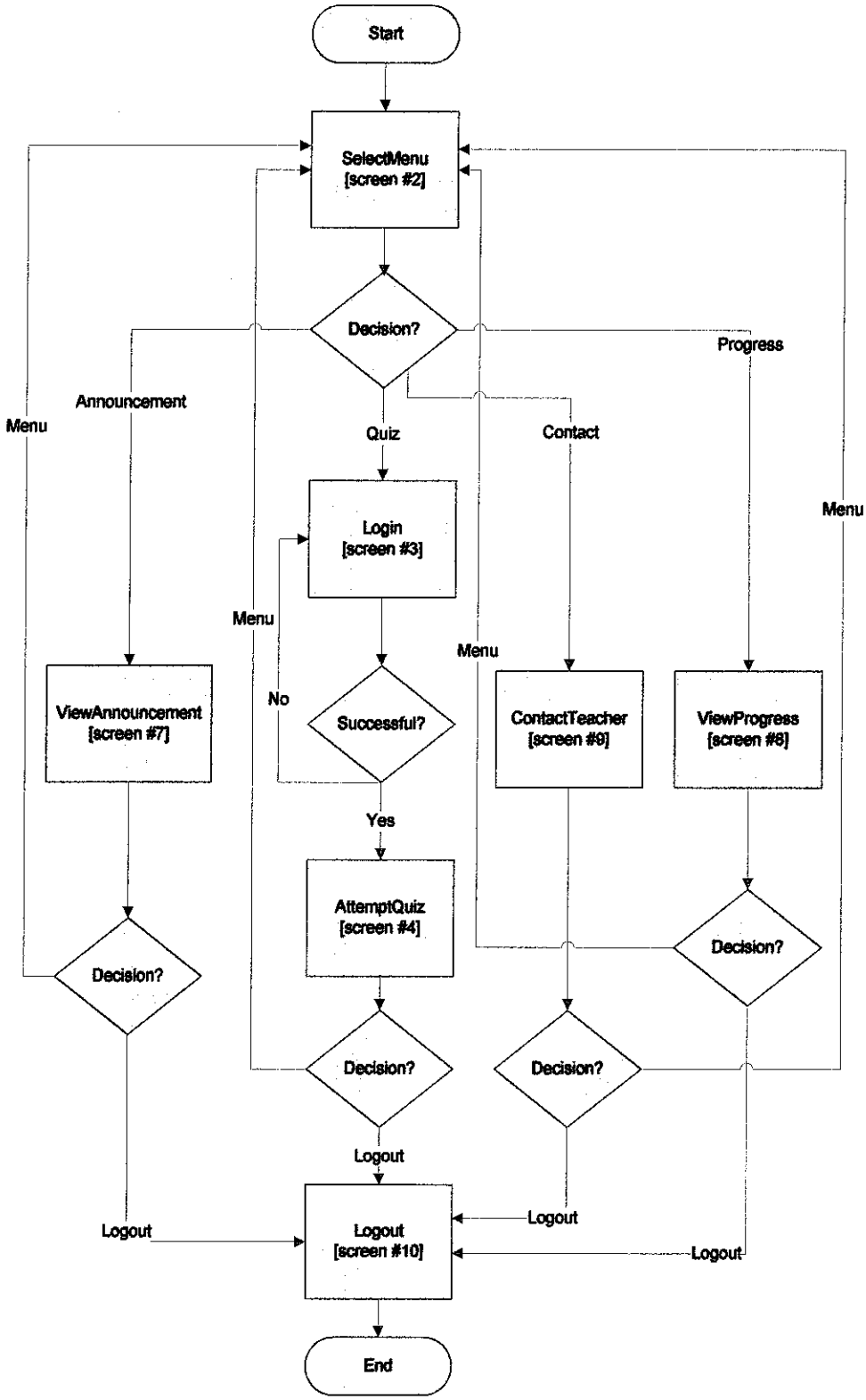
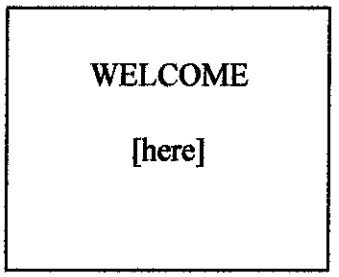


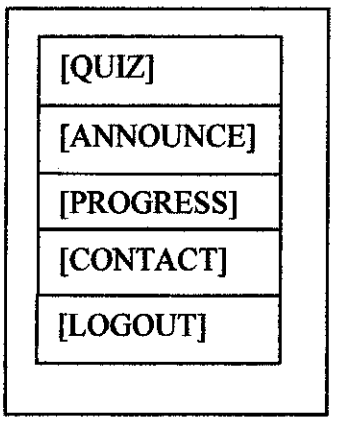

**Figure 3.3.2.2 The Flowchart of the proposed M-learning system**

### 3.3.3 Interface Design

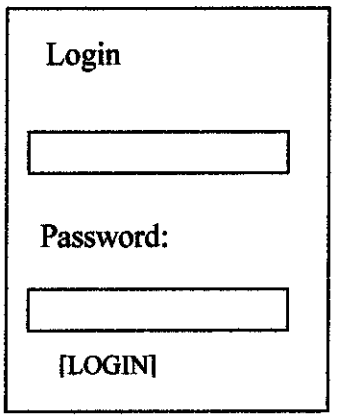
User interface design is the design of computers, appliances, machines, mobile communication devices, software applications, and websites with the focus on the user's experience and interaction. Unlike traditional design where the goal is to make the object or application physically attractive, the goal of user interface design is to make the user's interaction experience as simple and intuitive as possible—what is often called user-centered design. For this purpose, the author came out with his own interface design as below:



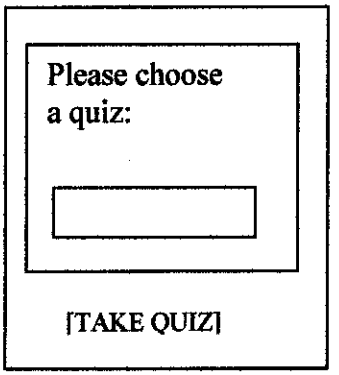

Screen # : 1
Use case : -
Actor : Student
Action : Student starts using the system when Hyperlink [here] being clicked. (Go to Screen #2).



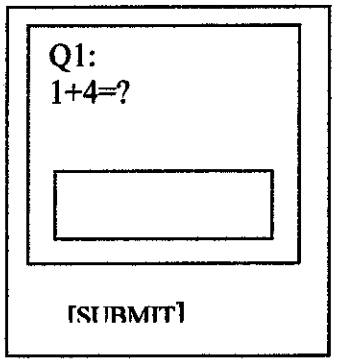

Screen # : 2
Use case : SelectMenu
Actor : Student
Action : Student selects which module to proceed from the given 5 options:
Quiz (Go to Screen #3)
Announcement (Go to Screen #7)
Progress (Go to Screen #8)
Contact (Go to Screen #9)
Logout (Go to Screen #10)



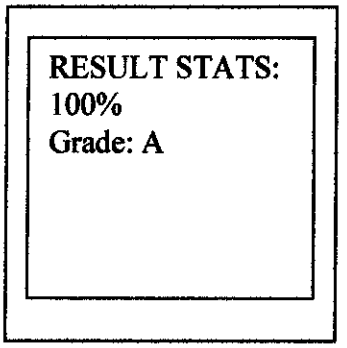

Screen # : 3
Use case : Login
Actor : Student
Action : Student Key in their ID and password to attempt the quiz by clicking [LOGIN]. (Go to Screen #4)



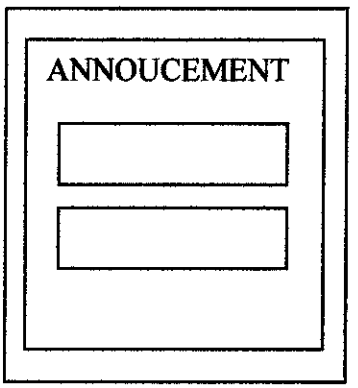

Screen # : 4
Use case : AttemptQuiz
Actor : Student
Action : Student selects which module of quizzes to attempt and click [TAKE QUIZ]. (Go to Screen #5)



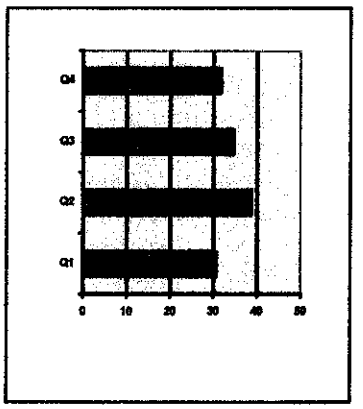

Screen # : 5
Use case : AttemptQuiz
Actor : Student
Action : Student attempt the selected quiz's module and click [SUBMIT]. (Go to Screen #6)




Screen # : 6
Use case : AttemptQuiz
Actor : Student
Action : Student view their result

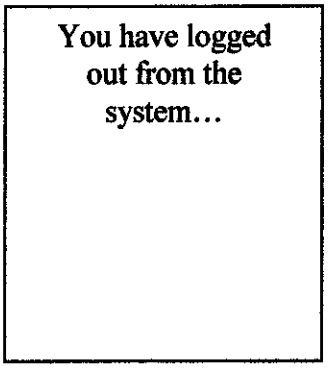



Screen # : 7
Use case : ViewAnnouncement
Actor : Student
Action : Student view announcement posted by teacher.




Screen # : 8
Use case : ViewProgress
Actor : Student
Action : Student view their performance through graph


Screen # : 9
Use case : ContactTeacher
Actor : Student
Action : Student contact their teacher through the system.




Screen # : 10
Use case : Logout
Actor : Student
Action : Student successfully logout from the system.

**Figure 3.3.3.1: Storyboard of the M-Learning system**

## 3.4 SYSTEM IMPLEMENTATION AND TESTING

The coding activities took place in this phase after all of the requirements needed had been gathered during the execution of the previous phases. The coding activities were based on the diagrams which were the deliverables from each of the earlier phases.

The system will be put on test in order to ensure the system performance conforms to the requirement of the system. System testing took place after the system had been fully developed.

The users then were trained to use the system. In this case, the teachers and the students, which are the potential users of the system, were trained to use the system after the system had been deployed. Any adjustments were made to the system if necessary.

### 3.4.1 SYSTEM CODING

Server side scripting, PHP were used as the programming language to develop this system. HTML and WML were used as the interface markup language for this system. The coding process had been done modularly, which means module by module.

SESSION HANDLER

One of the most important aspects in the system functionality is the use of the 'session' function in this system. It is being used to control the browsing activities of the users. The use of session had enabled the author to make the system more dynamic by enable the system to automatically generate the progress graph.

The example of the session usage used in this system are as below:

```
<?php
session_start();
?>
<?php
 print    '<small><p>Welcome    to    Mobile    Math    System    ,    '    .
ucfirst($_SESSION['username']) . '!      You have been logged in since: ' .
date     ('g:i     a',     $_SESSION['loggedin'])     .     '              (<a
href="logout1.php">Logout</a>)</p></small>';. ?>
```

The above code segment is inserted in every page with the use of 'header' function.

GRAPH GENERATION

The graph generating functionality was developed with the usage of a module named JpGraph. It is an object oriented open source library for generating graphs. GD 1 and GD2 library were both supported by JpGraph. The portion of the code for generating the graph is as below:

```
<?php
$db = mysql_connect("localhost", "root","") or die(mysql_error());
mysql_select_db("math",$db) or die(mysql_error());

//SQL statement to retrieve data from the database
$sql = mysql_query("SELECT test_title, test_result FROM test WHERE test_id=
'$_POST[test_id]' ORDER BY test_title ASC" ) or die(mysql_error());

while($row = mysql_fetch_array($sql))
{
$data[] = $row[1];
$leg[] = $row[0];
}

// Variable initiation
$graph = new Graph(780,370,"auto");
$graph->title->Set($title);
$graph->SetScale("textint");
$graph->img->SetMargin(30,30,90,30);
$graph->AdjBackgroundImage(0.9); //setting BG type
$graph->SetBackgroundImage("linux_pez.png",BGIMG_FILLFRAME); //adding image
$graph->SetShadow();

$graph->xaxis->SetTickLabels($leg);

$bplot = new BarPlot($data);
$bplot->SetFillColor("darkolivegreen"); // Fill color
$bplot->value->Show();
$bplot->value->SetFont(FF_ARIAL,FS_BOLD);
$bplot->value->SetAngle(90);
$bplot->value->SetColor("black","navy");


//$graph->title->Set($title2);
$graph->Add($bplot);
$graph->Stroke();
?>
<?php

?>
```

The include header consisting other JpGraph libraries were added. The 2 include headers are:

```
include ("jpgraph.php");
include ("jpgraph_bar.php");
```

URL DIALLING FUNCTIONS

The ability for the students to contact their teachers while on the web was done by the implementation of URL dialing. The whole module which enables the students to call his or her teachers is written in PHP and WML. The portion of the URL dialing function that had been implemented is as below:

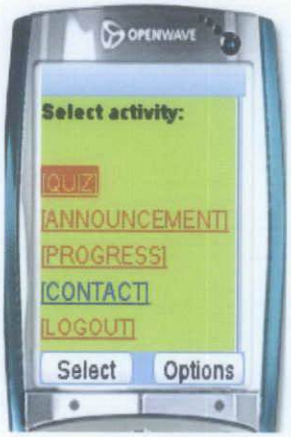
```
echo "<p mode=\"wrap\">".$lf;
echo "$line[teacher_name]<br />".$lf;

//allows the user to quickly dial on devices that
suppot URL dialing
echo "<a href=\"wtai://wp/mc;$line[teacher_contact]\" title=\"Dial\">";
echo "$line[teacher_contact]</a><br />".$lf;
echo "<a href=\"home.php\" title=\"Menu\">";
echo "[Home Menu]</a><br /><br />".$lf;
```

## THE SNAPSHOTS OF THE SYSTEM (MOBILE MODE)

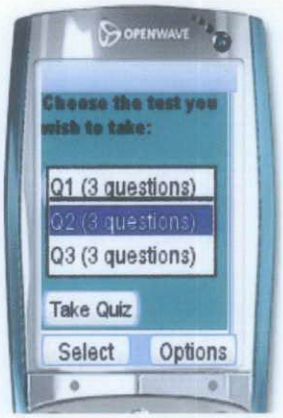
Below are the snapshots of the m-learning system:


Screen # : 1
Use case : Login
Actor : Student
Action : Student starts using the system when Hyperlink [here] being clicked. (Go to Screen #2).

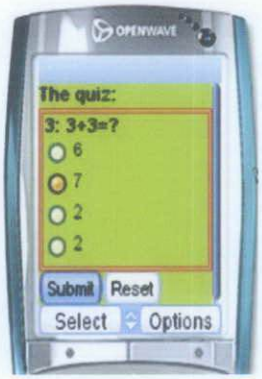



Screen # : 2
Use case : SelectMenu
Actor : Student
Action : Student selects which module to proceed from the given 5 options:
- Quiz (Go to Screen #3)
- Announcement (Go to Screen #7)
- Progress (Go to Screen #8)
- Contact (Go to Screen #9)
- Logout (Go to Screen #10)

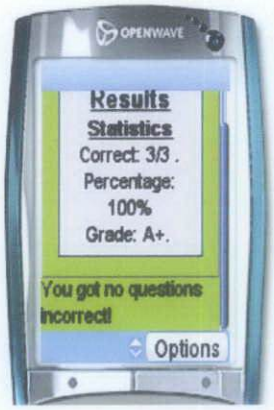

Screen # : 3
Use case : Login
Actor : Student
Action : Student Key in their ID and password to attempt the quiz by clicking [LOGIN]. (Go to Screen #4)




Screen # : 4
Use case : AttemptQuiz
Actor : Student
Action : Student selects which module of quizzes to attempt and click [TAKE QUIZ]. (Go to Screen #5)

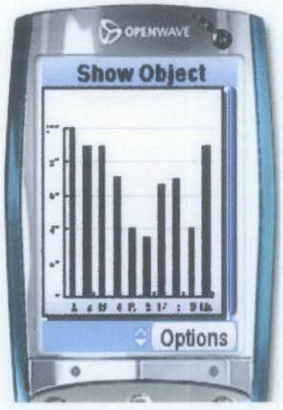



Screen # : 5
Use case : AttemptQuiz
Actor : Student
Action : Student attempt the selected quiz's module and click [SUBMIT]. (Go to Screen #6)



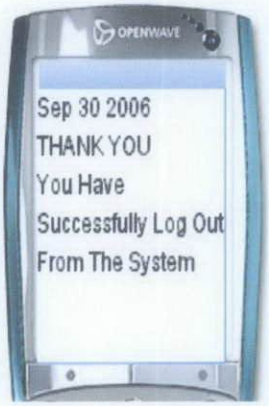

Screen # : 6
Use case : AttemptQuiz
Actor : Student
Action : Student view their result


Screen # : 7
Use case : ViewAnnouncement
Actor : Student
Action : Student view announcement posted by teacher.




Screen # : 8
Use case : ViewProgress
Actor : Student
Action : Student view their performance through graph


Screen # : 9
Use case : ContactTeacher
Actor : Student
Action : Student contact their teacher through the system by clicking [Dial].

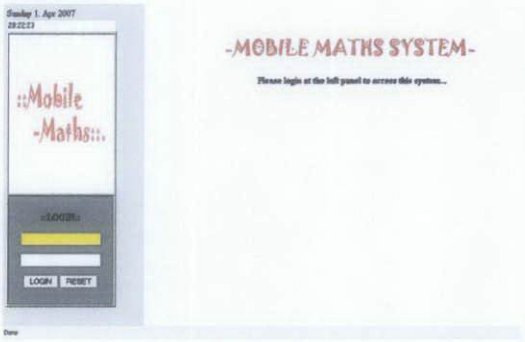



Screen # : 10
Use case : Logout
Actor : Student
Action : Student successfully logout from the system.

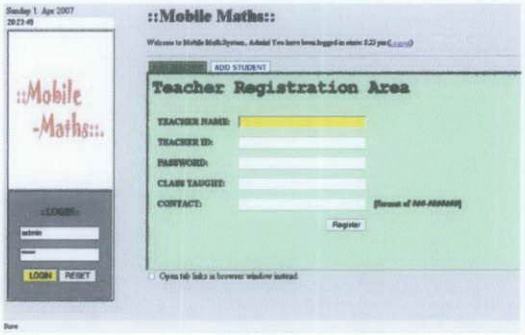
**Figure 3.4.1.1: Snapshots of the M-Learning system (mobile)**

## THE SNAPSHOTS OF THE SYSTEM (PC MODE)

### Administrator view

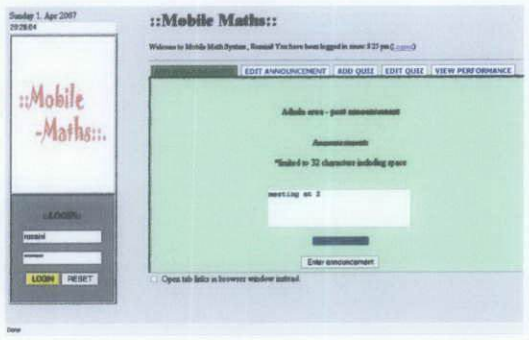



Use case : Login
Actor : Student, Teacher and Admin
Action : Key in username and password to access this system.

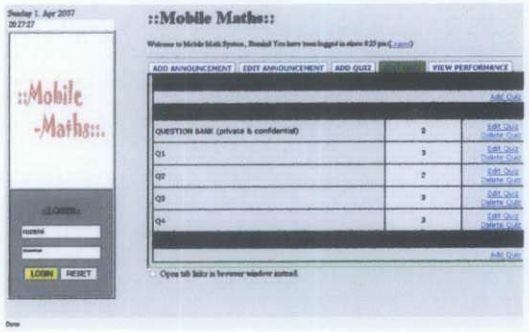



Use case : AddTeacher and AddStudent
Actor : Admin
Action : Admin register teacher and student.

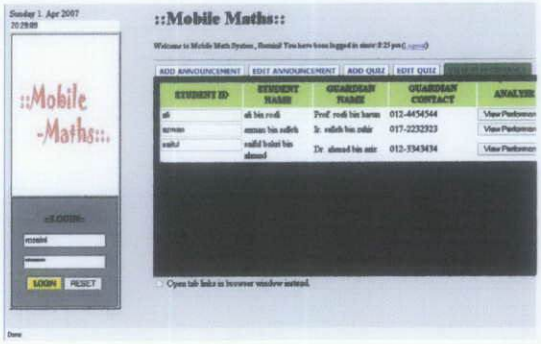
## Teacher view



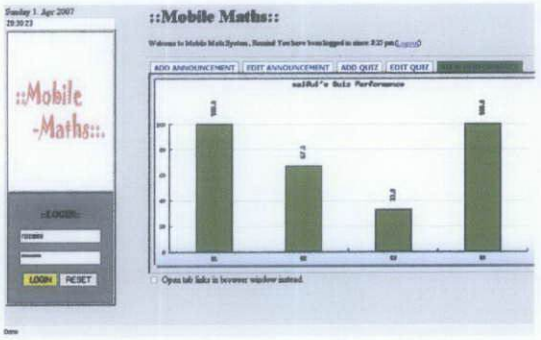

Use case : PostAnnouncement
Actor : Teacher
Action : Teacher post announcement to students.




Use case : PostQuiz
Actor : Teacher
Action : Teacher post quizzes to students.

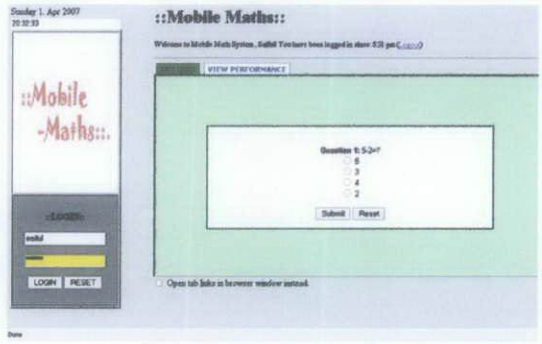



Use case : ViewProgress
Actor : Teacher
Action : Teacher view their students' information.

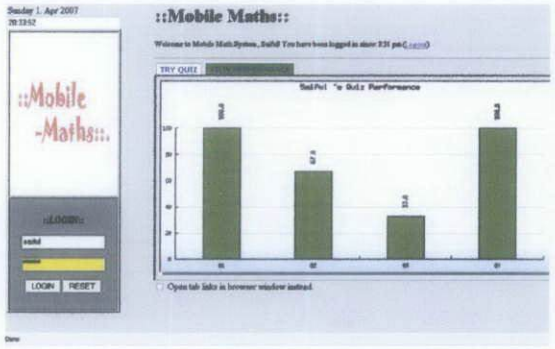



Use case : ViewProgress
Actor : Teacher
Action : Teacher view their students' progress.

**Student view**




Use case : AttemptQuiz
Actor : Student
Action : Students attempts quizzes.




Use case : ViewProgress
Actor : Student
Action : Students view their own progress.

**Figure 3.4.1.2: Snapshots of the M-Learning system (PC)**

### 3.4.2 SYSTEM TESTING

In this phase, system testing is being conducted to detect and fix the bugs and errors. It was divided into two, which are developer testing and user testing. The testing comes with the intent to ensure that the system meets all the requirements stated during the early phase. Complete project documentation is the final deliverable for the final phase of the System development Life Cycle (SDLC). This does not mean that the output is not going to be used. The documentation will be kept for references for other project and also for reference to other persons who will enhance this project in future. There are 2 deliverables during this phase which are;

- Documentation
- User manual and training

The tests that had been done are:

- User testing

  This testing is done by the real user. After the development of the software is complete, we will train the user on how to use the software. Then, the user will be ask to interact with the software while we take note of any of their comments pertaining to the software. From there, any errors related to the software interface such as functionality errors and command structure and entry errors.

  The user testing was done to the selected target user (20 primary school students aged 12 years old). This group of selected students was preparing for their UPSR examinations at the end of the year. The students were selected randomly from a class without considering their level of skills in the subject of Mathematics. This testing was done to compare the effectiveness of learning Mathematics for primary schools students using this system (m-learning). The steps on how the user testing was done are as below:

1. 10 of the selected students were trained to use the M-learning system to Attempt the mathematics'' quizzes while the other 10 selected students were not being introduced to the system. The students that had been introduced to the M-learning system were defined as 'Mobile group' while the other 10 were defined as 'Traditional group' since they attempted the quizzes using paper based.

2. All of the selected students (20 students) were taught 3 new chapters in the subject of Mathematics.

3. 10 of the students in Mobile group were then attempting the quizzes based on the 3 chapters using the M-learning system while the Traditional group students were attempting the quizzes supplied by using paper. There are 20 objective questions for each chapter.

4. An objective written test was conducted after 2 weeks time given to the 20 students in attempting the quizzes. The number and percentage of their achievement in the test were analyzed and being explained in next chapter (Results and discussions).

- System testing

  The data that will be key in by the user will be kept in MySQL database. Since the transactions will involve a lot of the database interactions, so it is crucial to test the performance of the database used. Basically, a database like MySQL will require 100 to 1000 records to be inserted to measure whether the database is reliable or not. 5 data entry that we had tested before this is not sufficient to measure the reliability of the database. An amount of test data between the appropriate ranges will be tested in the database in this testing.

# CHAPTER 4
# RESULTS AND DISCUSSIONS

## 4.1 RESULTS

The results of the user testing done are as follows:

| Marks range | No. of students | Percentage |
|---|---|---|
| 80-100 | 8 | 75% |
| 0-79 | 2 | 25% |

**Table 4.1.1: Results of the user testing done to Mobile group**

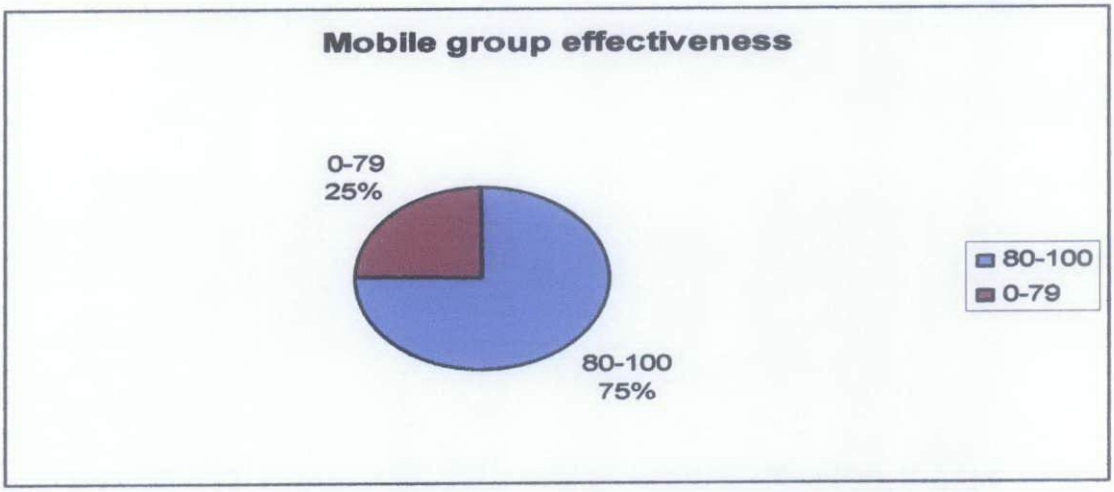



**Figure 4.1.2: The pie chart of the results from Mobile group**

The user testing done to the targeted students who is in the mobile group showed a positive result. Based on the table above, it clearly shows that the number of students in this group who performed (result of 80 % and above) in the test which had been conducted after they had learned using this system comprise of 75 % of the overall students in this group. Only 25 % of the students in this group got results below 80 %.

| Marks range | No. of students | Percentage |
|---|---|---|
| 80-100 | 5 | 50% |
| 0-79 | 5 | 50% |

**Table 4.1.3: Results of the user testing done to Traditional group**

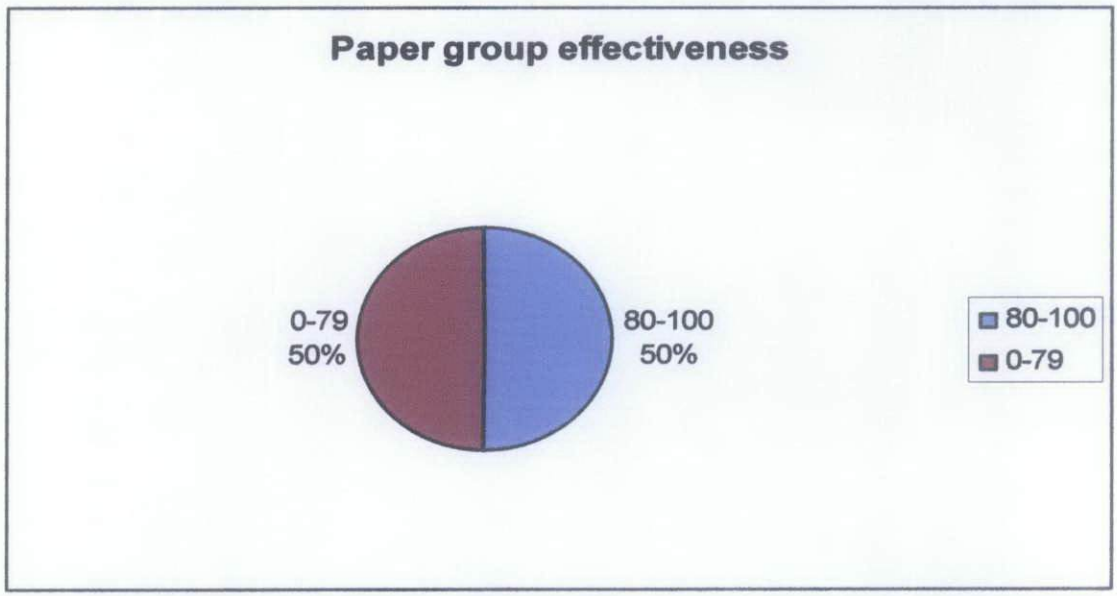



**Figure 4.1.4: The pie chart of the results from Traditional group**

The results for the targeted students who were in the paper group shows that the number of students who performed very well (result of 80 % and above) and students who got result below 80 % is the same. The results were taken from the final test conducted after they had learned (attempting quizzes) through traditional way (paper base). Several issues were identified in influencing this user testing results.

## 4.2 DISCUSSIONS

There are several issues that could be discussed pertaining to this project. The issues that interested the author were the issues of mobility in a learning environment and the impact of progress monitoring in learning environment.

### 4.2.1 Mobility Issues

M-learning, as its name stated means that the learning processes take place in a mobile or ubiquitous environment. The users, particularly the students are free to learn anywhere and at anytime at their own pace by using their personal mobile devices.
This project clearly champions the issue of mobility in learning by implementing learning content through mobile devices. Students have their own freedom to attempt the quizzes at their own pace anywhere. This eventually had solved the problem of the students that are not interested to do academic exercises regularly because of the heaviness of the materials, especially the books. Besides the issue of mobility, learning processes could be enhanced with the implementation of progress monitoring in the learning system itself.

### 4.2 Progress Monitoring Issues in Learning Environment

Progress monitoring can be depicted using graphs. Analyzing progress will be much easier if the data could be represented in a graphical manner. This project clearly champions the usage of progress monitoring functions in the m-learning system. The students could view their performance on the quizzes that they had attempted which is generated by a graph. The students can know their strengths and weaknesses on the subject and make necessary actions about it. The burdens of the teachers in analyzing their students' performance manually are reduced with the help of the computer generated graph instead of using any papers.

## 4.3 RECOMMENDATIONS AND FUTURE ENHANCEMENTS

This is a prototype system and it is open for more enhancements in the future in order to add its capability in being the preferred learning environment for the schools. This system focused on mobile quizzes and progress tracking and it is still open for further enhancements.

The implementation of teleconferencing could enhance the system in terms of the interaction process between the students and the teachers, and also among the students themselves. The current and future advancements in mobile phone technologies could enable the integration of teleconferencing in the m-learning system. Research in the area of the mathematical symbols in mobile device should be done to integrate more complex mathematical symbols in mobile devices. This is to ensure that any learning content using complex mathematical symbols could be developed and used using the mobile devices.

The implementation of animated graph could enhance the mobile learning system in terms of making the learning environment more appealing to students who normally need such motivation to keep on using the system.

# CHAPTER 5
# CONCLUSION

Learning environment in Malaysia had continuously being revised from time to time. The Ministry of Education, under the government of Malaysia had been given the responsibility to enhance and develop the level of educations in Malaysia. This shows that the government really pays a lot of attention to the level of educations in Malaysia

The Education Technology Division of Ministry of Education in 2006 had mentioned that one of their objectives is to increase the contact hours between the students and the computers in the learning process. The objectives could be achieved with the implementation of m-learning. Since m-learning focus on the usage of the students' own personal devices instead of the public PCs in the schools.

The advancement in the field of Information and Communication Technology (ICT) had broadened the horizon in the environment of education. From traditional based learning environment to electronic learning (e-learning) environment, then, the new way of learning, known as mobile learning (m-learning) had been implemented in developed countries such as the USA, UK and Japan. The content of m-learning could be more appealing to the students since it is the new concept and a new way of learning.

M-learning could be implemented in Malaysia in the future. With the good framework being designed and the support of various organizations, the m-learning environment could be realized successfully.

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# APPENDIX A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ☐ | announcement | | | | | | 2 | MyISAM | latin1_general_ci | 2.3 KB |
| ☐ | login | | | | | | 7 | MyISAM | latin1_general_ci | 2.3 KB |
| ☐ | student_data | | | | | | 3 | MyISAM | latin1_general_ci | 2.2 KB |
| ☐ | teacher_data | | | | | | 3 | MyISAM | latin1_general_ci | 2.2 KB |
| ☐ | test | | | | | | 12 | MyISAM | latin1_general_ci | 2.6 KB |
| ☐ | wisequiz_questions | | | | | | 19 | MyISAM | latin1_general_ci | 3.0 KB |
| ☐ | wisequiz_tests | | | | | | 6 | MyISAM | latin1_general_ci | 1.2 KB |
| | 7 table(s) | | | Sum | | | 52 | -- | latin1_general_ci | 15.8 KB |

Figure A1: The Systems database (math)

Server: localhost ▶ Database: math ▶ Table: announcement

Browse | Structure | SQL | Search | Insert | Export | Operations | Empty | Drop

| | Field | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| ☐ | a_id | tinyint(4) | | | No | | auto_increment | |
| ☐ | a_q | text | latin1_general_ci | | No | | | |
| ☐ | a_data | text | latin1_general_ci | | No | | | |

Figure A2: "Announcement" table

Server: localhost ▶ Database: math ▶ Table: login

Browse | Structure | SQL | Search | Insert | Export | Operations | Empty | Drop

| | Field | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| ☐ | login_id | varchar(20) | latin1_general_ci | | No | | | |
| ☐ | login_password | varchar(20) | latin1_general_ci | | No | | | |
| ☐ | login_privilege | varchar(20) | latin1_general_ci | | No | | | |

Figure A3: "Login" table

Server: localhost ▶ Database: math ▶ Table: student_data

Browse | Structure | SQL | Search | Insert | Export | Operations | Empty | Drop

| | Field | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| ☐ | student_id | varchar(10) | latin1_general_ci | | No | | | |
| ☐ | student_name | varchar(100) | latin1_general_ci | | No | | | |
| ☐ | student_password | varchar(100) | latin1_general_ci | | No | | | |
| ☐ | guardian_name | varchar(100) | latin1_general_ci | | No | | | |
| ☐ | guardian_contact | varchar(100) | latin1_general_ci | | No | | | |

Figure A4: "student_data" table

Server: localhost ▶ Database: math ▶ Table: teacher_data

Browse | Structure | SQL | Search | Insert | Export | Operations | Empty | Drop

| | Field | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| ☐ | teacher_id | varchar(10) | latin1_general_ci | | No | | | |
| ☐ | teacher_name | varchar(100) | latin1_general_ci | | No | | | |
| ☐ | teacher_password | varchar(100) | latin1_general_ci | | No | | | |
| ☐ | teacher_class | varchar(100) | latin1_general_ci | | No | | | |
| ☐ | teacher_contact | varchar(100) | latin1_general_ci | | No | | | |

Figure A5: "teacher_data" table

Server: localhost ▶ Database: math ▶ Table: test

Browse | Structure | SQL | Search | Insert | Export | Operations | Empty | Drop

| | Field | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| ☐ | test_no | int(10) | | UNSIGNED | No | | auto_increment | |
| ☐ | test_id | varchar(10) | latin1_general_ci | | No | | | |
| ☐ | test_title | varchar(10) | latin1_general_ci | | No | | | |
| ☐ | test_result | varchar(10) | latin1_general_ci | | No | | | |

Figure A6: "test" table


Figure A7: "quiz_questions" table

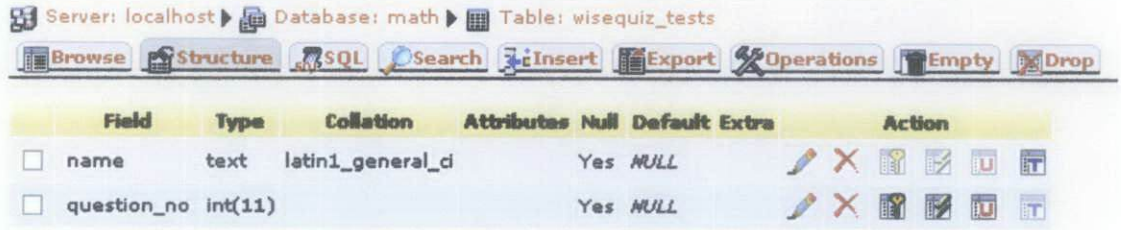


Figure A8: "quiz_test" table