

# **M-Learning**

by

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Dissertation submitted in partial fulfillment of  
the requirements for the  
Bachelor of Technology (Hons)  
(Business Information System)

DECEMBER 2005

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CERTIFICATION OF APPROVAL

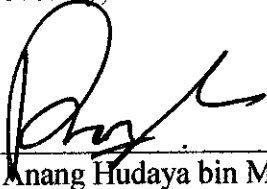
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A project dissertation submitted to the  
Information System Programme  
Universiti Teknologi PETRONAS  
in partial fulfillment of the requirement for the  
BACHELOR OF TECHNOLOGY (Hons)  
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Approved by,



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UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

DECEMBER 2005

## 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 original work contain herein have not to be undertaken or done by specified sources or person.

*Miziana*

MIZIANA ABDUL RAHMAN

## **ABSTRACT**

The objective of M-Learning is to integrate technology with education in order to enhance the effectiveness of students' traditional learning process. In order to explore the use of mobile and handheld IT devices as a learning tool, many factors need to be considered and it is important that context-awareness factor is emphasized here. The main purpose of M-Learning is to create a flexible learning environment for students where the implementation of just-in-time learning is applied here. The main issues that arise here are the challenges and future of M-Learning. The most challenging area in implementing M-Learning is in delivering the content; how users will view the materials in mobile devices instead of the usual large screen desktops. Apart from that, the technology of M-Learning is still new, so there are a lot of risks and challenges involved in this kind of project. The intended users for this project are targeted specifically at students. The scope of study will covers on how users view will be in M-Learning. Meanwhile, the methodologies used in the development of the system will follows four process which are planning, analysis, design and implementation. Efficiency and flexibility, together with ease of use, are likely the essential elements in the final system.

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 BACKGROUND OF STUDY**

Education is the cornerstone of economic development in any nation. Traditionally, formal education has been offered in a classroom setting where the teacher and students interact with each other face-to-face. This form of learning is group-based, and technology acts as a supplement to the teacher. For the student, this means that their physical presence and participation in group discussions forms an integral part of the institution's curriculum. The teacher has the challenge of meeting classroom schedules as well as the preparation and assessment of course materials.

Despite these challenges, the traditional classroom offers a unique opportunity for teachers and students alike, to interact with their peers. However, there is a problem that not everyone has the opportunity to get to school. For instance, they may be living too far away, may be physically handicapped and the like. These limitations called for other forms of education that had the capability of reaching out to a larger audience. Mobile learning (M-Learning) offer solutions that address the shortcomings of the traditional classroom.

### **1.2 OVERVIEW**

Web-based learning, embraced by many educators, extends study beyond physical classrooms. M-Learning, learning with mobile devices - promises continued extension towards "anywhere, anytime" learning. Experts in the field have offered different definitions for this form of education. The following quotes are obtained from "The Future of Learning: From E-Learning to M-Learning" [1]:

“The ability to receive learning anytime, anywhere and on any device” [2].

“The point at which mobile computing and E-Learning intersect to produce an anytime, anywhere learning experience” [3].

M-Learning – “it’s E-Learning through mobile computational devices: Palms, Windows CE machines, even your digital cell phone” [4].

A mobile device is by web definition a hand-held, wireless device that is capable of showing web pages. The device may be a PDA, mobile phone or a hybrid.

### **1.3 PROBLEM STATEMENT**

#### **1.3.1 Problem Identification**

The term Mobile-Learning (M-Learning) refers to the use of mobile and handheld devices, such as PDAs, mobile phones, laptops and tablet PCs, in teaching and learning.

As computers and the Internet become essential educational tools, the technologies become more portable, affordable, effective and easy to use. This provides many opportunities for widening participation in and access to the internet.

The need for M-Learning arises from the facts that students can and wish to access information they want anywhere, anytime at their own convenience. The implementation of M-learning also means that it eliminates the long wait to use the computer labs.

#### **1.3.2 Significant of the project**

This system is an addition to the current learning method where users will be able to access information or learning materials using a mobile device. However, for the purpose of this project, the author is using a mobile emulator to simulate the real world application. Through this system, it provides the concept of flexibility where users can have information on the go. Users can also access other modules such as their schedule and grade apart from the learning materials.

## **1.4 OBJECTIVES AND SCOPE OF PROJECT**

### **1.4.1 Objectives**

- To integrate technology with education in order to enhance the effectiveness of students' learning process
- To explore the use of mobile devices as a learning tool
- To create a flexible learning environment for students where the implementation of just-in-time learning is applied here

### **1.4.2 Project Scope**

The M-Learning application is based on the E-Learning system, only that its functionality is enhanced further through the mobility and flexibility concept. Since the concept of M-Learning is still new, this application will be minimized to as basic and simple as possible so that students will get a quick grasps of how to use and apply the system in their current learning style easily. It is also designed in a way that makes it easy for students to adapt to it. The main concern here is how users view will be affected in M-Learning due to screen limitation as compared to information that is available on wide screen PCs to mobile devices without losing its integrity and accuracy.

## **1.5 RELEVANCE AND FEASIBILITY OF THE PROJECT**

### **1.5.1 Relevancy of the Project**

With the increasing use of mobile phones and handheld devices among teenagers, the opportunity of implementing M-Learning in academic institutions is on the rise and some institutions are already implementing this. Basically, this project will revolved a lot on the research of the technology involved, the limitations and advantages of M-Learning. In M-Learning, the concept of just-in-time learning is apply where students will be able to access the information they want at hands with the available devices they have, the most common being mobile phones. Although there are a lot of constraints

involved in this project such as cost, it is becoming an interesting issue in the future as people adapt to changing technology.

### **1.5.2 Feasibility of the Project within the Scope and Time frame**

Initial feasibility of the project can be evaluated through economic, technical, and schedule factors.

- **Economic Feasibility**

This application supports feasibility in terms of economic by increasing effectiveness and productivity of current education system. With this application, the learning process will be more efficient, thus enhancing the flexibility of learning process.

From the hardware perspective, not much additional hardware is needed. It is not necessary to use a real mobile device in order to complete this project as it can be easily replaced with an emulator.

- **Technical Feasibility**

This application can be implemented practically using available technology and expertise. The skills and information to develop this application is available on the Internet and other sources of information

- **Schedule Feasibility**

The author has scheduled the time given according to the System Development Life Cycle phases that can be viewed in the project timeline. Please refer to Appendix A for the proposed project timeline.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 M-LEARNING: AN EMERGING PARADIGM

##### 2.1.1 Introduction to M-Learning

There are many mobile tools currently used to provide learning opportunities to learners. They include mobile phones, 'smart phones', PDAs (personal digital assistants also known as palms or handheld Personal Computers (PCs)), game consoles and Tablet PCs and laptops that have wireless capabilities. A report from NESTA Futurelab, 2004 summarizes many mobile learning projects from around the world. These projects made use of a wide range of mobile capable devices to provide learning to a diverse range of students.

There are many differences between M-Learning and E-Learning. The key difference would be that M-Learning offers greater flexibility in where and when learning happens [6]. Phone technology advances are also reaching critical mass faster than plugged in PC technology due to the depth and breadth of the mobile phone market and its acceptance within all of the market segments. Another important difference is that ownership of mobile devices (and of mobile phones in particular) is penetrating parts of various communities that were in the past disadvantaged by the "digital divide".

M-Learning has the promise of providing rich mobile internet experiences that are ubiquitous, accessible, rich in content, efficient, flexible, secure, reliable and interactive [7].

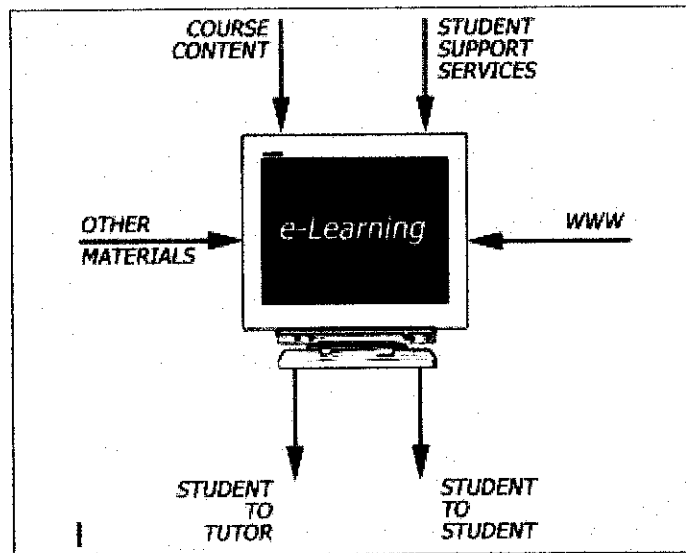
### 2.1.2 The Differences between E-Learning and M-Learning

#### Electronic Learning: E-Learning

The term E-Learning is analogous to online education. Online education is characterized by *the* separation of teachers and learners which distinguishes it from face-to-face, the influence of an educational organization which distinguishes it from self-study and private tutoring, the use of a computer network to present or distribute some educational content, and the provision of two-way communication via a computer network so that students may benefit from communication with each other, teachers, and staff [5].

One great advantage of the World Wide Web is that it is platform independent and supports several media types, for instance, audio and video. It is also available globally. From an educational perspective, it meant that teaching could now take place both synchronously and asynchronously [1]. The impact on students is that they may study course content from their computer screens, and thus are not dependent on being physically present at school.

Time and place are no longer restrictions as the learning experience can be tapped anywhere one has a computer and access to the Internet. The teacher's role is made more flexible in that they can now tutor from the confines of their offices or homes. Student-teacher / student-student interaction in E-Learning is mediated through the use of e-mail, discussion forums, chat rooms and the like. The model in Figure 2.0 illustrates how E-Learning works: The screen is the computer screen where the students receive course content, student support services, have access to the web and other materials. The student may also communicate with the teacher or peers from here via e-mail, or a chat session, for instance.



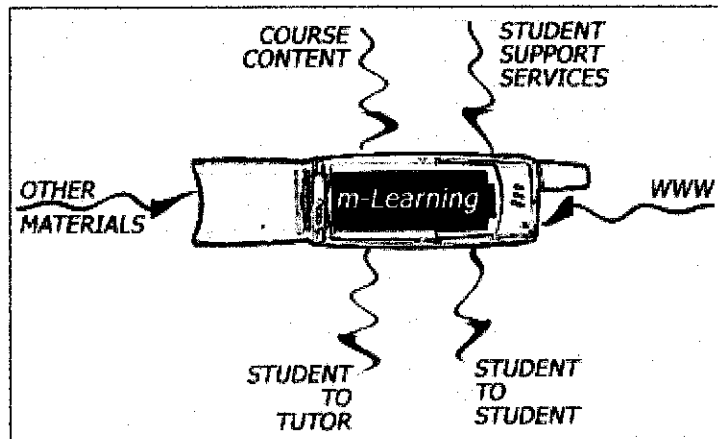
**Figure 2.0** Wired Virtual Learning Environment of Today

### **Mobile Learning: M-Learning**

This is where wireless technology comes in. Coupled with the use of a hand-held wireless device and software / hardware solutions that make it possible to access educational content, students are exposed to a new educational experience, mobile education or M-Learning.

Figure 2.1 illustrates how M-Learning works. The phone symbolizes a WAP enabled phone, smart phone or PDA. By means of a wireless Internet / intranet connection, students can receive course content located on a remote server, student support services and other material that constitute the overall educational package. The hand-held wireless device allows for student-student and student-tutor interaction. The main difference in this model compared to E-Learning is that all communication is wireless.





**Figure 2.1** Wireless Virtual Learning Environment of Tomorrow

### 2.1.3 Challenges in M-Learning

M-Learning is often defined as E-Learning through mobile devices. In general by mobile device we mean PDAs and mobile phones, but more generally we might think of any device that is small, autonomous and obtrusive enough to accompany us in every moment in our every-day life, and that can be used for some form of learning. These small tools can be seen as instruments for accessing content, either stored locally on the device or reachable through interconnection. They can also be a tool for interacting with people, via voice and through the exchange of written messages, still and moving images.

There are many properties that differ when comparing a mobile device from a desktop PC (the usual medium to deliver E-Learning) and they have impact on what is reasonable, useful and even pleasant to do on such devices. Some of them are the output (i.e. the screen size and resolution capabilities, etc.); input (i.e. keypad, touch-screen, voice input); processing power and memory; supported applications and media types.

Apart from that, issues such as new technology that still needs intensive development with challenges that include the variety of platforms now being used and non-compatibility between these platforms needs to be taken into account. Besides that existing PC applications (especially text heavy applications like email, word processing etc) are not easily integrated into mobile technology.

The challenge for educators and designers, however, is one of understanding and exploring how best we might use these resources to support learning. Compared to desktop technology, learning and teaching with mobile technology presents significant new challenges including context, which is the ability to acquire information about the user and his or her environment.

The concept of mobility - the 'anytime, anywhere' capabilities of mobile devices encourage learning experiences outside of a teacher-managed classroom environment. Inside the classroom, mobile devices provide students with the capabilities to link to activities in the outside world that do not correspond with either the teacher's agenda or the curriculum [8]. Both scenarios present significant challenges to conventional teaching practices. Apart from that lifelong learners will need effective tools to record, organize and reflect on their mobile learning experiences [9].

Another issue to consider is the benefits of the informality of mobile devices may be lost if their use becomes widespread throughout formal education. Students may abandon their use of certain technologies if they perceive their social networks to be under attack.

Both personal and group learning are most effectively supported when each student has access to a device. The ownership of the devices is thus a key consideration. Both tangible and intangible benefits can accrue through the use of mobile devices. Intangible benefits include a sense of belonging with the device and personal commitment and comfort. Ownership is stated as a prerequisite for engagement, where students have the potential to go "beyond the necessary and play with it to explore its potential". Personal ownership does, however, present a challenge to the institutional control of the technology [10].

Hand-held computers are becoming more common. The quality and capability are increasing as costs continue to drop. However, M-Learning faces two major technological issues, the first one being managing learning through intermittent connection.

Today's devices are limited by dial-up access to a network, small screens, slow processing, and limited storage capabilities. To function as an effective learning device, the application must be able to link to a Learning Management System on the same platform. Learners need to access all materials and exchange information that is independent of system preferences. If the Web connection is broken, any information will be lost until the connectivity is restored.

Using alternative platform-specific solutions such as plug-ins or applets won't solve the problem. Plug-ins or applets have had trouble working seamlessly across different versions of browsers and platforms. They also require that systems are configured to a unique standard, which adds to system maintenance headaches [4].

Standalone learning applications aren't the answer either. They currently use proprietary mechanisms and limit flexibility. It is difficult to find a standalone solution that provides sufficient breadth of content [4].

The second issue is device-independent delivery. The M-Learning solution must work for a range of devices, not only for one set. At the same time, a broad range of devices precludes specific solutions.

One example is eXtensible Markup Language (XML), which holds the promise of the ability to specify the content and how it appears on each different type of device. It will require some revisions to the content development process, and associated tools [4].

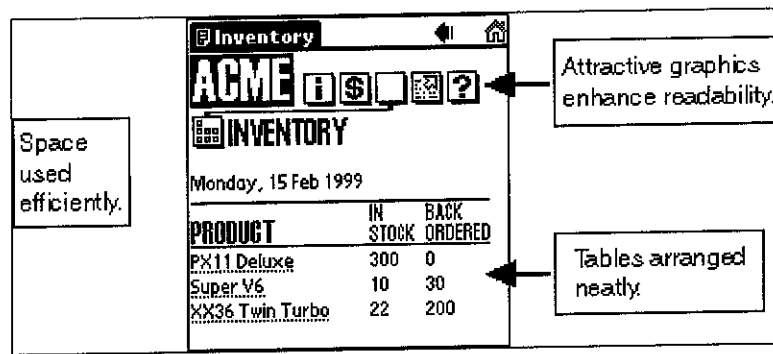
M-Learning vision requires technology that may not be available to individuals any time soon. It may include seamless wireless networking, information appliances with the power of a present-day supercomputer or flexible input from pen to keyboard.

When we try to transfer services provided by an E-Learning platform into services in an M-Learning platform we can see that some of them should change to fulfill the limitations of the small devices, some are impossible to be delivered in a certain context. Access to the Web through personal electronic devices, with their small screen size, has been an interesting problem for lots of researchers.

Unfortunately, today most web pages are designed to be displayed on desktop computers with color monitors having at least 800X600 resolutions. This leads to at least 2-to-1 (often greater) ratio of designed vs. available screen area, making direct presentation of most pages on the small screen aesthetically unpleasant, un-navigable, and in the worst case, completely illegible. In some cases if we think about WAP devices some transcoding techniques could be used to transform from one presentation language to another (WAP-HTML-WAP).

The main limitation of a handheld device is the small screen, which may also lack a mechanism for horizontal scrolling. Input is often with a stylus, not a mouse. Downloading to the device is likely to be both expensive and slow, the processors are slow, and the memory is limited. A lot of users may therefore choose to turn off in-line image loading. Small size is a virtue in these devices, but developing effective interactive applications for low-resolution monochrome displays requires thoughtful planning. An example of a well-designed page for handheld devices is shown at Figure 2.2.

Although it is possible to deliver content to WAP phones the reading is rarely easy enough and the interaction is quite a difficult tasks. One can also think of delivering the content in alternative ways (e.g. voice, video). When we consider PDAs instead of WAP devices the possibilities are wider, but still all problems linked with conversion/adaptation/transcodification of general purpose content remain [11].



**Figure 2.2** Example of a Well Designed Page for Handheld Devices

### 2.1.4 Guidelines for M-Learning Applications

In order to create a usable M-Learning application, there are a few basic standards that we need to adhere to. The first one is to create short, not more than 5-10 minutes long modules. Users should be able to use their small fragments of waiting or idle time for learning, by reading small pieces of data, doing quizzes or using forums or chat [12].

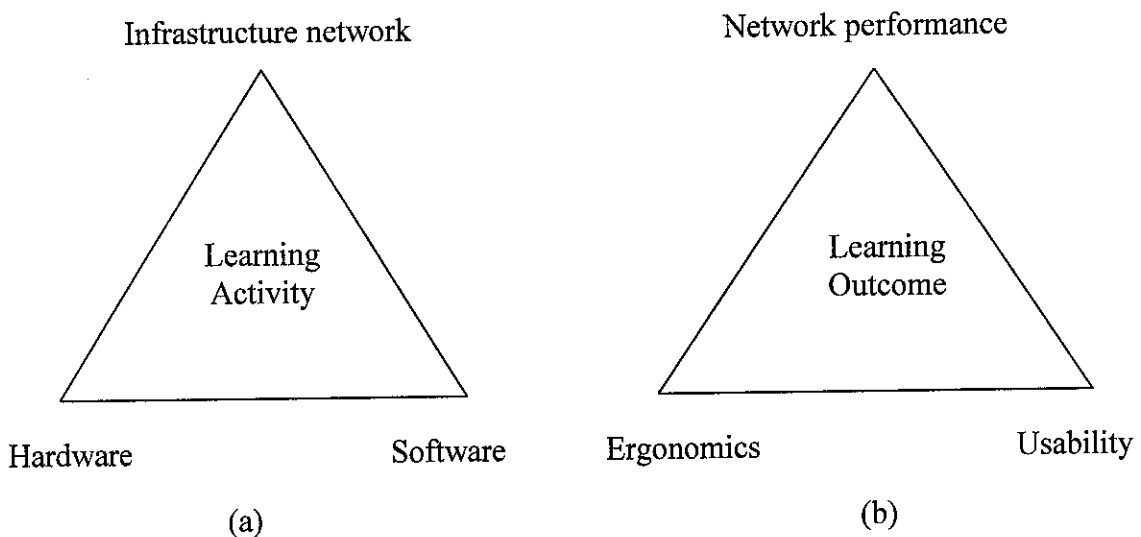
The second one is that it should be simple and has added value functionality. It should be possible to use an M-Learning system without reading a user manual and the experience of studying with the help of such devices should be interesting and engaging [12]. User interface should take into consideration factors such as task flow, predictability and consistency, and also ease of use [16].

Besides the other two factors, the area/domain specific content, delivered just in time/place is just as important as well. The mobility should bring the ability to guideline and support students and teachers in a new learning situation when and where it is necessary [12].

### 2.1.5 M-Learning Design Issues

A number of issues need to be taken into account when designing mobile learning applications. For example, the rapid advancements in mobile technology, the general incompatibility between devices, operating systems and applications, and the limited resources in relation to desktop technologies, make the choice of mobile technologies and infrastructures a very important decision.

The following figure examines the main dimensions of mobile learning systems in relation to (currently available) technologies [13].



**Figure 2.3** Dimensions for the (a) design and (b) evaluation of mobile learning systems

As Figure 2.3 depicts, the choices of infrastructure networks, hardware and software are interdependent and intertwined with the design of the learning activities. The design of the learning activities for mobile learning is governed by the same principles as the design of any other technology based learning activities, and the choice of the type of activity to implement has to be guided by the learning objectives. What the designer needs to bear in mind is that they design for the learning, not for the technology. The use of (mobile) technology is not the objective; rather, it is a means to enable activities that were otherwise not possible, or to increase the benefits for the learner(s). It is possible

that the use of mobile technologies is suitable for only a part of the learning activity, whereas other parts are better supported by other technologies – or even by no technology at all.

The infrastructure network component includes decisions about the selection of communication networks and, in the case of location-aware applications, the selection of positioning systems. The available communication networks include satellites, mobile telephony, wireless local networks, personal ad-hoc networks, etc. The selection of an infrastructure network is informed by the number of users, the need for range, connectivity and data access, the time and place of use, possible interference with other devices, security requirements, the costs to the provider and/or the user and the network configuration.

With regard to the hardware, there is a wide range of mobile devices to choose from including laptops/notebooks, tablet computers, personal digital assistants (PDAs) and smart phones. The selection of a device depends on the requirements for processing power, battery life, robustness and ergonomics factors (for example, whether the user has only one or both hands available, if they are moving or standing still, the weight they can bear, environmental factors such as temperature and noise, etc.).

Another issue that needs to be taken into account is the management of the hardware, especially in the case where it is provided by an educational institution as part of a course: are the devices for individual or for group use? Can the learners take the devices home? Who is responsible for damage? Etc.

With regard to the software a great challenge lies in the design of the user interface, the help system and the interaction. The typically small screen size and limited processing power limit designer choices and resources. Example interfaces are map-, menu-, voice-, text-based – and many more. Nielsen's usability heuristics [14] offer a good summary of the desired attributes of user interfaces.

To design the interactions, we need to study the users, their activities and their environment in relation to the learning activity. For example, the use 'on the go' means

limited ability for scrolling and possible use with only one hand available. Especially when the mobile application is for young children, the designer needs to remember their limited skills in hand-eye coordination and in the manipulation of small objects. Example interaction techniques make use of speech, handwriting, haptics, etc.

An important step in the design of mobile learning applications, as in any other type of application, is the continuous evaluation and re-designs. Figure 2.3 illustrates the dimensions towards which mobile learning systems need to be evaluated, in correspondence to the design dimensions. The outcomes of the learning activity need to be evaluated against preset educational objectives, using appropriate evaluation instruments (questionnaires, quiz, drill-and-practice, etc.).

The evaluation needs to compare the performance of the learner(s) before and after the mobile learning activity; and also the performance of the learner(s) who used the mobile learning application against other learner(s) who did not use it. The infrastructure network needs to be evaluated for its reliability, security, quality of service and seamlessness.

The hardware needs to be evaluated with regard to ergonomics issues, including comfortable use (appropriate form, size, etc.) during the supported activities in the specified context of use, and also with regard to robustness, performance, reliability, unobtrusiveness and, in the case of sensors and probes, accuracy. The software needs to be evaluated with regard to its usability and more specifically its learnability, performance, effectiveness, error tolerance and recovery, and user satisfaction.



### **2.1.6 Benefits of M-Learning in the Education System**

A new generation of learners, and what we know about how people learn, are causing faculty to adopt new roles. Faculties are finding a variety of approaches that result in greater student learning, but they often require a shift of traditional roles. Ensuring that learning is collaborative necessitates a shift from a one-to-many delivery mode to allowing many to participate.

To create greater interaction, faculty must ensure that learners are actively engaged in the subject matter, not listening passively. This may involve the use of student response units and concept inventories in a lecture setting or a complete redesign of the learning environment

M-Learning does not replace traditional learning; it just represents another way of learning using a new technology. In fact, the fundamentals of learning still do not change with M-Learning

- Learning is more effective when active. A course built around actively doing will be better than passively reading from the screen
- Individual learning styles. Some learners prefer reading, others might prefer observing, doing, or being coached, and the preferred method of learning can change depending on the context
- Learner controls learning. Content should be presented in such way that the learner understands and controls the information flow. The Instructor, whether human or computer, is a learning facilitator

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 PROCEDURE IDENTIFICATION**

The methodology that has been used in this project contains many of the same elements as a traditional information-development process.

##### **3.1.1 Phases of Project Development**

The four phases of the methodology follows:

###### **3.1.1.1 Planning Phase**

During planning, the author chooses among several factors so that overall goals for the application can be set. These goals include anticipating and deciding on the target audience, purpose, and objectives for the information. It is at this phase also that the author has done the planning for all the stages involved in the completion of this project and any possibility of errors that might be encountered.

###### **3.1.1.2 Analysis Phase**

In order to improve the application's overall quality, the author has gone through the process of gathering and comparing information about the application and its functionality. The author then weighs all alternatives and gathers information to help with a decision in the other processes of planning, design, implementation, or development. Please refer Appendix B-1 for the system conceptual flow chart for the system.

### 3.1.1.3 Design Phase

During this phase, the author has been working within the application's specification, makes decision about how the application actual components have been constructed. This process involves taking into account the application's purpose, audience and objective. It relies heavily on the other processes and elements in the system development. The design phase also emphasize on the user interface of the system.

### 3.1.1.4 Implementation Phase

In this phase, the author builds the system using all the available tools. The author uses Microsoft Visual Studio.NET as the development tool and C# as the language to build it. For the database part, the author has chosen to use Microsoft Access 2000 database.

## 3.2 TOOLS AND UTILITIES

These are the tools that are used throughout the project:

NO	ELEMENTS	TOOLS
1	Project Management	Microsoft Visio
2	Documentation	Microsoft Word
3	System Modeling	Microsoft Visio
4	Hardware	<ul style="list-style-type: none"><li>• 166 MHz processor or higher</li><li>• Hard disk space 1.5 GB (at least)</li><li>• 256 MB RAM or higher</li></ul>
5	Software	<ul style="list-style-type: none"><li>• Microsoft Visual Studio.NET 2003</li><li>• Microsoft Mobile Internet Toolkit</li><li>• Microsoft Mobile Emulator (MME)</li><li>• Microsoft Access 2000</li><li>• Microsoft .NET Framework</li></ul>

**Table 3.0** Tools and Utilities

## **CHAPTER 4**

### **RESULTS AND DISCUSSION**

#### **4.1 FINDINGS**

##### **4.1.1 M-Learning in the Education Field**

M-Learning is a natural extension of E-learning and has the potential to make learning even more widely available and accessible than in existing E-Learning environments. The role that flexibility plays in the learning process is a critical success factor.

It is within this context that M-Learning can contribute to the quality of education. It offers opportunities to optimize interaction between lecturers and learners. Wireless and mobile technologies also make it possible to provide learning opportunities to learners that are either without infrastructure for access (for example rural learners) or continually on the move (for example business professionals).

Whether as a form of basic education delivery for students of all ages or as a form of professional development delivery for teachers, M-Learning represents education "on the go"--"anywhere, anytime learning."

However, a lot of factors need to be taken into consideration such as cost-effectiveness and user acceptance before M-Learning becomes a common thing in the future.

#### **4.1.2 Microsoft Mobile Internet Toolkit (MMIT)**

Throughout the project development, the author found out that MMIT can generate different markup language for different device. Thus, this means that application needs to be written only once and the different languages will be generated by the .NET framework. The toolkit has been tested with many such as Nokia 6210, Pocket PC with Microsoft Internet Explorer version 4.5, Ericsson R380 among others. Please refer to Appendix C for MMIT architecture.

#### **4.1.3 Programming Standard Supported by Microsoft Mobile Internet Toolkit**

The MMIT is built on the Microsoft ASP.NET Web Forms. Because the toolkit is an extension of ASP.NET Web forms, it supports language like VB.NET, C#, and JScript.NET. The toolkit is also integrated with Microsoft Visual Studio.NET.

#### **4.1.4 Microsoft Mobile Explorer**

Microsoft Mobile Explorer (MME) is the Microsoft browser product for the handheld market. For the most part, MME provides a feature set that is similar to that offered by most browsers available on the Internet. However, it offer one very significant advantage – it is a multimode browser, supporting not only WAP but also cHTML. MME, because of its ease of use, simple configuration, and integration with Visual Studio.NET, is a very productive development environment when developing mobile applications using the Microsoft .NET framework.

## 4.2 DISCUSSION

### 4.2.1 Results

Throughout the development of this project, the author finds out that although M-Learning is a natural evolution of E-Learning, to effectively build and deliver M-Learning requires rethinking, reinvestigating, and re-evaluating the human-computer interaction in the M-Learning environment. Existing E-Learning frameworks may not work very well with M-Learning: the interaction experience in M-Learning is different from other types of learning.

Learning with mobile devices constitutes a new learning-interaction experience; a lot is still unknown about the M-Learning experience. Although some research in M-Learning has discussed some aspects of mobile experiences, the discussion did not really focus on the understanding of what constitutes interaction experiences in the mobile environment. It is believed that interaction experience can be an important, mediating towards the success of M-Learning.

The author research is aimed at understanding interaction experience in M-Learning by examining a broad range of aspects of M-learners, their environments, and relationships. This research is broken into two main areas: understanding of interaction experience in the mobile environment and the usability of M-Learning.

To understand the interaction experience in the mobile environment, three important components are examined:

- Understanding of the mobile learners - including their characteristics, psychological (affective and cognitive), and physical capability
- Understanding of the M-Learning environment - the motivations and circumstances surrounding mobile device use and adoption; and how and why people adopt M-Learning

- Understanding of the mobile experience - completely different from desktop experience as it has specific characteristics that need to be factored into the design of a mobile application

Based on the research theme above, a prototype of M-Learning was developed using the specified tools. The M-Learning has several modules; course module, schedule module, grade module and assignment module. Each of these modules has its own element which constitutes the findings of the research, i.e. how the research element is applied into the development of M-Learning.

The module was built on a mobile form each, which is different from the normal web forms because mobile forms is dedicated specially to cater to the needs of developing mobile application. Each mobile form can have more than one form in it, whereas in normal web forms each web form can have and only one form per page. This means that, by having multiple forms, it will allow faster loading and direct access to any particular form does easing the task of developer.

Each of the modules was developed based on the research done earlier, thus this mean that the development for M-Learning was built based on the research element. Each module is analyzed to meet the needs of users and at the same time to accommodate the technology that is available.

The main constraint in developing modules for M-Learning is the screen limitation of the emulators that is being used to test the application. Each module are analyzed from the usability issue, meaning that the content is made simplified but at the same time still maintain the objective of learning and integrity of data.

Another constraint that the author discovered during the development process is that the lack of HTML controls support in the mobile form. The HTML controls such as a table is not easily integrated into the system.

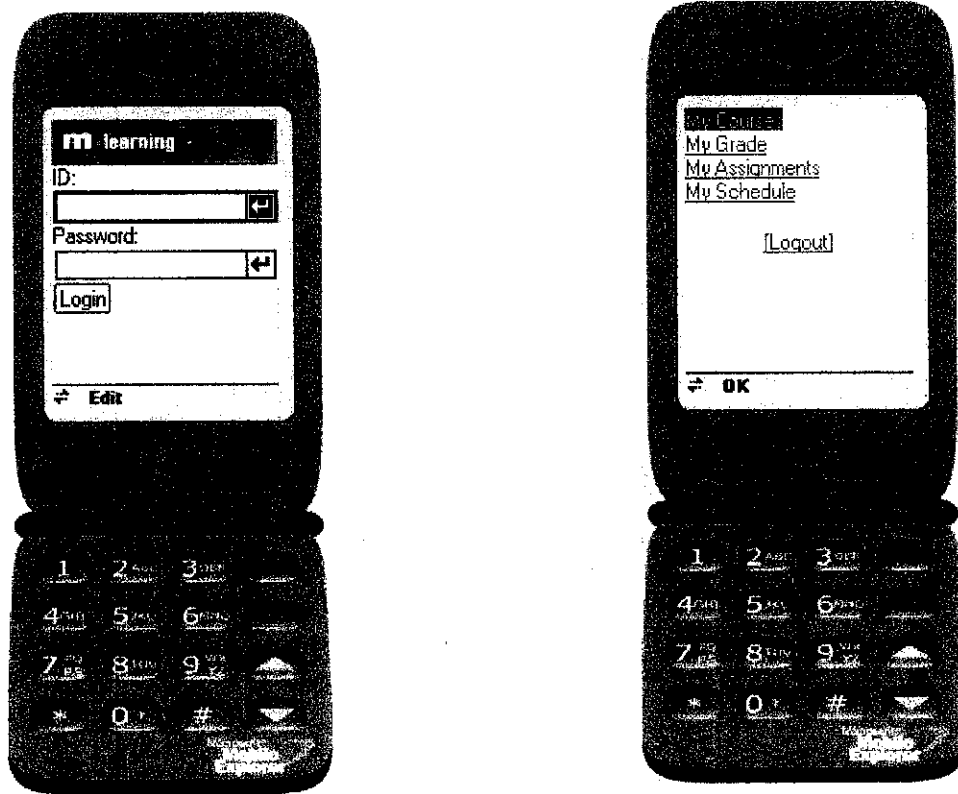
The emulator that is used in this project is Microsoft Mobile Explorer which is used to test the application that has been built. Using this emulator, the author can have a

conceptual view of how the system will look on a real mobile device, which means that it is able to emulate the real application that is to be used, thus eliminating the need to use a real device and save costs at the same time.

In general, the system works like any normal system where users will need to login first into the system. For the login part, the author use forms authentication as a security measure so that when there users who try to access a page in the system without being authenticated first, then they will be redirected back to the login page. Once they have been logged in then they will be able to access other pages in the system. Please refer to Appendix B-1 for the conceptual flow model of M-Learning.

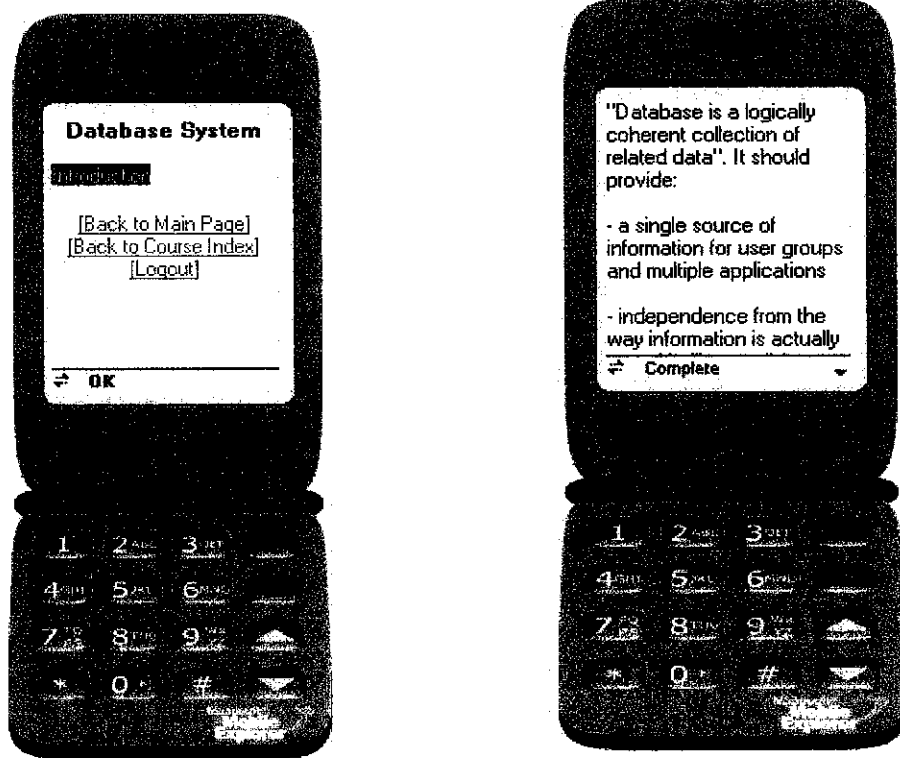


## 4.2.2 System Construction



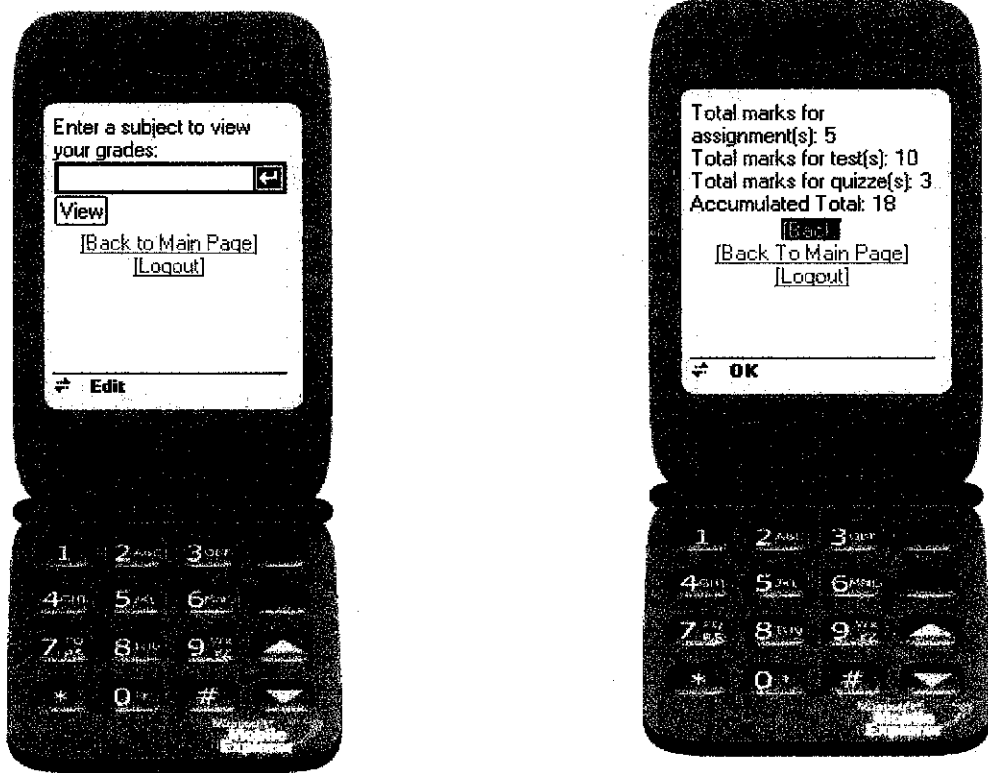
**Figure 4.0** Login Page and Default Page of M-Learning

Figure 4.0 above shows the login page and the default page of the system. Once user has been logged in, they will be directed to the main page of the system. The main page consists of four modules; courses module, grade module, assignments module and the schedule module.



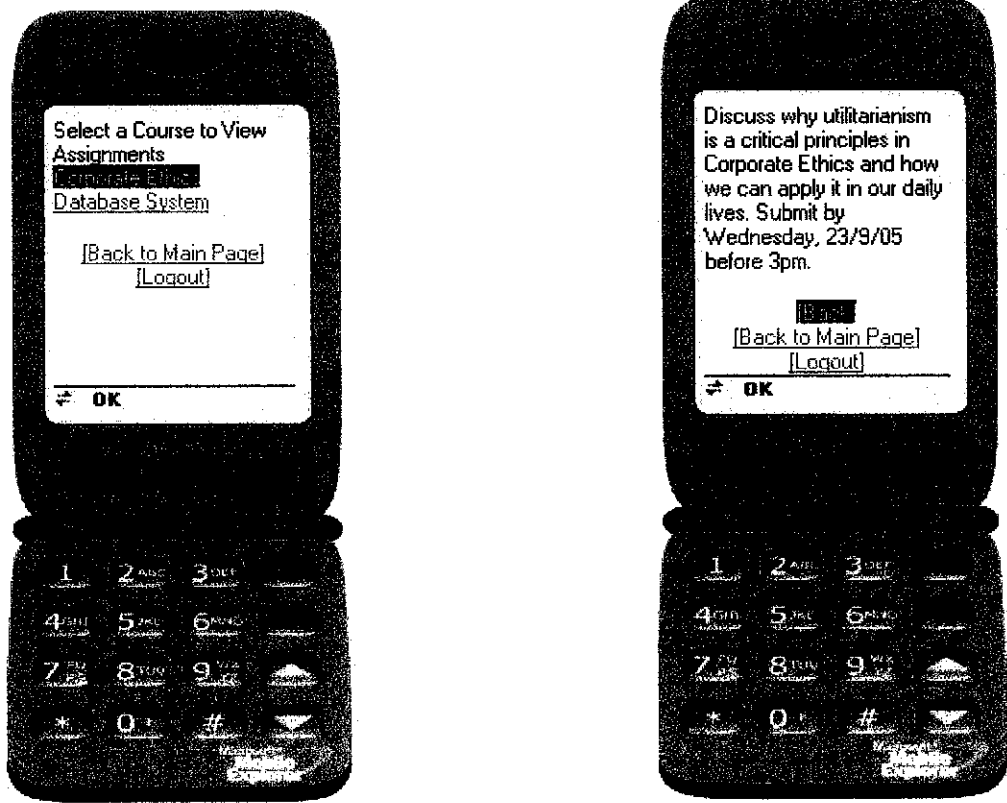
**Figure 4.1** Course Module

Based on the course(s) that has been registered, users will be able to view learning materials according to chapters as shown above. Users can navigate back and forth between the first page and the next page of the learning materials if the materials are lengthy in text.



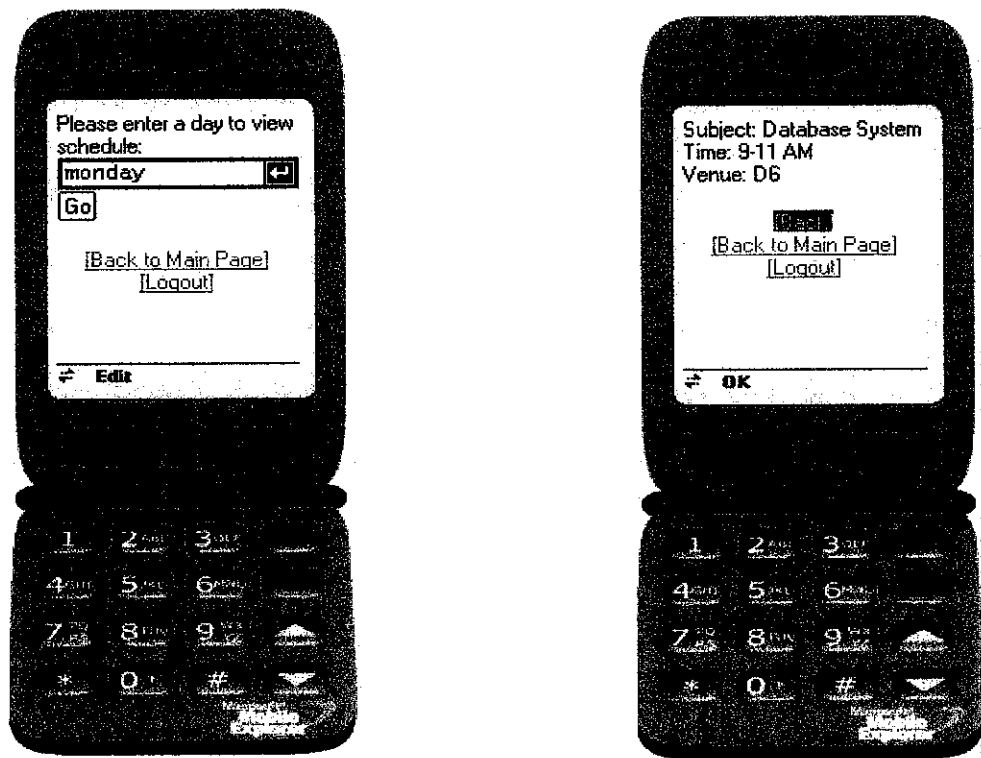
**Figure 4.2** Grade Module

Figure 4.2 above shows the page for the grades module. This module shows the marks for labs, projects, tests etc. All the data are retrieved from the database. If the user has not register for the course input by them, an error message will be displayed.



**Figure 4.3** Assignment Module

The assignment module enables students to open text file from lecturers to view the assignments that has been given. The figure above shows a sample page of the assignment module.



**Figure 4.4** Schedule Module

The schedule module allows users to search for a schedule according to their preferences where they will be able to choose a day that they would like to view the schedule. All the schedule information is retrieved from the database and if users have no schedule on a particular day that they have chosen a message will inform them that they have no schedule on that day.

### 4.2.3 System Add-On

Based on a recommendation from the author's supervisor, a desktop based application has been developed as an add-on to the mobile system. This application is to complement the mobile system and is used by administrators of the system to manage users' profile, based on the assumption that the profiles are provided for users that have registered for the mobile system. The main function of this application is to add, delete and modify users' profile.

Administrators first need to login with the provided credentials and once they are authenticated, they will be able to access the full function of the system. Among the details of the students included in the system are name, email, and courses registered.

The administrators also can access the mobile system from their computers provided that the emulator is installed in the computers. However, for the purpose of this project, the author has designed the mobile system and the desktop application in such a way that they are not connected to each other, which means the databases are separate and distinct from each other.

The phases involved in developing application are the same as the mobile system, which include the planning phase, analysis phase, design phase and implementation phase. The most important phases in developing this application are analysis and design phase where the author needs to take every small details of consideration into account. During the design phase, the author has to make sure that the user interface of the application is kept simple so it will be easy to use.

This application is developed using Visual Studio.NET 2003 with Visual Basic.NET as the programming language. Using Microsoft Access database for the purpose of storing data in this system, the database is driven by the MS Data Jet Database Engine.

The main technology used to handle the database is ADO.NET, which stands for ActiveX data objects. ADO.NET provides a uniform set of objects that can be used to handle all kinds of data, alleviating the need to learn different interfaces/code for different kinds of data.

#### 4.2.4 System Add-On Construction

The screenshot shows a web application window titled "View Profile". At the top left, there is a search field labeled "STUDENT ID:" followed by a "View Profiles" button. Below this, the form is divided into two columns. The left column is titled "Student Details" and contains six input fields: "Name:", "Account ID:", "Programme:", "Year:", "Semester:", and "Email:". The right column is titled "Courses Registered" and contains one input field labeled "Course Name:" followed by three empty rows for listing courses. At the bottom of the form, there are four buttons: "Add New Profile", "Delete Profile", "Modify Profile", and "Update Database".

Figure 4.5 Screenshot for View Profile Form

When the administrators have been logged in, they will be redirected to this form first. They can view students profiles based on students ID and the details will be displayed according to information in the database. The add, delete and modify profile function is also available.

The screenshot shows a window titled "Add New Profile" with a dotted grid background. The window is divided into two main sections:

- Student Details:** A vertical column of seven text input fields, each preceded by a label: "Name:", "Account ID:", "Student ID:", "Programme:", "Year:", "Semester:", and "Email:".
- Courses Registered:** A vertical column of three text input fields, each preceded by the label "Course Name:".

At the bottom right of the form, there are four buttons arranged vertically:

- "Add Details"
- "Clear"
- "Update Database"
- "Close this form"

**Figure 4.6** Screenshot for Add New Profile Form

When administrators want to add new record of students, they will be using this form where they need to enter all the required details of the students and this information later on will be updated in the database. Please refer to Appendix B-2 for flow diagram of the administrator system.



## 4.3 SYSTEM EVALUATION

### 4.3.1 Method of Gathering User and Task Data

The purpose of the questionnaire is to elicit information on the effectiveness of M-Learning in as a learning tool. It is an excellent way of obtaining either quantitative or qualitative data, since the user responses are written and can be tallied to illustrate user preferences. Questionnaires can only evaluate users' opinions about the user interface, not their behavior while using it. Please refer to Appendix D-1 for the questionnaire sample.

For these reasons, the author had decided to adopt a variant of the Delphi survey approach. In the early 1950s, the term Delphi was used to describe a reliable consensus of opinion, obtained from group of experts by a series of intensive questionnaires interspersed with controlled opinion feedback [17]. This approach is characterized as 'a method for the systematic solicitation and collation of judgments on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarized information on feedback of opinions derived from earlier responses'[18]

Delphi is particularly useful when accurate information is unavailable or expensive to obtain, or where evaluation models require subjective inputs to the point where they become the dominating parameters [17]. The survey is the most common technique of Delphi application. Delphi surveys are specially designed to obtain the opinion of experts and such survey has three special features;

- Anonymity of participants
- Iteration and controlled feedback between rounds
- Statistical summary of group responses

Administering the survey by distributing the questionnaire to the intended users allow the author to collate and return information to the participants quickly, thus improving the percentage of participants remaining committed throughout the session.

One of the benefits of questionnaires is that they can be administered without an evaluator present; forms can be distributed to users. Another benefit is that questionnaires can be distributed to large groups or geographically dispersed populations. But, one of the drawbacks of using questionnaires that is faced by user is that questions cannot be rephrased as they can during verbal interviews.

#### **4.3.2 Research Design**

A research design is a logically designed plan allowing the author to derive appropriate conclusions from his or her initial research question [19]. After deciding on the Delphi technique, the author made the following design decisions:

- The appropriate number of participants would be between 10 to 20 people in total, which is composed of students
- Since time was a limiting factor, it would be most appropriate to have only one rounds of Delphi survey
- Structured questions would be used for the questionnaire to allow participants to provide analyzable data on what the author realized would be an enormous body of information

The main steps involved in conducting the Delphi survey included:

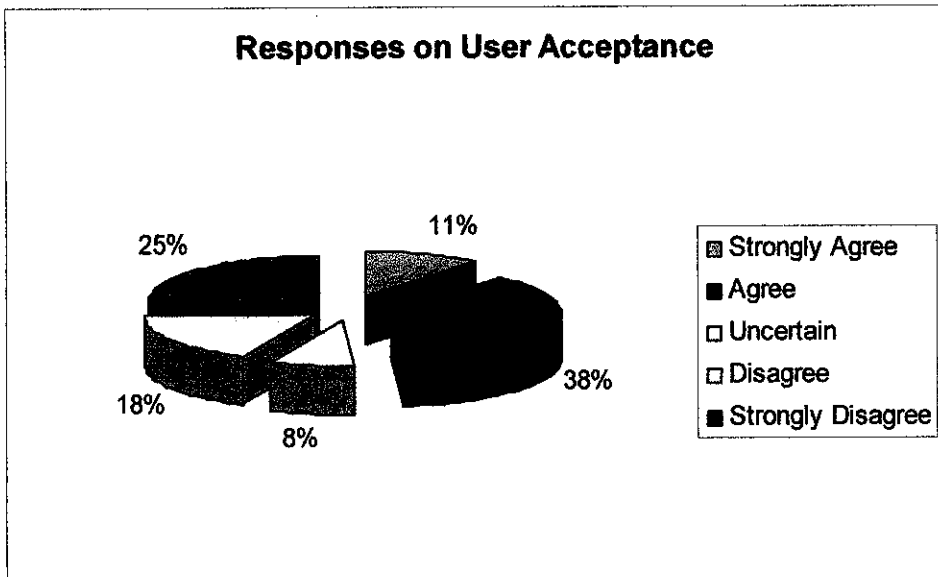
- Identifying and contacting respondents to gain their agreement
- Designing and sending the questionnaires to the intended users
- Analyzing the results
- Producing feedback
- Preparing for the final presentation of results

Decbecq, *et al.* (1975) argued that the participants are individuals who have a deep interest in the issue under investigation; or important knowledge that can be valuable for the study. Therefore, the survey sample that has been chosen by the author is considered to be experts'.

#### **4.3.3 Reactions to the Idea of M-Learning in Education**

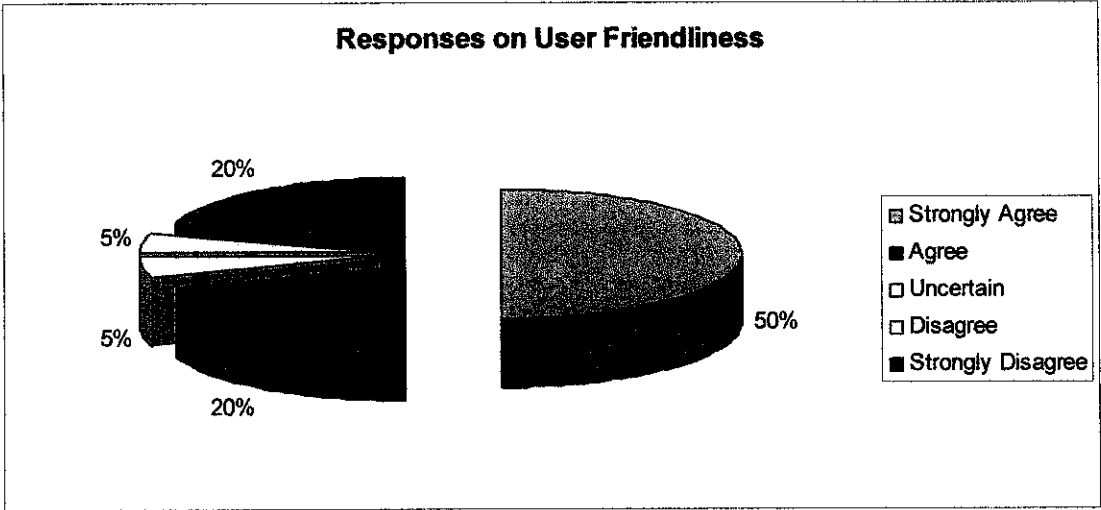
First responses to the idea were mixed, as many were immediately accepting, some were immediately rejecting. Irrespective of their initial views, most responded with questions about the nature, format and purpose of M-Learning. Respondents are quite difficult to adapt to the term M-Learning, largely because it was still a new concept in education, and this was used for the remainder of the discussions.

The initial tendency was for the respondents to consider the benefits and drawbacks of M-Learning for themselves as individuals. Those initially most favorable towards the idea argued that they would benefit from it. However, the ones that disagree towards the idea argue that they would benefit more from the traditional learning system.



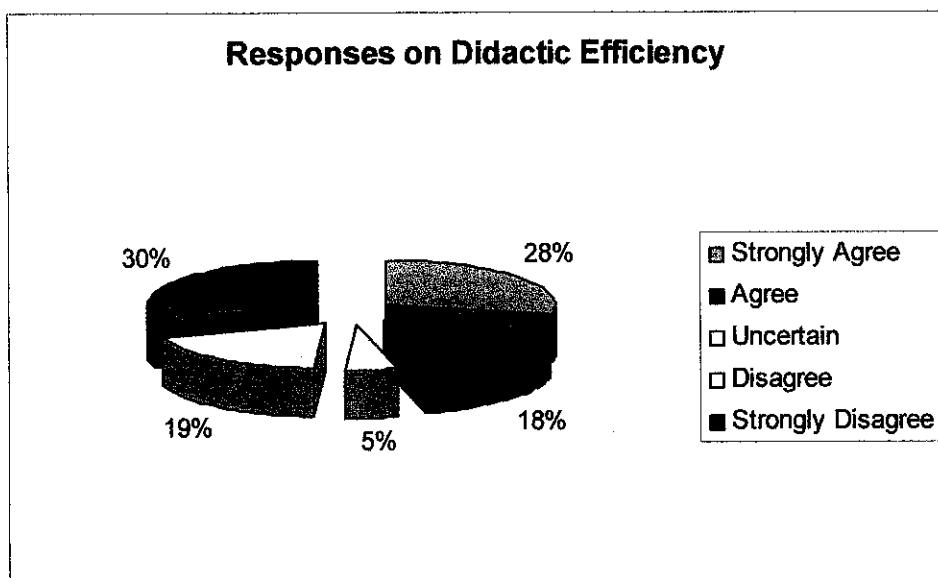
**Figure 4.7** Responses on User Acceptance

Generally, students are interested in the kind of technology that M-Learning can offer them. Another plus factor is that most of them own at least one mobile device, the most common being mobile phones. Figure 4.7 shows that 11 percent and 38 percent both strongly agree while 25 percent strongly disagree. Another 18 percent disagree while the remaining is uncertain.



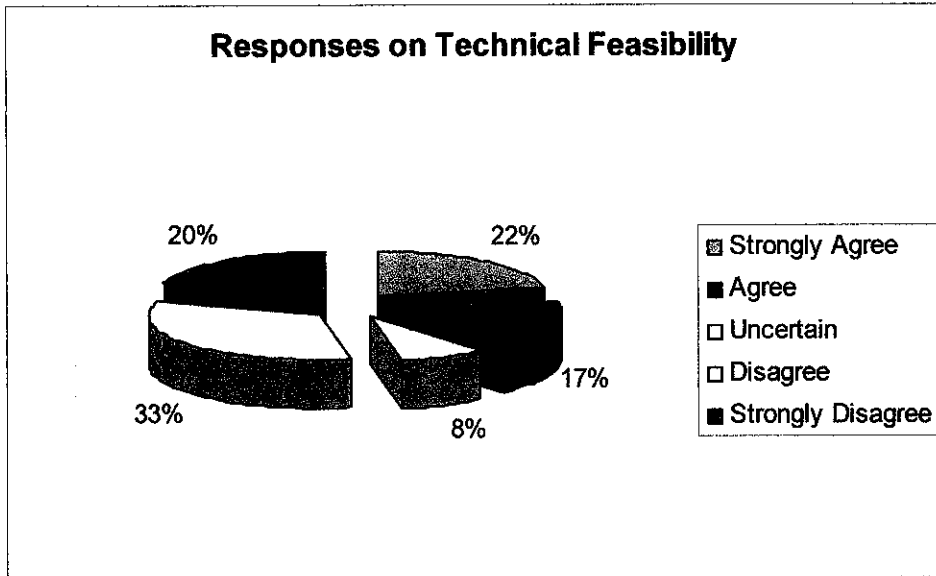
**Figure 4.8** Responses on User Friendliness

Based on Figure 4.8, the author found that 50 percent strongly agree that the system that is user friendly and easy to use. Another 20 percent agree, while 5 percent are uncertain whether it is user friendly or not. Both 5 percent and 20 percent disagree and strongly disagree on the user friendliness of the system.



**Figure 4.9** Responses on Didactic Efficiency

Figure 4.9 shows an almost balance distribution between those that agreed and those who did not. 28 percent strongly agree that M-Learning improves educational efficiency while 30 percent strongly disagree and still prefers the current learning styles. The rest shows that 18 percent agree, 19 percent disagree while another 5 percent are uncertain.



**Figure 4.10** Responses on Technical Feasibility

Figure 4.10 shows that 33 percent disagree on technical feasibility, with most of them disagree that it is not necessary to use graphics and illustrations in order for M-Learning to be effective, considering the screen limitation factor. 20 percent strongly disagree while 8 percent remain uncertain. Both 22 percent and 17 percent strongly agree on technical feasibility.

#### 4.3.4 Conclusion Derived From Questionnaires

After analyzing the survey data, the author found that the concept of M-Learning might be of an interest to the users, provided that it can assist them in their learning process. Apart from that, it seems that M-Learning can be more easily acceptable if it is able to provide almost the same learning experience based on the current education style, and able to provide an interactive learning environment for the users. Those that disagree prefer to stick to the current learning style or might be resistant to technology changes. Users are very concern with the usability of the system as this will be the main factor whether the system will be easy to use or not.

## **CHAPTER 5**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1 CONCLUSION**

This system provide user with a new look on learning style, where they can access information they want using a mobile device. Users can choose from a few modules such as courseware or schedule. This in turn introduces the concept of flexibility; however, it demands new pedagogies, and new approaches to deliver a course. A user-friendly system is achieved by integrating all the research area in the development process.

During the development of the system, the author faced a lot of challenges and problems which at times hindered the development of the system. Lack of resources and time constraint is the main limitation factor in the development of the system. Apart from that, unavailability of certain software also posed a problem to the user.

The author found that understanding interaction experience is not an entirely new area in human computer interaction (HCI), but there is no agreed framework that can actually guide designers and developers towards the development of usable M-Learning systems. There is considerable work to be accomplished on many fronts - HCI, mobile technology, learning communities, and content development before the potential of M-Learning comes to fruition.

Overall, it can be said that all objectives are achieved. The author believed that she managed to explore the possibility of learning through a mobile device and came up with a result from the survey.



## **5.2 SUGGESTED FUTURE WORK FOR EXPANSION AND CONTINUATION**

For future recommendation, the author suggest that a real mobile device, such as a mobile phone, is use to test the system, instead of an emulator as this will give users a more accurate view of how the system look and feel will be. Apart from that, if possible it is also suggested that a Pocket PC is used to test the system as the author feels that it has more functionality to offer than a mobile phone.

The author also suggests that more modules to be included in the system, such as a quiz module that enabled users to take a short quiz and get instant results from the system. This way, users can test their knowledge while on the go, for example while waiting for the bus etc.

The author also suggest that users will be able to view documents such as Word document etc. on the system and if possible to download the documents into the device, so that the documents can be viewed later on.

The author suggests that the system will allow communication between students to students and students to lecturers so that an interactive learning environment will be available.

The author also suggests that user's personalization to be included into the mobile system. This means that when users log in to the system, the interface of the system will be displayed according to their preferences.

Finally, the author suggest that the system to be integrated with audio/video streaming to create a more conducive learning environment for users to fully benefit from it.

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# **APPENDIX A**

## **Proposed Project Timeline**

# Proposed Project Timeline

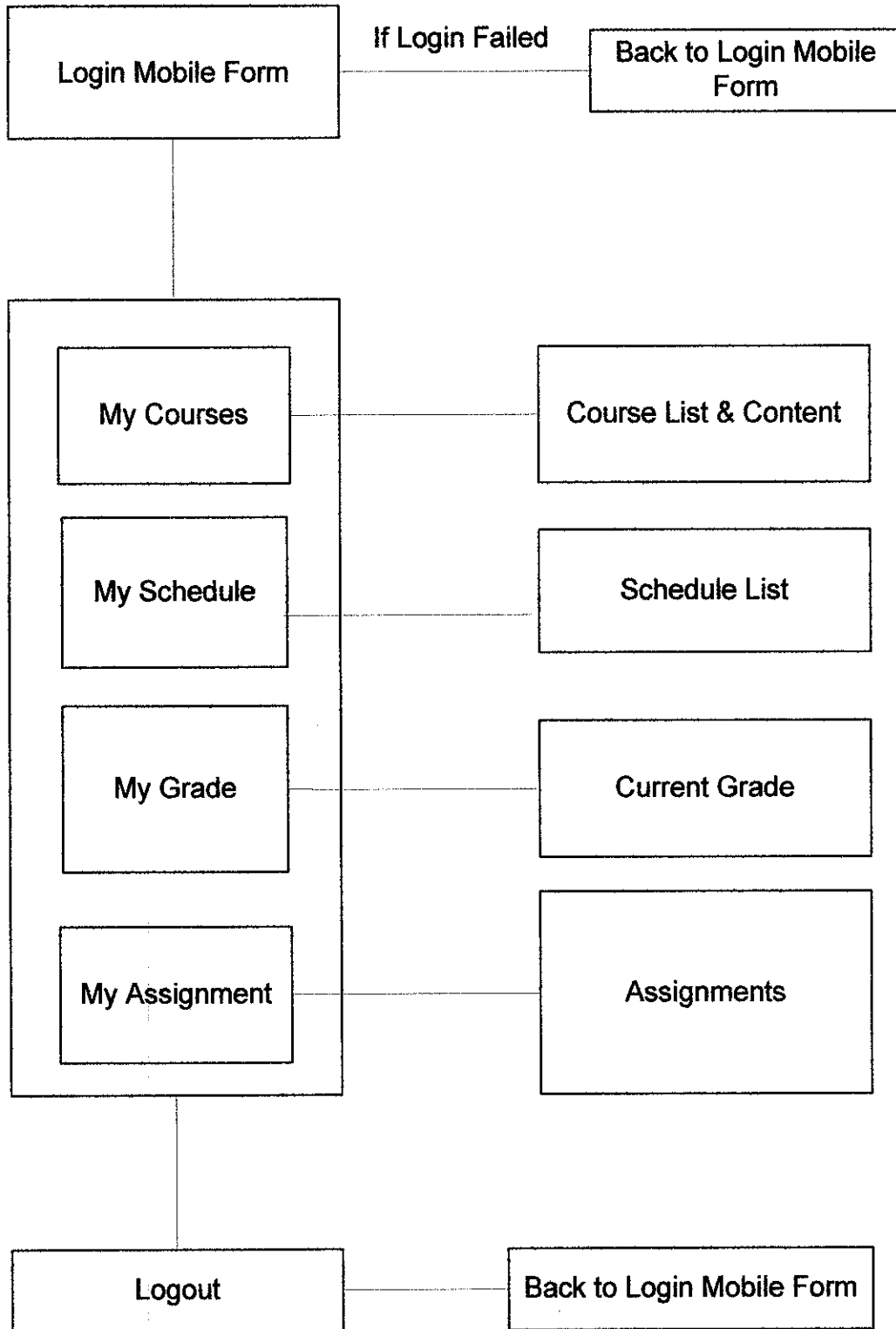
ID	Task Name	Start	Finish	Duration	Aug 2005	Sep 2005	Oct 2005	Nov 2005	Dec 2005
	Selection of Project Topic - Propose Topic - Topic assigned to students	25/07/2005	29/07/2005	1w	█				
	Analysis Phase - Research and Planning	01/08/2005	12/08/2005	2w	█				
	Design Phase - Conceptual Design - User Interface Design	15/08/2005	02/09/2005	3w	█				
	Construction Phase - System Construction	05/09/2005	14/10/2005	6w		█			
	Submission of Preliminary Report (Initial Proposal)	19/08/2005	19/08/2005	0w	◇				
	Integration Phase - Integration Testing	17/10/2005	28/10/2005	2w			█		
	Submission of Progress Report	20/10/2005	20/10/2005	0w			◇		
	Submission of Dissertation Final Draft to Supervisor and External Examiner	14/11/2005	14/11/2005	0w				◇	
	Oral Presentation	09/12/2005	09/12/2005	0w					◇
	Submission of Project Dissertation	19/12/2005	19/12/2005	0w					◇

## **APPENDIX B**

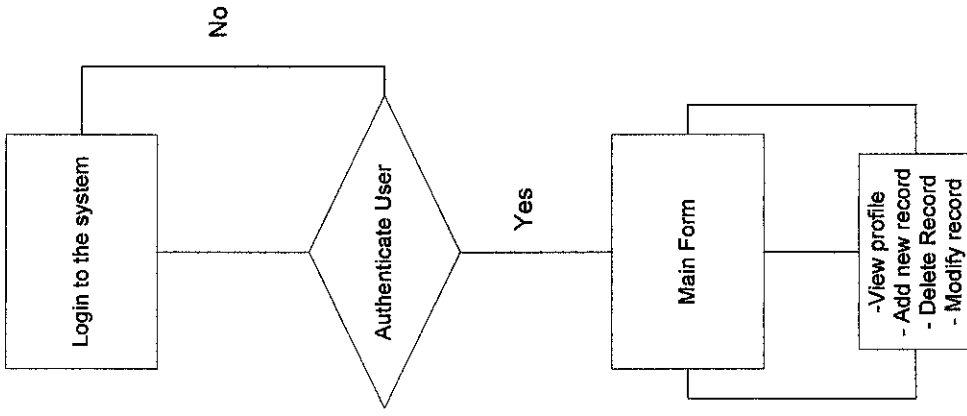
### Conceptual Flow Diagram

**APPENDIX B-1**

**Conceptual Flow Model of M-Learning**



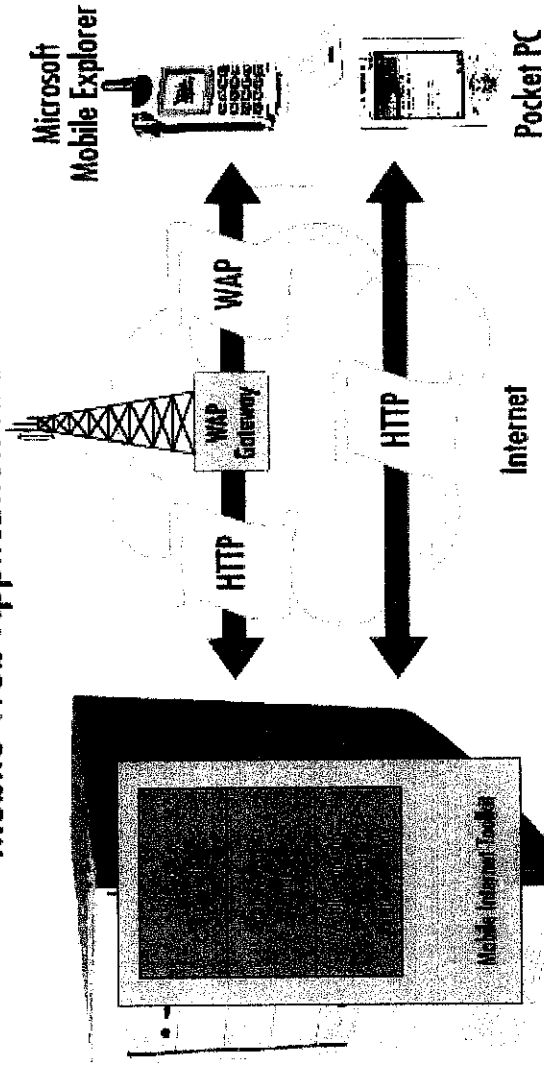




## **APPENDIX C**

Microsoft Mobile Internet Toolkit Architecture

### Mobile Web Application Architecture



IIS with .NET framework

# **APPENDIX D**

Project Source Code

**Source Code for Login Mobile Form**

```

<%@ Import Namespace="System.Web.Mobile" %>
<%@ Import Namespace="System.web.Security" %>
<%@ Import Namespace="System.web" %>
<%@ Import Namespace="System.Data.OleDb" %>
<%@ Import Namespace="System.Data"%>
<%@ Import Namespace="System" %>
<%@ Register TagPrefix="mobile" Namespace="System.Web.UI.MobileControls" Assembly="System.Web.Mobile"%>
<%@ Assembly Name="System.Web" %>
<%@ Page Inherits="System.Web.UI.MobileControls.MobilePage" Language="C#" Debug="true" %>
<script runat="server" language="C#">
public String str;
public string strConn="Provider=Microsoft.Jet.OLEDB.4.0;DATA
SOURCE=C:/inetpub/wwwroot/iistest/iistest/MobileLearning/mobile.mdb";
protected OleDbConnection oleDbConnection1;
protected OleDbCommand oleDbCommand1;

private void Page_Load(object sender, System.EventArgs e)
{
oleDbConnection1 = new OleDbConnection(strConn);
oleDbCommand1 = new OleDbCommand();
}

private void Command1_Click(object sender, System.EventArgs e)
{
oleDbCommand1.Connection = oleDbConnection1;
oleDbCommand1.CommandText = "SELECT COUNT(UserID) AS Expr1 FROM TblUser WHERE (Pwd = ?) AND (UserID
= ?)";

oleDbCommand1.Parameters.Add("UserId",OleDbType.VarChar,50);
oleDbCommand1.Parameters[0].Value = txtPwd.Text;
oleDbCommand1.Parameters.Add("UserId", OleDbType.VarChar,50);
oleDbCommand1.Parameters[1].Value = txtUser.Text;
oleDbConnection1.Open();
int nCount = (int)oleDbCommand1.ExecuteScalar();
oleDbConnection1.Close();
if (nCount >= 1)
{
MobileFormsAuthentication.RedirectFromLoginPage(txtUser.Text, true);
}
else
{
lblError.Text = "Authentication failed, check ID and password";
}
}
</script>
<mobile:Form id="Form1" runat="server">
  <mobile:Image id="Image1" runat="server" ImageUrl="file:///C:/Documents and
Settings\Miziana\Desktop\logo_copy.jpg"></mobile:Image>
  <mobile:Label id="lblUser" runat="server">ID:</mobile:Label>
  <mobile:TextBox id="txtUser" runat="server" MaxLength="5"></mobile:TextBox>
  <mobile:Label id="lblPassword" runat="server">Password:</mobile:Label>
  <mobile:TextBox id="txtPwd" runat="server" MaxLength="5" Password="True"></mobile:TextBox>
  <mobile:Command id="cmdLogin" onclick="Command1_Click" runat="server">Login</mobile:Command>
  <mobile:Label id="lblError" runat="server"></mobile:Label>
</mobile:Form>

```

### Source Code for Grade Mobile Form

```
<%@Page Inherits="System.Web.UI.MobileControls.MobilePage" Language="C#" Debug="true"%>
<%@Register TagPrefix="mobile" Namespace="System.Web.UI.MobileControls" Assembly="System.Web.Mobile"%>
<%@Import Namespace="System" %>
<%@Import Namespace="System.Data"%>
<%@Import Namespace="System.Data.OleDb"%>
<script runat="server" language="C#">

public String str;
public String str1;
public String str2;
public String str3;

public string strAccessConn="PROVIDER=Microsoft.Jet.OLEDB.4.0;DATA
SOURCE=C:/inetpub/wwwroot/iistest/iistest/MobileLearning/mobile.mdb";
DataSet myDataSet = new DataSet();
int RowCount;

public void Check_Grade(object sender, EventArgs e)
{
if(Page.IsValid)
{

OleDbConnection myAccessConn = new OleDbConnection(strAccessConn);
OleDbCommand myAccessCommand = new OleDbCommand("select Assignment, Test, Quiz, Total from TblMarks where
SubjectName='"+txtSubject.Text+"'",myAccessConn);
OleDbDataAdapter myDataAdapter = new OleDbDataAdapter(myAccessCommand);
myAccessConn.Open();
try
{
myDataAdapter.Fill(myDataSet,"TblMarks");
}
finally
{
myAccessConn.Close();
}

RowCount = myDataSet.Tables["TblMarks"].Rows.Count;
DataRowCollection dra = myDataSet.Tables["TblMarks"].Rows;

foreach (DataRow dr in dra)
{
str = dr[0].ToString();
str1 = dr[1].ToString();
str2 = dr[2].ToString();
str3 = dr[3].ToString();

}

if (RowCount == 0)
{
ActiveForm = Form3;
}
else
{
lblAssign.Text = "Total marks for assignment(s): " +str;
lblTest.Text = "Total marks for test(s): " +str1;
lblQuiz.Text = "Total marks for quize(s): " +str2;
lblTotal.Text = "Accumulated Total: " +str3;
ActiveForm=Form2;
}
}
}

</script>
<mobile:Form id="Form1" runat="server">
<P>
<mobile:Label id="Label1" runat="server">Enter a subject to view your grades:</mobile:Label></P>
<P>
```

```

        <mobile:TextBox id="txtSubject" runat="server"></mobile:TextBox></P>
    <P>
        <mobile:Command id="cmdView" onclick="Check_Grade"
runat="server">View</mobile:Command></P>
    <P>
        <mobile:Link id="Link3" runat="server" NavigateUrl="default.aspx" Alignment="Center">[Back to
Main Page]</mobile:Link>
        <mobile:Link id="Link4" runat="server" NavigateUrl="login.aspx"
Alignment="Center">[Logout]</mobile:Link></P>
</mobile:Form>
<mobile:Form id="Form2" runat="server">
    <P>
        <mobile:Label id="lblAssign" runat="server"></mobile:Label>
        <mobile:Label id="lblTest" runat="server"></mobile:Label>
        <mobile:Label id="lblQuiz" runat="server"></mobile:Label>
        <mobile:Label id="lblTotal" runat="server"></mobile:Label></P>
    <P>
        <mobile:Link id="Link1" runat="server" NavigateUrl="#Form1 "
Alignment="Center">[Back]</mobile:Link>
        <mobile:Link id="Link2" runat="server" NavigateUrl="default.aspx" Alignment="Center">[Back To
Main Page]</mobile:Link>
        <mobile:Link id="Link5" runat="server" NavigateUrl="login.aspx"
Alignment="Center">[Logout]</mobile:Link></P>
</mobile:Form>
<mobile:Form id="Form3" runat="server">
    <P>
        <mobile:Label id="Label2" runat="server">You did not registered for this course or incorrect subject
name</mobile:Label></P>
    <P>
        <mobile:Link id="Link6" runat="server" NavigateUrl="#Form1 "
Alignment="Center">[Back]</mobile:Link>
        <mobile:Link id="Link7" runat="server" NavigateUrl="default.aspx" Alignment="Center">[Back To
Main Page]</mobile:Link>
        <mobile:Link id="Link8" runat="server" NavigateUrl="login.aspx"
Alignment="Center">[Logout]</mobile:Link></P>
</mobile:Form>

```

### Source Code for Assignment Mobile Form

```
<%@ Import Namespace="System.IO" %>
<%@ Register TagPrefix="Mobile" Namespace="System.Web.UI.MobileControls"
Assembly="System.Web.Mobile"%>
<%@ Page Inherits="System.Web.UI.MobileControls.MobilePage" Language="CS" %>
<META http-equiv="Content-Type" content="text/html; charset=windows-1252">
<script runat="server" language="C#" ID="Script1">

protected void Page_Load(Object sender, EventArgs e)
{

String str="C:/inetpub/wwwroot/iistest/iistest/MobileLearning/assigndbase.txt";
StreamReader reader=File.OpenText(str);
string output="";
string output1="";

while((output=reader.ReadLine()) !=null)
{
    output1 = output1 + output;
}
reader.Close();
    TextView1.Text = output1;
}

</script>
<mobile:Form id="Form1" runat="server">
    <P>
        <mobile:TextView id="TextView1" runat="server"></mobile:TextView></P>
    <P>&nbsp;</P>
    <P>
        <mobile:Link id="Link2" runat="server" Alignment="Center"
NavigateUrl="myassign.aspx">[Back]</mobile:Link>
        <mobile:Link id="Link1" runat="server" Alignment="Center" NavigateUrl="default.aspx">[Back to
Main Page]</mobile:Link>
        <mobile:Link id="Link3" runat="server" Alignment="Center"
NavigateUrl="login.aspx">[Logout]</mobile:Link></P>
</mobile:Form>
```



### Source Code for Schedule Mobile Form

```
<%@ Import Namespace="System" %>
<%@Import Namespace="System.Data.OleDb"%>
<%@Import Namespace="System.Data"%>
<%@Import Namespace="System" %>
<%@Register TagPrefix="mobile" Namespace="System.Web.UI.MobileControls" Assembly="System.Web.Mobile"%>
<%@Page Inherits="System.Web.UI.MobileControls.MobilePage" Language="C#" Debug="true"%>
<script language="C#" runat="server">

public String str;
public String str1;
public String str2;

public string strAccessConn="PROVIDER=Microsoft.Jet.OLEDB.4.0;DATA
SOURCE=C:/inetpub/wwwroot/iistest/iistest/MobileLearning/mobile.mdb";
DataSet myDataSet = new DataSet();
int RowCount;

public void Check_Schedule(object sender, EventArgs e)
{
if(Page.IsValid)
{

OleDbConnection myAccessConn = new OleDbConnection(strAccessConn);
OleDbCommand myAccessCommand = new OleDbCommand("select Subject, Time, Venue from schedule where Day
="+txtDay.Text+"",myAccessConn);
OleDbDataAdapter myDataAdapter = new OleDbDataAdapter(myAccessCommand);
myAccessConn.Open();
try
{
myDataAdapter.Fill(myDataSet,"schedule");
}
finally
{
myAccessConn.Close();
}

RowCount = myDataSet.Tables["schedule"].Rows.Count;
DataRowCollection dra = myDataSet.Tables["schedule"].Rows;

foreach (DataRow dr in dra)
{
str = dr[0].ToString();
str1 = dr[1].ToString();
str2 = dr[2].ToString();
}

if (RowCount == 0)
{
ActiveForm = Form3;
}
else
{
lblSubject.Text = "Subject: " +str;
lblTime.Text = "Time: " +str1;
lblVenue.Text = "Venue: " +str2;
ActiveForm=Form2;
}
}

private string strConn = "PROVIDER=Microsoft.Jet.OLEDB.4.0;DATA
SOURCE=C:/inetpub/wwwroot/iistest/iistest/MobileLearning/mobile.mdb";
DataSet ds = new DataSet();
private void FillQuotes()
{
OleDbConnection Conn = new OleDbConnection(strConn);
OleDbCommand cmd = new OleDbCommand("select subjectname from product",Conn);
OleDbDataAdapter oDataAdapter = new OleDbDataAdapter(cmd);
Conn.Open();
```

```
ds = new DataSet();
oDataAdapter.Fill(ds, "product");
Conn.Close();
}
```

```
</script>
<mobile:form id="Form1" runat="server">
<mobile:Label id="Label4" runat="server">Please enter a day to view schedule:</mobile:Label>
<mobile:TextBox id="txtDay" runat="server"></mobile:TextBox>
<mobile:Command id="Command1" onclick="Check_Schedule" runat="server"Text="Go"></mobile:Command>
<mobile:Link id="Link1" runat="server" NavigateUrl="default.aspx" Alignment="Center">[Back to Main
Page]</mobile:Link>
<mobile:Linkid="Link5"runat="server"NavigateUrl="login.aspx"Alignment="Center">[Logout]</mobile:Link>
</mobile:form><mobile:form id="Form2" runat="server">
<mobile:Label id="lblSubject" runat="server"></mobile:Label>
<mobile:Label id="lblTime" runat="server"></mobile:Label>
<mobile:Label id="lblVenue" runat="server"></mobile:Label>
<mobile:Link id="Link3" runat="server" NavigateUrl="#Form1" Alignment="Center">[Back]</mobile:Link>
<mobile:Link id="Link7" runat="server" NavigateUrl="default.aspx" Alignment="Center">[Back to Main
Page]</mobile:Link>
<mobile:Link id="Link8" runat="server" NavigateUrl="login.aspx"Alignment="Center">[Logout]</mobile:Link>
</mobile:form><mobile:form id="Form3" runat="server">
<mobile:Label id="lblShedule" runat="server">You have no available schedule on that day</mobile:Label>
<mobile:Link id="Link6" runat="server" NavigateUrl="#Form1" Alignment="Center">[Back]</mobile:Link>
<mobile:Link id="Link2" runat="server" NavigateUrl="default.aspx" Alignment="Center">[Back To Main
Page]</mobile:Link>
<mobile:Link id="Link4" runat="server" NavigateUrl="login.aspx"Alignment="Center">[Logout]</mobile:Link></P>
</mobile:form>
```

Source Code for Login Form

```

Imports System
Imports System.IO
Public Class Form3
    Inherits System.Windows.Forms.Form

Private Sub btnLogin_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnLogin.Click
    If txtUser.Text = "" Then
        MsgBox("Enter A Login ID!", vbCritical)
        txtUser.Focus()
    ElseIf txtPassword.Text = "" Then
        MsgBox("Enter A Password!", vbCritical)
        txtPassword.Focus()
    Else
        Dim con As New OleDb.OleDbConnection
        Dim oda As New OleDb.OleDbDataAdapter
        Dim ds As New DataSet
        Dim strPath As String, strSQL As String

        strPath = Path.GetFullPath("Mobile.mdb")
        con.ConnectionString = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=" & strPath
        strSQL = "SELECT * FROM UserAcc"
        oda.SelectCommand = New OleDb.OleDbCommand(strSQL, con)
        ds.Tables.Add("UserAcc")
        Try
            oda.FillSchema(ds, SchemaType.Mapped, "UserAcc")
        Catch ex As Exception
            MsgBox(ex.ToString)
        End Try

        oda.Fill(ds, "UserAcc")
        Dim found() As DataRow
        found = ds.Tables("UserAcc").Select("UserID=" & txtUser.Text & " AND UserPassword=" & txtPassword.Text & "")
        If found.Length > 0 Then
            Dim frm As New Form1
            frm.Show()
            Me.Hide()
        Else
            txtUser.Focus()
        End If
    End If
End Sub

Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnReset.Click
    txtUser.Text = ""
    txtPassword.Text = ""

End Sub
End Class

```

### Source Code for Add New Profile Form

```
Public Class Form2
    Inherits System.Windows.Forms.Form

    Private Sub btnAdd_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnAdd.Click
        Dim NewRecord As DataRow
        NewRecord = DsRecord1.Tables("StudentRecord").NewRow
        NewRecord("AccountID") = txtAccountID.Text
        NewRecord("Name") = txtName.Text
        NewRecord("Programme") = txtProg.Text
        NewRecord("Email") = txtEmail.Text
        NewRecord("Semester") = txtSemester.Text
        NewRecord("StudentID") = txtStudent.Text
        NewRecord("Year") = txtYear.Text
        NewRecord("C1") = txtC1.Text
        NewRecord("C2") = txtC2.Text
        NewRecord("C3") = txtC3.Text
        NewRecord("C4") = txtC4.Text
        NewRecord("C5") = txtC5.Text
        DsRecord1.Tables("StudentRecord").Rows.Add(NewRecord)
    End Sub

    Private Sub btnUpdate_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnUpdate.Click
        DsRecord1.Update(DsRecord1)
        DsRecord1.AcceptChanges()
    End Sub

    Private Sub btnMain_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnMain.Click
        Me.Close()
    End Sub

    Private Sub btnClear_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnClear.Click
        txtAccountID.Text = ""
        txtName.Text = ""
        txtProg.Text = ""
        txtEmail.Text = ""
        txtSemester.Text = ""
        txtStudent.Text = ""
        txtYear.Text = ""
        txtC1.Text = ""
        txtC2.Text = ""
        txtC3.Text = ""
        txtC4.Text = ""
        txtC5.Text = ""
    End Sub

    Private Sub Form2_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load
        txtStudent.Focus()
    End Sub
End Class
```

### Source Code for View Profile Form

```
Public Class Form1
    Inherits System.Windows.Forms.Form

    Private Sub btnAdd_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnAdd.Click
        Dim Form As New Form2
        Form.Show()
    End Sub

    Private Sub btnDelete_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnDelete.Click
        If txtID.Text = "" Then
            MsgBox("Please enter a student ID")
        End If

        Dim Response As Integer
        If Len(Trim(txtID.Text)) > 0 Then
            Response = MsgBox("Are you sure you want to delete this record?", MsgBoxStyle.Question Or MsgBoxStyle.YesNo,
"Confirmation")
            If Response = MsgBoxResult.Yes Then
                Dim TheRecord() As DataRow
                TheRecord = DsStudent1.Tables("StudentRecord").Select("StudentID=" & txtID.Text & "")
                TheRecord(0).Delete()
            Else
                End If
        End If
    End Sub

    Private Sub btnModify_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnModify.Click
        txtID.Focus()

        Dim NewRecord() As DataRow
        NewRecord = DsStudent1.Tables("StudentRecord").Select("StudentID=" & txtID.Text & "")
        NewRecord(0)("AccountID") = txtAccountID.Text
        NewRecord(0)("Name") = txtName.Text
        NewRecord(0)("Programme") = txtProg.Text
        NewRecord(0)("Email") = txtEmail.Text
        NewRecord(0)("Semester") = txtSemester.Text
        NewRecord(0)("StudentID") = txtID.Text
        NewRecord(0)("Year") = txtYear.Text
        NewRecord(0)("C1") = txtC1.Text
        NewRecord(0)("C2") = txtC2.Text
        NewRecord(0)("C3") = txtC3.Text
        NewRecord(0)("C4") = txtC4.Text
        NewRecord(0)("C5") = txtC5.Text
    End Sub

    Private Sub btnUpdate_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnUpdate.Click

        odaStudent.Update(DsStudent1)
        DsStudent1.AcceptChanges()

    End Sub

    Private Sub btnView_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles btnView.Click
        odaStudent.SelectCommand.Parameters("StudentID").Value = txtID.Text
        DsStudent1.Clear()
        odaStudent.Fill(DsStudent1.StudentRecord)

        Dim FoundRows() As DataRow
        FoundRows = DsStudent1.Tables("StudentRecord").Select("StudentID= " & txtID.Text & " ")
        If FoundRows.Length = 0 Then
            MsgBox("Record Not Found Or The ID You Have Entered is Incorrect!")
        End If
    End Sub
End Class
```

# **APPENDIX E**

## Questionnaire



The purpose of this questionnaire is to elicit information on the efficiency of M-Learning in education field.

---

## **Appendix E: QUESTIONNAIRE ON MOBILE LEARNING (M-LEARNING)**

### **Section 1 Personal background**

1. What is your level of education?
  - High school matriculation
  - One to three years of post-secondary education
  - Four or more years of post-secondary education
  
2. What is your age grouping?
  - less than 24
  - 25-29
  - 30-40
  - 41-50
  - over 50
  
3. Gender?
  - Male
  - Female
  
4. Mobile device ownership
  - Do you own a mobile phone?
  - Do you own a PDA (personal digital assistant), pocket PC or palmtop?
  - Do you own both a mobile phone and a PDA?

---

## **Section 2      Acceptance on M-Learning**

1.      If you are provided with a state-of-the-art mobile device, would you use it to access M-Learning?  
 Strongly agree  
 Agree  
 Uncertain  
 Disagree  
 Strongly disagree
  
2.      Do you think M-Learning have the potential to be a common thing in the future?  
 Strongly agree  
 Agree  
 Uncertain  
 Disagree  
 Strongly disagree
  
3.      Would you consider M-Learning to be part of your education mode?  
 Strongly agree  
 Agree  
 Uncertain  
 Disagree  
 Strongly disagree

## **Section 3      Student user friendliness**

4.      It was easy to use the equipment in this mobile learning course  
 Strongly agree  
 Agree  
 Uncertain  
 Disagree  
 Strongly disagree
  
5.      This mobile learning experience was fun  
 Strongly agree  
 Agree  
 Uncertain  
 Disagree  
 Strongly disagree



---

6. According to my experience I would take another mobile learning course if relevant to my learning needs

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

7. I would recommend mobile learning as a method of study to others

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

8. Where did you study the mobile learning course?

- At home
- At the office or work
- While travelling
- Other

### **Section 3. Didactic efficiency**

9. Mobile learning increases the quality of e-learning

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

10. Course learning objectives can be met by mobile learning

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

11. Mobile learning is convenient for 'on-the-go' information

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

---

**Section 4. Technical feasibility**

12. Navigation through the mobile learning course was easy

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

13. For mobile learning to be effective it is necessary to use graphics and illustrations

- Strongly agree
- Agree
- Uncertain
- Disagree
- Strongly disagree

Comments:

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---

Comments on equipment functionality and user friendliness:

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---