EXPERT ASSESSMENT MODULE (EAM) FOR INTELLIGENT TUTORING SYSTEM (ITS)

By

ODHAM B. NEIMAD @ BAKAR

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

JUNE 2005

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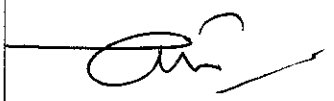
CERTIFICATION OF FYP DISSERTATION SUBMISSION

Herewith I, ODHAM B. NEIMAD @ BAKAR (2387), certify that I am responsible for the work submitted in this project, and I have done all the modifications according to my supervisor's advice.

Thank you.

	Submit by Student	Verify by Supervisor
Signature		
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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information Technology Programme
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Approved by,

_____

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TRONOH, PERAK
JUNE 2005

CERTIFICATION OF ORIGINALITY

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

ODHAM B. NEIMAD @ BAKAR

ABSTRACT

This paper, entitled Expert Assessment Module (EAM) for Intelligence Tutoring System (ITS), looks into the way of implementing Artificial Intelligence (AI) components into an online learning system that could help tertiary students to master the subject of Structure Programming in C. The main objective of this project is to develop a prototype of EAM that is capable of assessing, diagnosing and categorizing students into three main level of expertise based on their performance, so that learning experience can be much more effective. Currently, most of the existing online learning systems are only capable to cater one-way-communication direction in which the lecturer of a particular subject will upload all the relevant study materials at one end and students will download and learn them from the other end. Unfortunately, slow learners might find difficulty to understand complicated topics without any explanation or guidance from the lecturers. Nevertheless, the lecturer has less or no supervision of his students' performances and perhaps the tests conducted tend to be set according to the lecturer's own standard. Therefore, the scope of study for this project will covers the understanding of current online learning system and the field of Artificial Intelligence, the best pedagogical approach to design the course contents for learning modules based on the student's performance, prototype development of EAM and integration of the system as a whole. The EAM is expected to solve this problem by assessing the student's capability, providing guidance and tips, grading students, and determining the best ways of presenting the lecture materials according to the student's level of expertise. The Waterfall Model is used to assist and monitor all activities through out the project's lifetime. The methodology consists of five phases including the requirement definition phase, system and software design phase, development and unit testing phase, implementation and system testing phase and project closing and submission phase. This project is seen to be capable of improving the capability of current online learning system and the output obtained is expected to assist both students and lecturers in learning and teaching the subject of C Programming more conveniently and effectively.

ACKNOWLEDGEMENTS

This project has been challenging in many ways. It would not have been completed successfully without the generosity and vision of certain key people who praise their valuable knowledge and guidance to help make this project a reality. Here by, I would like to express my appreciations to those who had contributed tremendously for the success of this project.

First and foremost, I would like to express my gratitude to The Almighty God for giving me the opportunity and strength to accomplish this project successfully. It would have been a tough time to go through this far without His bless.

In developing this project, the sources and resources from which I have drawn have been numerous and varied over the months. However, in particular, I wish to acknowledge the encouragement I've received from my parents. I am also grateful to my supervisor, Pn. Aliza, for her guidance and morale support through ups and downs of the project's lifetime. She had been very pertinent in helping me defining the objectives, scopes and goals of this project.

Personally, I would like to thank Mr. Megat Azim Jamil and Mr. Bobby Ryxler for getting me started with HTML and ASP. With all their guidance, support and technical assistance, I managed to come up with this astonishing report and wonderful prototype of the overall system.

Special thanks and grateful acknowledgement are also due to those who have proofread the text. I am especially grateful to people who have made effort to ponder valuable advises in the development of this website. The positive encouragement and practical support of these people has been of immeasurable importance to me. Thank you once again to all!

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ABBREVIATIONS AND NOMENCLATURES

AI	Artificial Intelligence
ASP	Active Server Pages
ASTD	American Society for Training and Development
C-Programming	Structure Programming
EAM	Expert Assessment Module
E-Learning	Computer-Based Network System use for Education
GCC Compiler	GNU C Compiler to compile C, C++ and Objective C
GUI	Graphical User Interface
HTML	Hypertext Markup Language
ICAI	Intelligent Computer-Aided Instruction
IT	Information Technology
ITS	Intelligent Tutoring System
SEAM	Sequential Query Language by Oracle
UML	Unified Modeling Technique
UTP	Universiti Teknologi PETRONAS
VB Script	Visual Basic Script
WWW	World Wide Web

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND OF STUDY

The ready availability of networked computers, along with access to the Internet and the World Wide Web, has created an information explosion throughout the society in general and business in particular. Managing computer generated information differs in significant ways from handling manually produced data. In the new era of technology advancement, an E-Learning system has fast becoming one of the latest and increasingly gaining reputation among learners, business associations and other IT users.

Philosophers have been trying for over two thousand years to understand and resolve two big questions of the universe: how does a human mind work, and can non-humans have minds? However, the nature of philosophy allows for disagreements to remain unsolved. By definition, *intelligence* is the ability to think and understand instead of doing things by instinct or automatically. Therefore, the goal of AI as a science is to make machines do things that would require intelligence if done by humans.

For this project, an interactive online learning environment integrated with AI components will be designed to help tertiary students achieve deep understanding and master the subject of C Programming as the system itself learn to teach the subject. This environment enables individualized, flexible learning and perhaps to be successfully achieve the objective of this project.

1.2 PROBLEM STATEMENT

1.2.1 Problem Identification

Technological Advancement Preference: Structure Programming or particularly C Programming is one of various computer programming languages that are offered for university students who are undertaking IT related courses. It helps students to understand the basic fundamentals and principles of computer programming. However, the traditional way of in-class teaching and learning method is less preferred nowadays as online learning and self-learning are more widely used or developed with the support of technology.

One Way Teaching-Learning Direction: Currently, most of the existing online learning systems are only capable to cater one-way-communication direction where the lecturer of a particular subject will upload all the relevant study materials at one end and students will download and learn them from the other end without any sort of intervention in the middle (wizards, hints, helps, FAQs etc). Perhaps, if a student has any doubt about the subject, he or she will have to elevate the problem to the lecturer through e-mail where there is less possibility for real time feedback from the lecturer. The only advantage of this system is that students do not have to attend classes and on contrary it tends to raise other drawbacks as well.

No Guidance during the Learning Curve: Students may comprise of various people from different backgrounds, level of knowledge, skills and capabilities. It is important to consider these factors as they would affect the effectiveness of the learning module in learning the C Programming language. Slow learners might find it difficult to understand the learning module of complicated topics without any supervision or guidance from an expert. As a result, they will pose to stop or become de-motivated to continue learning. This problem is related to the previous issue as discussed above.

No Performance Tracker: Furthermore, it is almost impossible for the lecturer to keep track on the performance of the students. Even though students can be evaluated through assignments, quizzes and tests, the reliability of the findings are doubted since they are tend to be set according to the lecturer's own standard. It will not only leave slow learners behind but also broaden the gap between expert, intermediate and beginner level of students.

1.2.2 Significance of the Project

The ITS is aimed to provide students with individualized, dedicated tutoring based partly upon an analysis of the procedures followed by the user and the integration of AI elements that may provide some assistance on how the user should progress. In order to make the learning process more effective for students, an EAM has been identified to be crucial to synchronously guides and diagnoses a student's understanding and capability before advancing to the next level of the learning curve. Therefore, this project is aimed to cater this need by *focusing solely on the research and development of the EAM's prototype.* It will then be integrated with a prototype of other components including the ITS, TestBank, and the C-Compiler to enable students to debug the source codes online in real time.

This project is a prerequisite for graduating students to complete their course. It will be carried through out the final semester of their learning period in UTP that consists of 14 weeks in total. The methodology adapted must consider the time-frame given so that all necessary tasks, activities, and responsibilities can be conducted smoothly and successfully. Therefore, the Waterfall model used to develop and implement this project will be designed in such a way it fits the activities involve with the time allocated effectively. The model comprises of five phases including the requirement definition phase, system and software design phase, development and unit testing phase, integration and system testing phase, and project closing and submission. Detail explanations of each phase will be given under Chapter Three.

1.3 OBJECTIVES AND SCOPE OF STUDY

1.3.1 Objectives

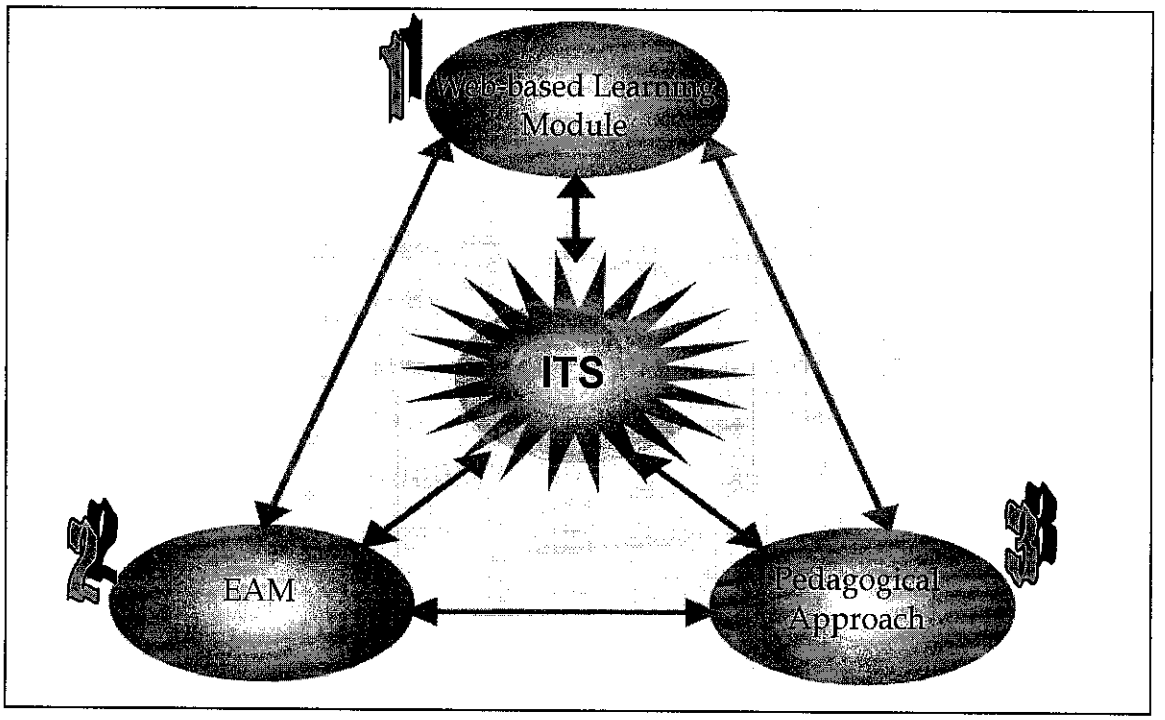

Figure 1.1: Objectives of the Project.

1. The main objective of this project is to provide a web-based tutoring system via the internet for university students to learn, practice, and master the knowledge of the Structure Programming in C, effectively and efficiently.

2. To develop a prototype of EAM that consists of AI components to guide the students with step-by-step procedures, providing hints and tips of important topics and diagnosing their performances through the given test modules.

3. The test shall be conducted online and the EAM should be able to make comparison between the compiled results with the one stored in database. Based on this, the EAM will grades the student and determine the suitable teaching method (content's presentation) for preceding topic.

1.3.2 Scope of Study (Specification of EAM - SEAM)

This project focuses on developing a prototype of an intelligent web-based tutoring system for students to learn the subject of C Programming according to a set of procedures determined by the EAM. The scopes of studies are as below:

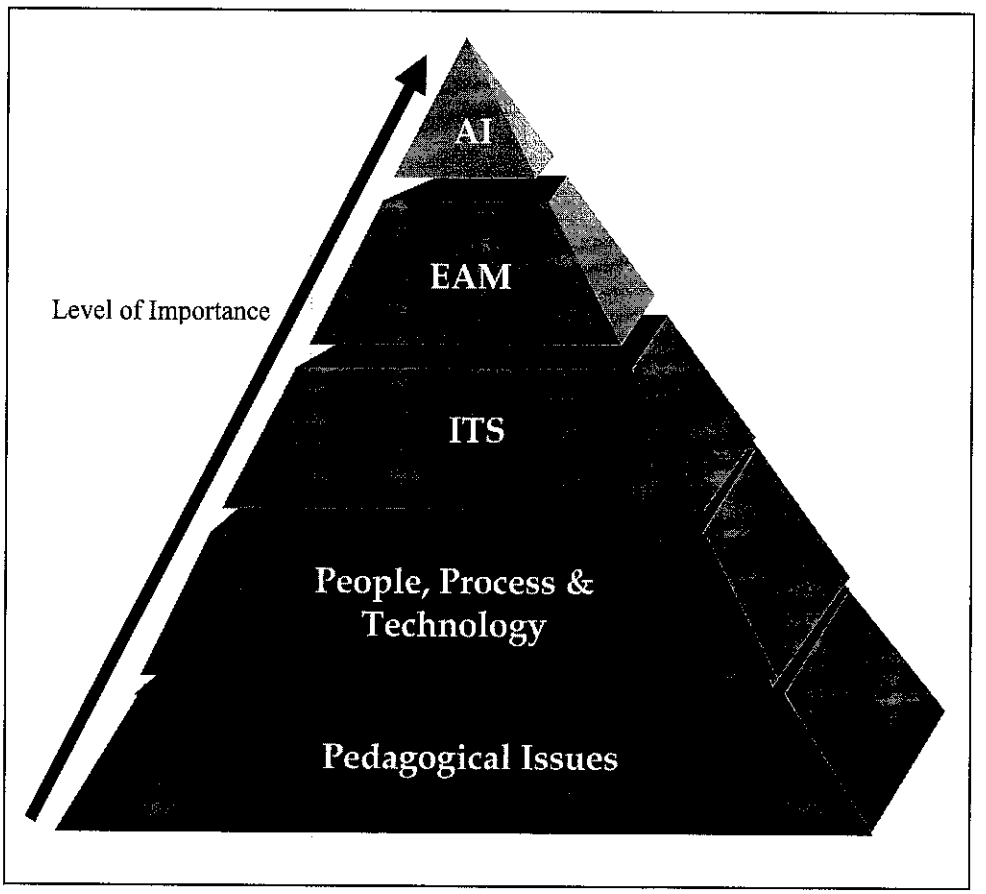

Figure 1.2: Scopes of Study

1. To study the area of Artificial Intelligence (AI) and how it can be utilized in improving the e-learning capability for self-learning module.

2. To develop a prototype of Expert Assessment Module (EAM) that is capable of diagnosing a student's capability and assisting him / her to master the Structure Programming language effectively and efficiently. The EAM must also be able to select appropriate questions from the 'TestBank' to be included in the test module based on the student's performance.

3. To develop a prototype of Intelligent Tutoring System (ITS) that is capable to present the course content and other related features in order to visualize the concept of EAM.

4. To study the process, people and technological issues that may occur along the time-frame in developing and implementing this project.

5. To study on various pedagogical approaches available and select the best one that suits students from different level of expertise.

The scopes of studies are arranged in a Pyramidal order with the highest one being the most important factor to consider before developing this project.

1.3.3 Relevancy of the Project

With the evolving needs for an online learning system to help university students to master the subject of Structure Programming – C in particular, an effort has to be taken in order to ensure the effectiveness of the learning curve. However, most of existing online learning systems are only capable to cater for only one way communication channel and this may cause a lot of problems for students.

The EAM is seen to be capable of evaluating the student's capability through the test module conducted in between every topic before he or she can eventually proceed to the next chapter. From the test module, the student will be evaluated according to the time taken to complete the test, the number of times he / she hits the hint button, the number of errors made, the total scores gained and other criteria that will be explained in greater details under Chapter Three of this report.

From the test result, the student will be categorized into either one of the three different levels of expertise (beginner, intermediate or expert) so that the EAM can determine the best pedagogical approach to present the preceding learning materials for the student.

Nevertheless, in case if the student has any doubt or query during the learning curve, he or she can make a quick search of related topic and the feedback will be given in real-time.

Therefore, this project is forecasted to be able to increase the effectiveness of an Intelligent Tutoring System (ITS) in guiding students to master the subject of C Programming with the support of Expert Assessment Module (EAM).

1.3.4 Feasibility of the Project

This project is to be developed within the time frame of 14 weeks. The allocated time frame will be used to carry out the preliminary research, system design, development and implementation of EAM, and integration with a prototype of ITS as a whole. The methodology used and activities involve in each phase will be explained in greater details under Chapter Three of this report.

CHAPTER 2
LITERATURE REVIEW AND / OR THEORY

2.1 PEDAGOGICAL ISSUES IN EDUCATION

According to the definition adapted from WordNet 2.0 by Princeton University [1], *Pedagogy* simply means the activities of educating, instructing or teaching that impart knowledge or skill. It is identified that educator's method in teaching students substantially affects their learning curve. Planned course synopsis that is made as a guideline for both students and educators sometimes does not consider the time needed for students to understand a particular topic. Meisalo [2] is very definite by which he stated that, "There is a need for a more flexible schedule, or alternatively, the topics of the course should be organized in a new way".

In a combined report written by Schaverien and Cosgrove [3] about the issue of computer based learning in 1997, they quoted that, "We have developed a theory of learning which posits that the heuristic, generate-test-regenerate is natural, and, as such, available to all learners since it is built into the brains and genes of all living things". This theory grew out of two major empirical studies, reports of which have now been published in international journals (Cosgrove, 1995; Schaverien and Cosgrove, 1997). The findings of these two projects suggest:

1. That students' learning of seminal science ideas is well-explained as a process of generating and testing (hence selecting) of ideas on their value, that is by means of a Darwinian generate-test-regenerate heuristic, and
2. That teachers' learning to teach (in ways that support such natural learning) can be understood in terms of that selectionist heuristic as well.

In the same report, Schaverien and Cosgrove [3] had conducted an analysis on the importance of education in pre-industrial, industrial and information technology societies. The findings are as below:

	Pre-Industrial	Industrial	Information Era
Learners	Young of the Elite	All Young People	Everyone
Language	Latin and Greek	National language	English
Age of Learners	6-20yrs	6-16yrs	Any
Payment	Parents	Taxes	Users
Provider	Church	State	Corporations
Economic System	Traditionalist/Medieval	Taylorist/Fordist	Neo-Liberal/Post-Fordist
Where Available	Sites of Knowledge	Town Schools	Anywhere
When Available	Arranged Time	Set Time	Anytime
Source of Curric.	Teacher	State	Learners' Needs
Teaching Methods	Master-Apprentice	Transmissive	?
Learners' Role	Imitative	Passive/Receptive	?

Table 2.1: Education in Pre-Industrial, Industrial and Information Technology Societies

However, this report demonstrates that although the radical re-learning required in both cases is possible, it occurs at a price. Those interventions by a teacher-cum-mentor which brought this re-learning about were intensive, making them expensive and difficult to replicate. Many teachers lacked insight into them and lecturers considered them undignified in tertiary lectures. So, a way of scaling up these interventions was required, as was a way for students to gain access to these ideas. They turned to other forms of mediation than human teacher-mentors, forms which might constitute information age learners' roles and teaching methods. Following Laurillard (1993) they reviewed a range of media, from books to interactive multimedia (IMM); arriving at the view that an IMM-supported base offered the opportunity they sought.

A depiction from a book written by Andrew Sather [4], "Creating Killer Interactive Websites", 1997, describes the boom of the WWW as, "Long gone are the days of text-only information on web pages with drab gray backgrounds. With graphics, sound, and animation, the WWW now possesses the potential to be highly dynamic and interactive. People can now design interfaces as strong and compelling as the actual content of their sites".

Thus, from my opinion, it is important to include multimedia elements in web-based tutoring system and stress on the presentation of the contents in a better approach, whose sole purpose is to increase understanding of the current topic being taught.

2.2 IMPORTANCE OF INTELLIGENCE TUTORING SYSTEM (ITS)

The importance of an online learning system is best described by Ken Koedinger [5], a professor of human-computer interaction and psychology at Carnegie Mellon University (2002), who stated that, "Effective personal tutors can raise student scores by two grade levels but the average human tutor helps raise grade level only by one-half. His computer-based system falls in between, raising students' scores by one grade level." He also added some compliments regarding the area of Artificial Intelligence as, "They don't do windows but the next generation of AI applications can teach, tutor, and even grade essays".

Following Katie Hafner [6], the New York Times (September 16, 2004), an Intelligent Tutoring System is broadly defined as educational software containing an artificial intelligence component. The software tracks students' work, tailoring feedback and hints along the way. By collecting information on a particular student's performance, the software can make inferences about strengths and weaknesses, and can suggest additional work. The artificial intelligence built into the program helps set it apart. Not only does the program present drills according to a student's weaknesses, but it watches the work step by step, detecting where the student stumbles, and chimes in when necessary. The artificial intelligence components mentioned by Katie can also be

referred to the Expert Assessment Module (EAM) intended for this project because they act in similar ways.

A couple of years before that, a paragraph from an article of the February 2000 edition of Learning Circuits [7], a Webzine about E-Learning from the American Society for Training & Development (ASTD) had suggested, "Imagine that each learner in a classroom or WBT setting has a personal training assistant who pays attention to the participant's learning needs, assesses and diagnoses problems, and provides assistance as needed. Providing a personal training assistant for each learner is beyond the training budgets of most organizations. However, a virtual training assistant that captures the subject matter and teaching expertise of experienced trainers provides a captivating new option. The concept, known as Intelligent Tutoring Systems (ITS) or Intelligent Computer-Aided Instruction (ICAI) has been pursued for more than three decades by researchers in education, psychology, and artificial intelligence".

2.3 IMPLICATIONS OF ARTIFIAL INTELLIGENCE (AI) ON ITS

Intelligent Tutoring System (ITS) is the most appropriate system for learning programming courses as it combines monitoring and control by having the Artificial Intelligent components. There is a number of ITS available on the Internet. They have not been adopted as standards because they seem to have removed from the actual needs of the teachers and students. The underlying methodologies used for developing an ITS was not designed from an educational viewpoint and therefore do not possess all the attributes necessary to fulfill educational objectives. Many of the ITSs developed are for the learning of programming language because the domain of computer programming being very structured is well suited for ITS development [8].

AI is widely used in various fields including education, business, medical, and even military. As reported by Eric Mankin [9], USC News (June 21, 2004), he stated that, "To teach soldiers basic Arabic quickly, USC computer scientists are developing a system that merges artificial intelligence with computer game techniques. The Rapid

Tactical Language Training System created by the USC Viterbi School of Engineering's Center for Research in Technology for Education (CARTE) and partners, tests soldier students with videogame missions in animated virtual environments where, to pass, the students must successfully phrase questions and understands answers in Arabic. They are trying to build an improved model of instruction, one that can be closely tailored to both the needs and the abilities of each individual student".

Artificial neural networks have come a long way from the early models of McCulloch and Pitts to an interdisciplinary subject with roots in neuroscience, psychology, mathematics and engineering, and will continue to develop in both theory and practical applications. However, Hopfield's [10] paper (Hopfield, 1982) and Rumelhart and McClelland's [11] book (Rumerhart and McClelland, 1986) were the most significant and influential works responsible for the rebirth of neural networks in the 1980s. They agreed that natural intelligence is a product of evolution. Therefore, by simulating biological evolution, we might expect to discover how living systems are propelled towards high-level intelligence.

To develop a parallel computer system, certain guidelines have to be adhered in order to ascertain the successfulness of the project. In 1998, McGraw and Axelrod [12] identified four distinct paths for the development of applications software for parallel computers:

1. Extend an existing compiler to translate sequential programs into parallel programs.
2. Extend an existing language with new operations that allow users to express parallelism
3. Add a new parallel language layer on top of an existing sequential language.
4. Define a totally new parallel language and compiler system.

No matter how much we crave for a superbly reliable expert system, humans are still the most wonderful creations of God incomparable to any Artificial Intelligence systems ever developed by humans themselves. A paragraph taken from a book written by Michael Negnevitsky [13], "A Guide to Intelligent Systems, 2001", stated that, from the mid-1950s, AI researchers were making promises to build all-purpose intelligent machines on a human-scale knowledge base by the 1980s, and to exceed human intelligence by the year 2000. By 1970, however, they realized that such claims were too optimistic. Although a few AI programs could demonstrate some level of machine intelligence in one or two toy problems, almost not AI projects could deal with a wider selection of tasks or more difficult real-world problems.

CHAPTER 3
METHODOLOGY / PROJECT WORK

3.1 PROCEDURE IDENTIFICATION

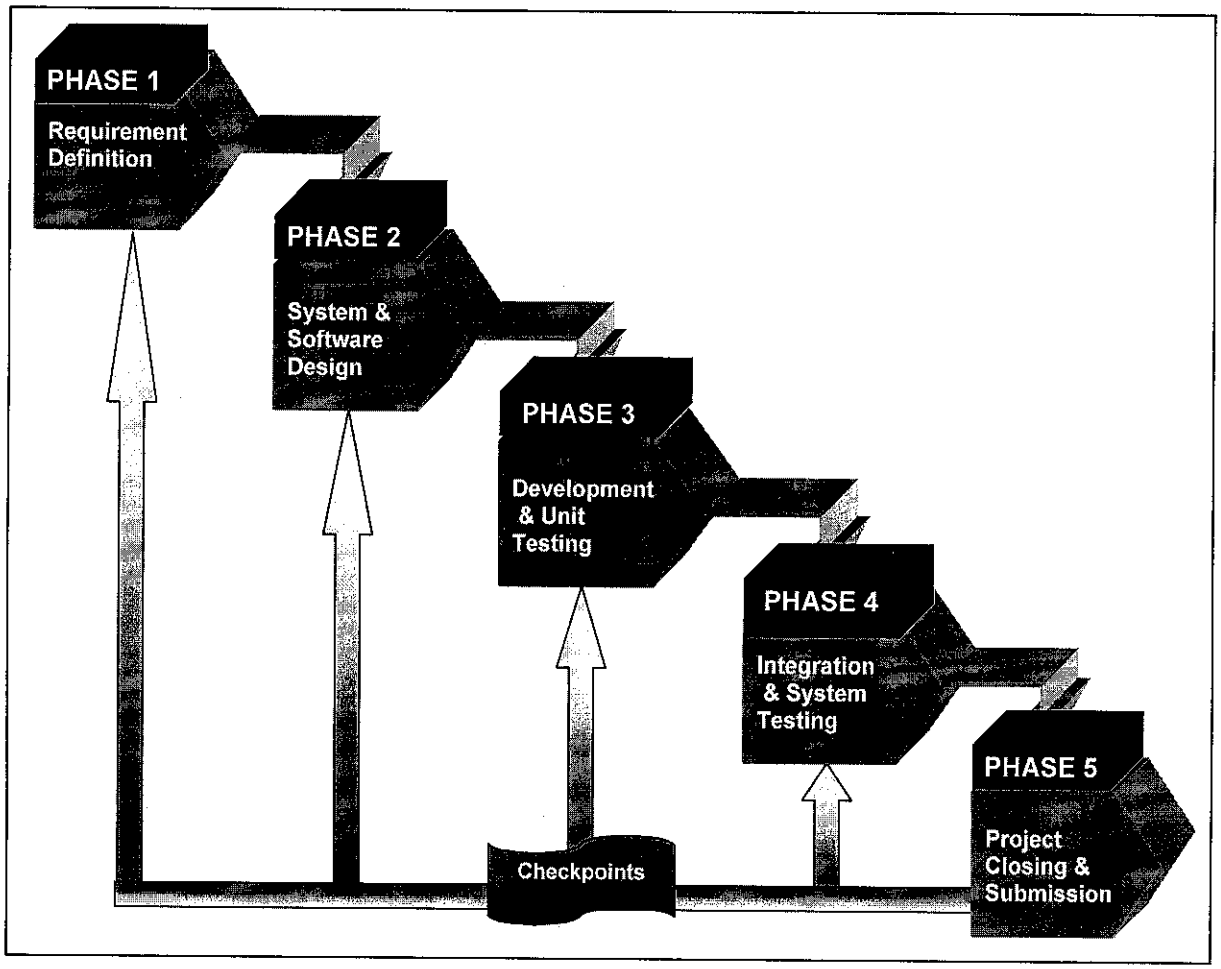

Figure 3.1: Waterfall Model of the Project's Work Flow

Due to the limited time-frame and resources to complete this project on time and fulfill the objective and scope of study, the best methodology has been adapted to ensure the success of this project. A Waterfall Model has been chosen to assist and monitor all activities through out the project's lifetime. Figure 3.1 above is the depiction of all the five phases to be carried out along the 14 weeks time-frame allocated.

3.1.1 Requirements Definition

A thorough research will be conducted on specifications of the current online learning system and all constituencies who use and are affected by the system. Valuable resources such as journals, articles, interviews, magazines and reference books are analyzed in order to obtain sufficient information regarding the research study. There are several important criteria to be considered before initializing this project. Among others are including the:

1. ***System Philosophy***: Sets of interacting components within an environment to fulfill a purpose or a set of objectives.
2. ***System Analysis***: Approaches in identifying and evaluating problems, defining scope, determining opportunities, constraints and needs.
3. ***System Management***: Address technological, process and people issues who are affected directly or indirectly by this project.

The objectives, constraints, scopes and goals of this project are established during this stage. The data collected are filtered using a deductive method by eliminating less-important ones and indulges in more vital information. They are then defined in more details and serves as a guideline for system and software design phase.

3.1.2 System and Software Design

After all necessary information has been gathered, the design phase will take place. The system shall be defined in more detailed with regards to the system inputs, work processes, system outputs and interface designs. The emphasis is on determining what functions must be performed rather than how to perform those functions. Design Phase is to transform the detailed, defined requirements into complete, detailed specifications for the system to guide the work of the preceding Development Phase. The decisions made in this phase address in detail, how the system will meet the defined functional, physical, interface and data requirements. Activities involved may be conducted in an

iterative fashion, first by producing a general system design that emphasizes the functional features of the system, then a more detailed system design that expands the general design by providing all the technical detail.

System Architecture Design

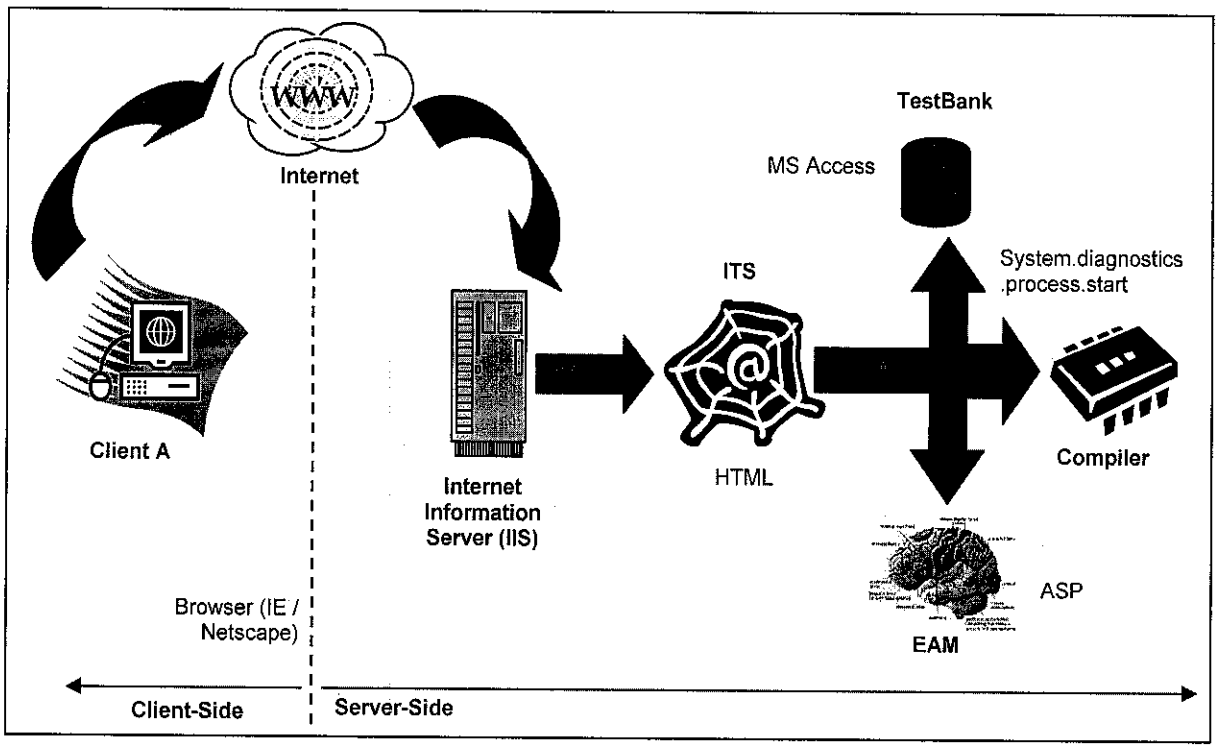

Figure 3.2: System Architecture Design

As shown above, the system architecture is designed in such a way it enables students to gain access to the entire system via the internet. An Internet Information Server (IIS) is installed in a dedicated server to host the website. The overall system's components including the EAM, ITS, C-Compiler and TestBank are stored in the same server. Each component plays a different role but they are highly integrated in order to ensure the effectiveness of this project.

The contents of the website including learning materials, forums and frequently asked questions are presented in the ITS and it is perceived as the parent class to other components of the system. It helps students to learn, practice and master the subject of C

Programming effectively. On the other hand, EAM is responsible for generating the test module and assess the student's performance. It will then determine the best pedagogical approach to present the preceding learning materials based on the test result. Nevertheless, a C-compiler is needed to process and debug the source codes online and a TestBank is created to store all related information including personal information of the students and test questions.

System Modeling Designs

Context Diagram

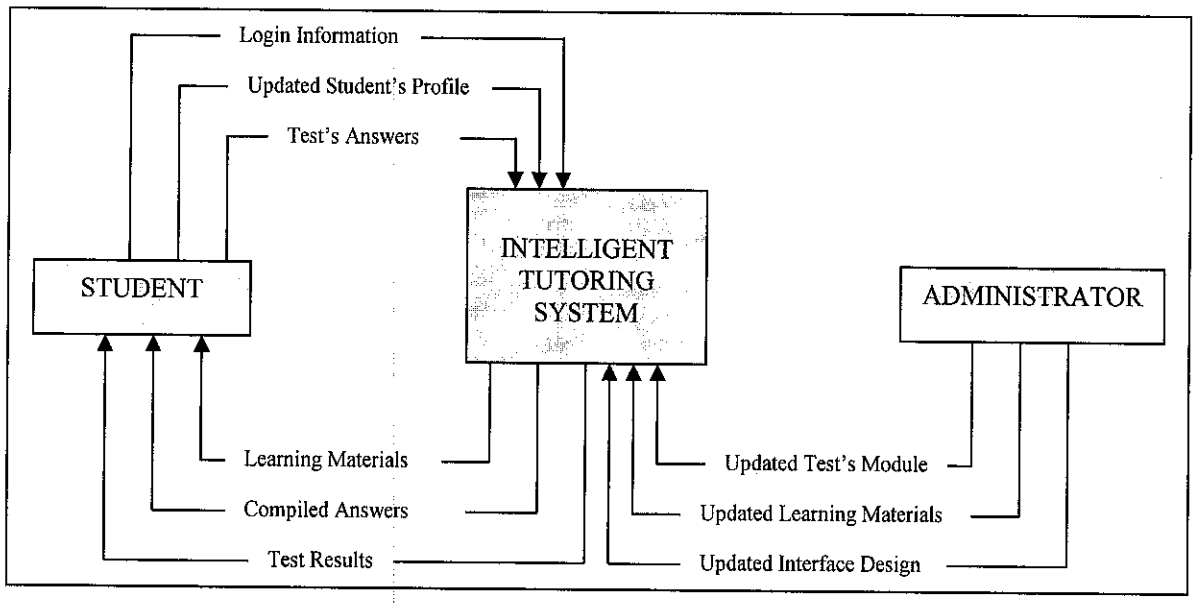

Figure 3.3: Context Diagram

The Context Diagram above denotes the process flow of the entire Intelligent Tutoring System from a bird's eye view. Two main entities have been identified as the Student and Administrator. A user will send login information if he / she is an existing user or register for a new account if he / she is a new user in order to assess the system. The user will be able to learn the course contents, sits for a test and compile the source codes online without having to install a third party compiler. The system will process the given inputs and updates the student's profile in the TestBank. Then, the learning materials will be displayed and when the student sits for the test, the EAM evaluate the

answers and returns the test result. Administrators will have higher privileges to update the test modules, learning materials and interface designs of the website. However, due to the limited time-frame and resources, only the front-end of the system that interacts with the users will be developed whilst administrators will have to make changes manually by "*hard-coding*".

Unified Modeling Language (UML) Use Case Diagram

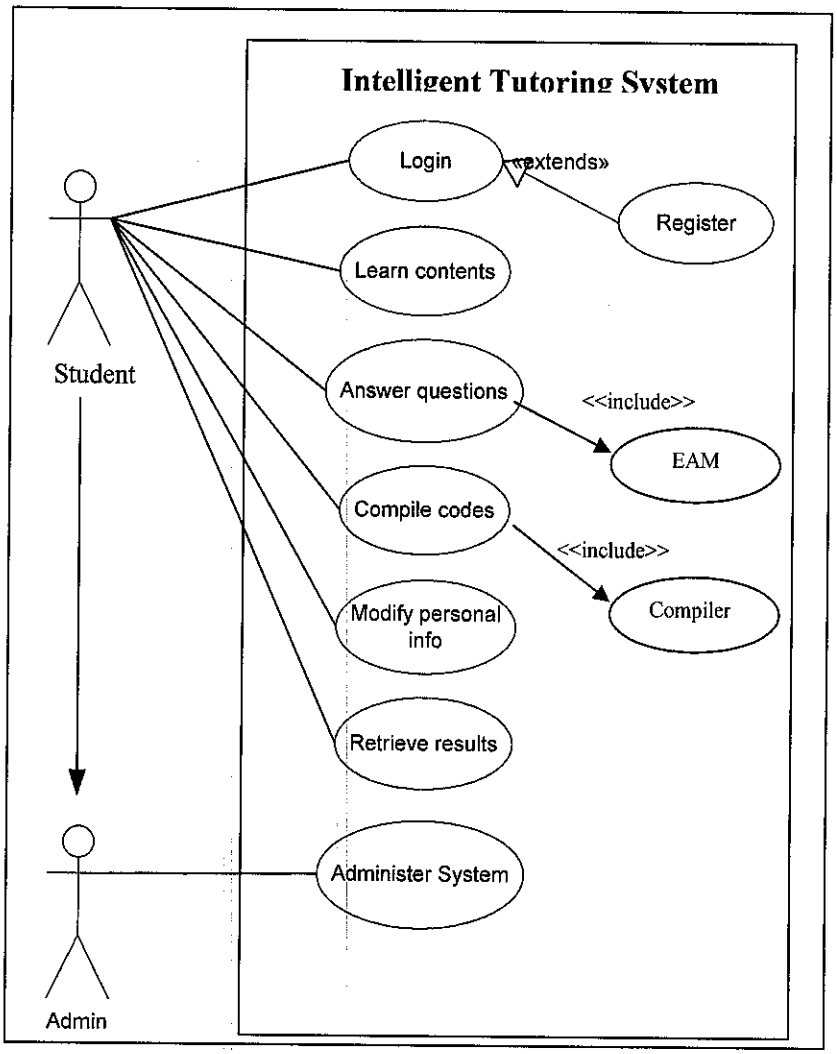

Figure 3.4: UML Use Case Diagram

As shown above is the UML Use Case Diagram that includes all functions that are involved. Entities are treated as objects in order to show a clearer view of the entire

process flow. The explanations of the UML Use Case Diagram are somewhat similar with the given explanations for the Context Diagram.

Class Diagram

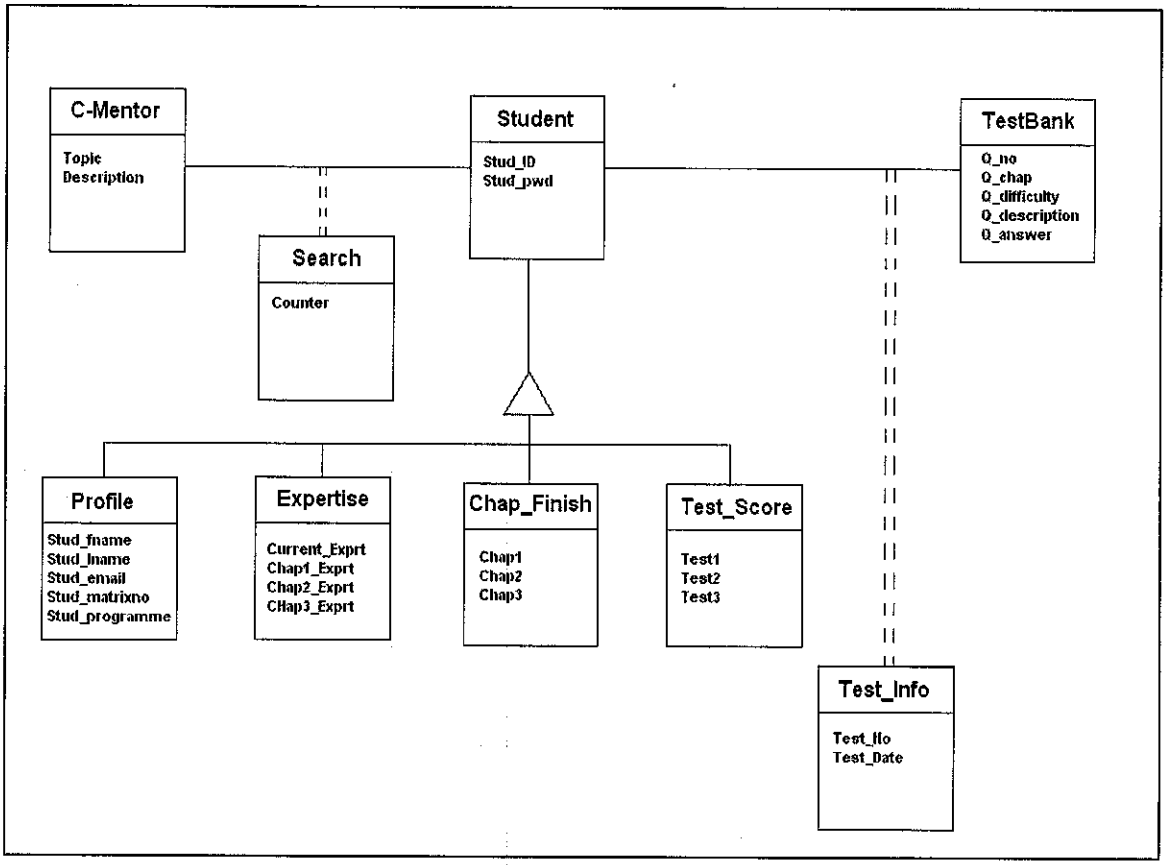

Figure 3.5: Class Diagram

The Class Diagram in Figure 3.5 above shows the database schema of the overall system indicating all the entities, attributes, and relationships that may occur. An object-oriented approach has been chosen to design the interrelationships between objects so that the same model can addresses both programming and database.

There are 9 tables all together including Student, Profile, Expertise, Chap_Finish, Test_Score, TestBank, Test_Info, C_Mentor, and Search. Table Student is the parent for tables Profile, Expertise, Chap_Finish and Test_Score. They inherit and share the common attributes of table Student. Table Profile stores personal information of the

students while table Expertise stores the students' current level of expertise and their performance for each chapter accordingly. Table Chap_Finish indicates the chapters that the students have completed and table Test_Score records the result for each test.

All test questions will be stored in table TestBank and the information by which the tests are conducted are stored in table Test_Info. In case if the students have any doubts or query during the test, they can make a quick search and the available information will be retrieved from table C_Mentor. In supportive, table Search will acts as a temporary storage to hold inclusive data of the number of time a student hit the search button during the test. An overriding method will be used to clear the table once the test has been completed.

3.1.3 Development and Unit Testing

In this phase, the system will be developed according to the specifications designed in the earlier phase. Massive amount of programming hours will be spent here that requires good understanding of programming languages and development tools used. The entire system comprises of four major components including the ITS, EAM, C-compiler and TestBank. Each module will be developed separately and tested individually to verify that each unit meets its specification. When it has been conducted successfully, only then they will be integrated and tested as a whole during the implementation phase or also better known as integration phase. Activities, outcomes and explanations regarding the development phase will be discussed in greater detail under Chapter 4.

3.1.4 Implementation / Integration and System Testing

During this phase, the individual program units are integrated and tested as a complete system to ensure that the software requirements have been met. An IIS server will be setup to host the complete system online. The availability, reliability, traffic congestion and speed of the internet connection will give serious impact to the successfulness of the

system testing. Several test methods are adopted during this phase including the path testing, usability testing, bottom-up testing, and user acceptance test.

Path testing is a structural testing strategy whose objective is to exercise every independent execution path through a component or program, and thus, path testing is used when testing the flow of the system to make sure every page contains executable methods, as well as true and false conditions. The true and false condition is usually applied during logging in into the system, as well as when answering test questions generated by EAM.

Usability testing is done to ensure the look-and-feel of the system is user friendly, easy to understand and helpful for students. A proper usage and combination of colors, texts and objects are important since the main function of the system is to deliver the tutorial contents according to the best pedagogical approach defined earlier. Hence, usability testing is done upfront before the development phase is completed. This is to provide the opportunity for system developer to make any changes or improvement that is not indicated in the initial design phase if necessary.

Bottom-up testing is done by testing lower-level components individually, and then working up the hierarchy of the modules until the final module is tested. It does not require the architectural design of the system to complete first, and thus, this approach can be started at early development phase in which each subcomponent is tested to ensure that they are defect-free. As development progresses, the bottom-up testing will focus more on integration of the subcomponent to ensure proper communication between them. The overall system testing will be conducted in the implementation phase when the entire system as a whole has been completed.

User Acceptance Test (UAT) is an exercise used to verify that the hardware and software of the technology solution has fulfills the system's requirements. It focuses on three main aspects of people, process and technology issues and includes participations from users' representatives. The results and findings of the User Acceptance Test will

be provided under Chapter Four for reference. Figure 3.6 below is the explanation of the People, Process and Technology issues related to the UAT:

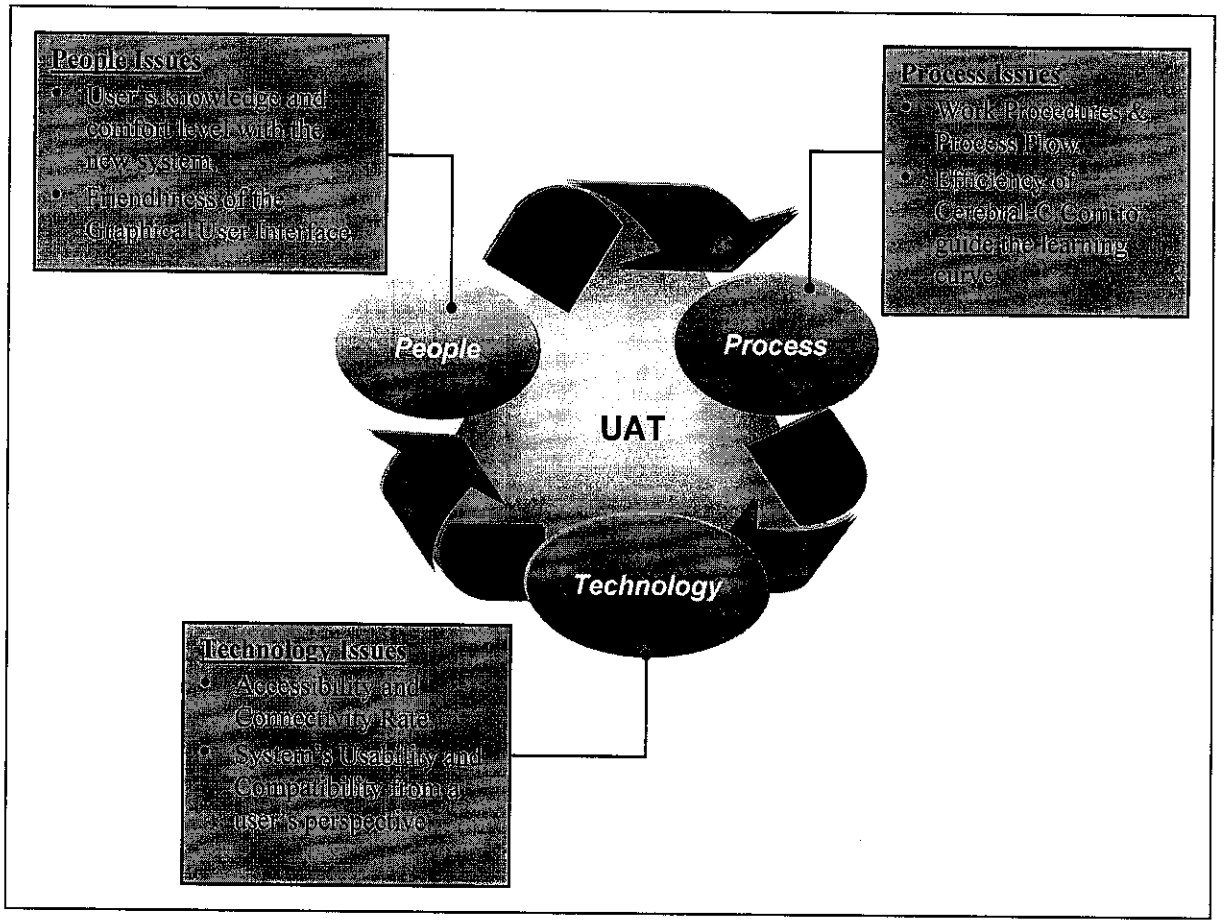

Figure 3.6: People, Process and Technology Issues of User Acceptance Test.

3.1.5 Project Closing and Submission

During this phase, a dissertation of the final report will be produced to document all the important information including work processes, procedures, methodologies, designs, testing results and any relevant appendices. A final presentation will be held to demonstrate the functionalities of the system to the internal and external examiners.

3.1.6 Checkpoints

In between every phase, there will be a checkpoint to evaluate whether all the necessary tasks have been completed successfully in the previous phase. Assuming there is no error made, and then only the project can be preceded to the next phase.

3.2 TOOLS REQUIRED

3.2.1 Active Server Pages (ASP)

Active Server Pages was introduced by Microsoft in the mid-1990s. This is the standard programming system for Internet applications hosted on Windows servers. It is bundled with Internet Information Server (IIS) when bought with Windows. The fundamental idea is that you write HTML pages with little embedded bits of Visual Basic, C# or other languages that are interpreted by the server. Since the scripts in ASP pages (suffix. asp) are processed by the server, any browser can work with ASP pages regardless of its support for the scripting language used therein.

3.2.2 Visual Basic (VB) Script

Visual Basic Script is an easy-to-use programming language that can be embedded in the header of web pages. It can enhance the dynamics and interactive features of page by allowing performing calculations, check forms, write interactive games, add special effects, customize graphics selections, and create security passwords and more. The AI components will de developed hugely in VB Script.

3.2.3 Hypertext Markup Language (HTML)

HTML is the coded format language used for creating hypertext documents on the World Wide Web and controlling how Web pages appear. HTML gave us text, graphics, links, movies, sound, colors, tables, and even forms. It is based on 30-year-old

technology (GML and SGML), and even with pretty colors and backgrounds and table layouts, "straight" HTML pales in comparison to the effect and power of scripted pages.

3.2.4 MS Access

Microsoft Access is a database which comes bundled in Microsoft Office® Products. Access is fully compatible with Active Server Pages (ASP) scripting which is only available only on NT virtual servers. It is a Microsoft software product that is primarily a data management tool (database software). Access has tools to enter, edit, and index data and to retrieve it via custom forms and reports. It also contains Visual Basic for Applications.

3.2.5 Internet Information Server (IIS)

A Microsoft® product, one of many available web servers which run on all Windows based platform. IIS contains a number of other Internet server related applications including FTP. It interfaces cleanly with the NT Operating System, and you are backed by the support and power of Microsoft. Its connections to ASP and the ease with which you can connect to Access and SQL databases make it ideal for Web businesses.

3.2.6 Borland C Compiler

C++ compiler from Borland for DOS and Windows applications can also be used to compile C source codes. It is Turbo C-compatible and its debugger supports Windows programs written in Microsoft C. It includes application frameworks for Windows (Object Windows) and DOS (Turbo Vision).

3.2.7 Web Browser

Software that provides users an access to the World Wide Web. Web browsers provide a graphical interface that lets users click buttons, icons, and menu options to view and

navigate Web pages. Netscape Navigator and Microsoft Internet Explorer are popular Web browsers.

3.2.8 Hardware

Apart from software, hardware also plays an important role for the development process. It is vital for the purpose of interface design, system development and testing, and web hosting. A complete development platform with specifications as below had been used for this project:

- Pentium IV 1.8GHz
- 256MB DDRAM
- 60GB HDD Storage Capacity
- G-Force 4 MX 64MB Graphic Accelerator
- 10/100 MBPS Internal LAN Card

CHAPTER 4.0
RESULTS AND DISCUSSIONS

This chapter is divided into two main sections which are the Results / Findings and the Discussion. The first section will focus on the progress of the activities regarding this project, while the second section will discuss of what shall have been done to meet the objectives and scopes of this project.

4.1 RESULTS / FINDINGS

4.1.1 System & Software Design

Before the system is constructed, a thorough research and understanding of the system must be gained. All information regarding the system that is going to be developed must be accessible, as it will help the design to be more accurate and able to define any opportunity for improvement. Therefore, the User Interface has been designed according to the process flow as planned in the earlier stage. Below are several snapshots of the system's main interfaces.

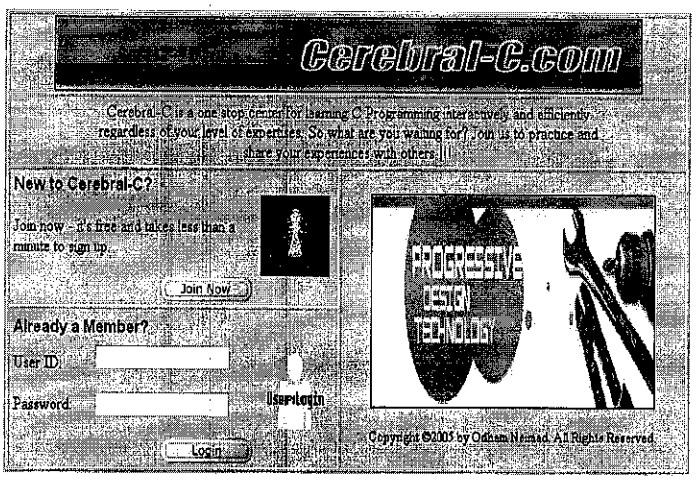

Figure 4.1: Login Page

The login page in Figure 4.1 above provides registered students with text input for username and password. A new user can register an account by clicking on the appropriate link above the login frame. This is necessary in order to gain the privilege to access the system. The system is named as Cerebral-C.Com. It is a biological term for the particular part in human brain that controls a person's intelligence making it appropriate for this project as to study the field of Artificial Intelligence.

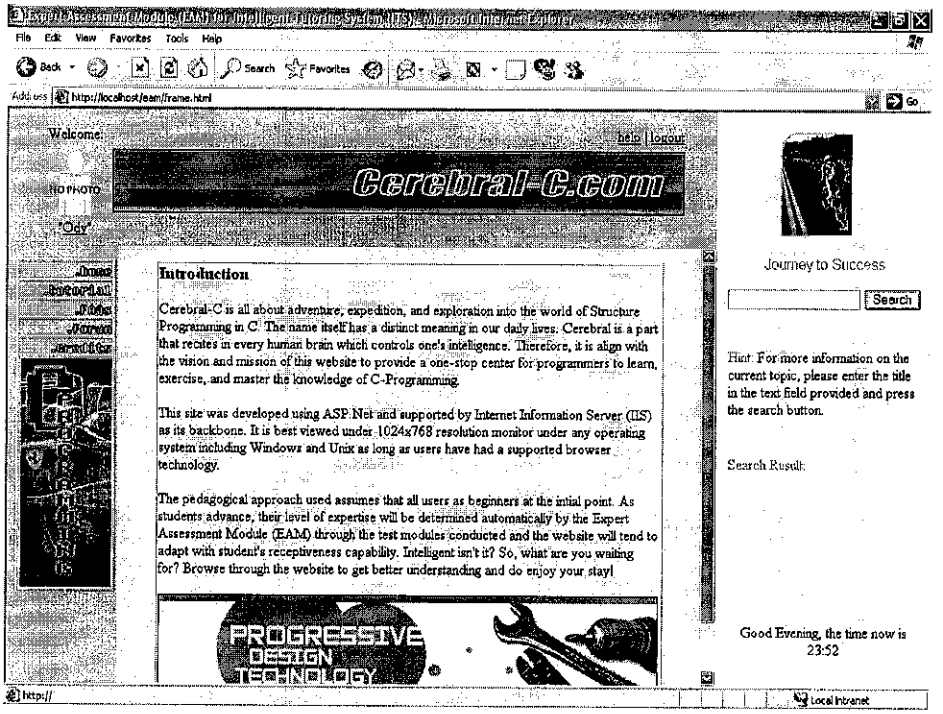

Figure 4.2: Main Page

The main page (Figure 4.2) can be accessed after a verified user is logged in. The page is divided into four main frames which are the header (top), navigation (left), contents (middle), and help or also known as C_Mentor (right). Once a user has logged in, his or her User ID will be displayed at the top left corner of the header frame. The user can follow the link to view his or her profile by clicking on the User ID hyperlink. The Help link will lead users to the Frequently Asked Questions (FAQ) page where users can view existing posts or add new query if there's any. The Logout link will terminate a student's session and exits from the system.

The contents frame located at the middle of the page will be used to display all related information when user click on the navigation buttons. Meanwhile, the search facility is placed at the right frame of the page. Users are able to make a query of any topic that is in doubt. However, the search result will be displayed in the same frame unlike other links that are loaded in the middle frame upon clicking the navigation buttons.

The navigation buttons are placed at the left-side of the main page. Users may click on the navigation buttons to go to the main page, tutorial, FAQ, external forum, or credits. For the tutorial, all new users are assumed as beginners and have zero knowledge of the subject in order to give equal treatment and attention to them. A structured pedagogical approach is used in which students have to complete the tutorial chapter-by-chapter before he or she can eventually advance to the next chapter. At the end of each chapter, the students will be asked to click on the finish button to indicate that they have already completed studying that chapter so that their profile (Chap_Finish) in the database can be updated.

In between every chapter, the students will have to sit for a test module that is generated automatically by the EAM. The questions are randomly chosen from the TestBank according to the chapter, type and level of difficulty. They are categorized into three level of difficulty which is easy, medium or hard to suit the students' level of expertise (beginner, intermediate or expert). However, since new users are assumed as beginners, the questions for the first test will be taken from the easy category. Based on the first test result, the students will then be further categorized into their respective level of expertise so that EAM can determine the best pedagogical approach to present the next learning material.

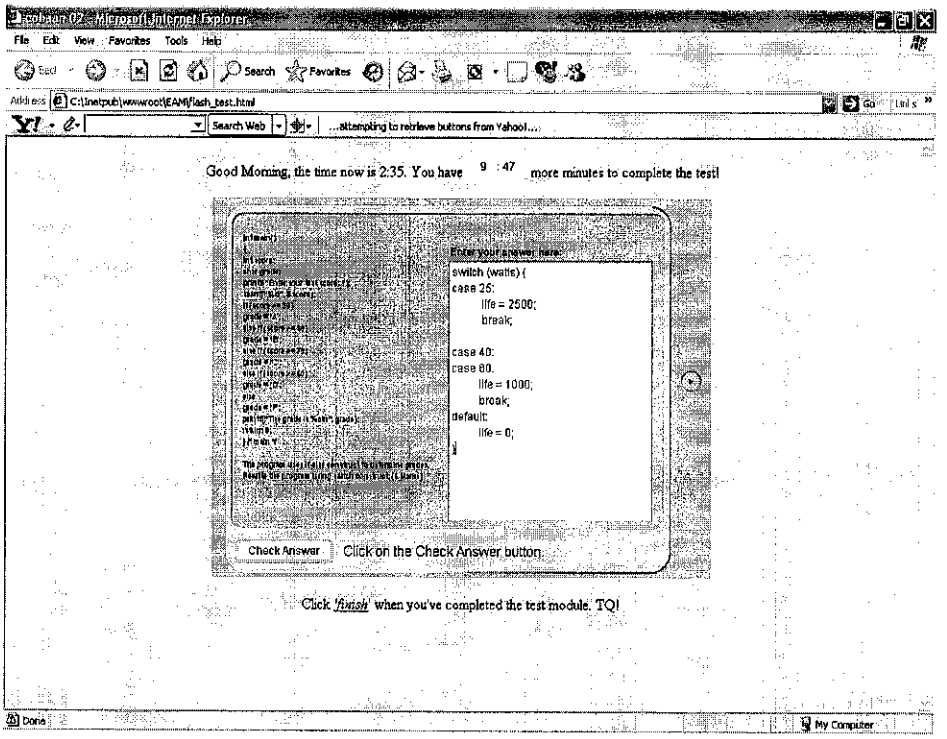

Figure 4.3: Test Module

Figure 4.3 above shows the test module that students have to sit before advancing to the next chapter. A total time of 30 minutes will be given to complete the test which comprises of at least 10 questions including multiple choice questions, true or false and essay. Each question is given a certain amount of marks to sum the total of 100%. However, the test score does not only rely on the marks gained by giving the right answers, other criteria are also taken into considerations including:

No	Evaluation Criteria	Weighting
1.	Total time to complete the test.	TP = Total Time Possible TT = Total Time Taken If TT < TP = 10% If TT > TP = ((TT-TP)/TT) * 10

2.	Idle time will be deducted from the total time taken to complete the test (2 minutes after the last key stroke).	IT = Idle Time
		If (TT-IT) < TP = 5%
		If (TT-IT) > TP = ((TT–IT-TP) / TP) * 5%

3.	Number of times the student hit the 'check answer' button during the test.	TA = Total Hit Allowed TH = Total Time Hitted If Not Used = 15% Else = ((TA-TH)/TA) * 15%
4.	Questions will be randomly chosen from the database based on the level of difficulty, chapter and type (MCQ (1m), True or False (2m), and Essay (2-5m)). Maximum 10 questions and at least 2 essay questions.	TA = Total Answers Right X = (TA/TQ) * 50%

5.	Total errors made based on comparison between answers given by the student and answers in the database (only applicable for essay questions).	TE = Total Essay Questions TQ = Total Questions Y = (TE / TQ) * 100% TEA =Total Errors Allowed TEM = Total Errors Made If No Error = 20% Else =((TEA-TEM)/TEA)*Y
6.	Levels of difficulty of the questions given are according to the student's level of expertise (Beginner – Easy, Intermediate – Medium, and Expert - Hard).	-

Table 4.1: Evaluation Criteria for the Test Module.

Each criterion is given a certain weighed percentage and the score will be added with the total marks gained from right answers given to sum the overall test score of 100%. Classifications of students according to their level of expertise are based on the test scores as below:

1. Beginner: Below 40 (<40%).
2. Intermediate: Equal to 40 or below 75 ($40 \leq x < 75$ %)
3. Expert: 75% and above (≥75%).

Three different approaches have been recognized as most suitable in guiding students to master the subject in matter. Firstly, for beginners, the course contents will be presented in a step-by-step manner with detail explanations so that students can have deep understanding of each topic and subtopics. Secondly, intermediate students will be given a lot of examples of case studies so that they can understand and analyze situational issues related to each topic. Lastly, expert students are pictured as those who have already acquired basic knowledge and skills of the topic, therefore they will only be guided through a series of commonly asked questions related to each topic. These approaches are designed in such ways as a result of thorough researches and surveys that had been conducted on several websites with good interfaces design and principles proposed by a few authors of books related to the field of Human-Computer Interaction.

Figure 4.4, 4.5 and 4.6 below are examples of how the tutorials shall be presented according to the student's level of expertise:

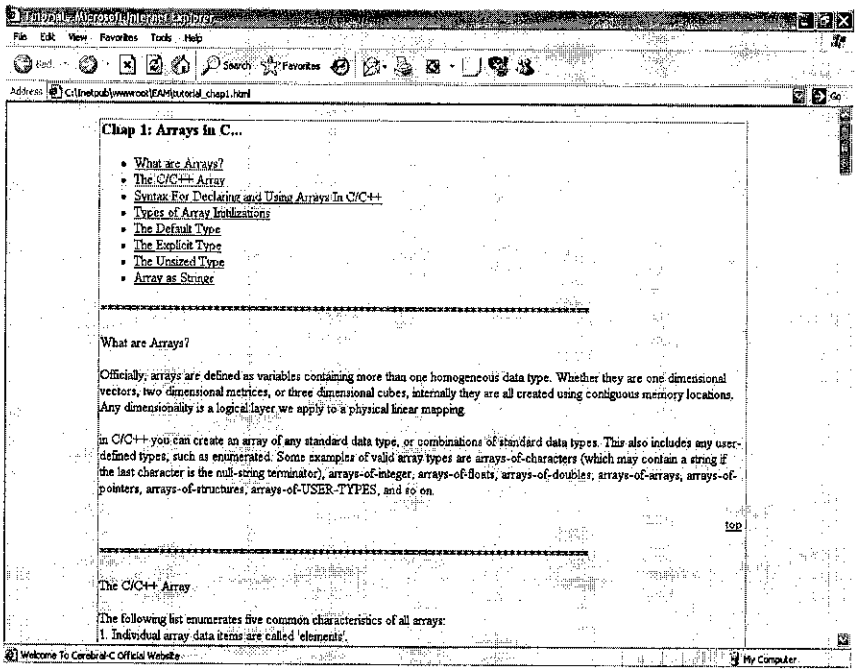

Figure 4.4: Beginner's Pedagogical Approach

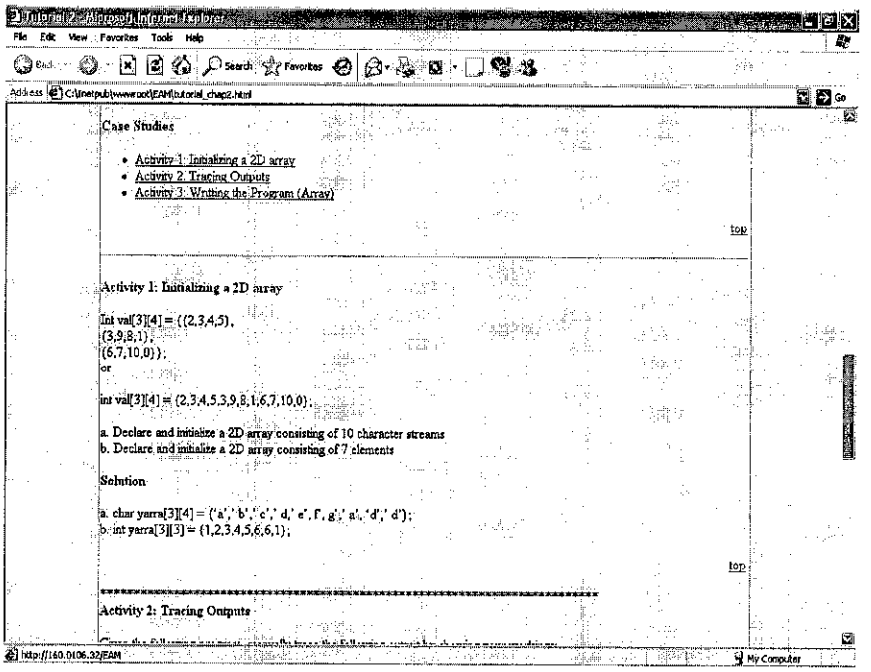

Figure 4.5: Intermediate's Pedagogical Approach

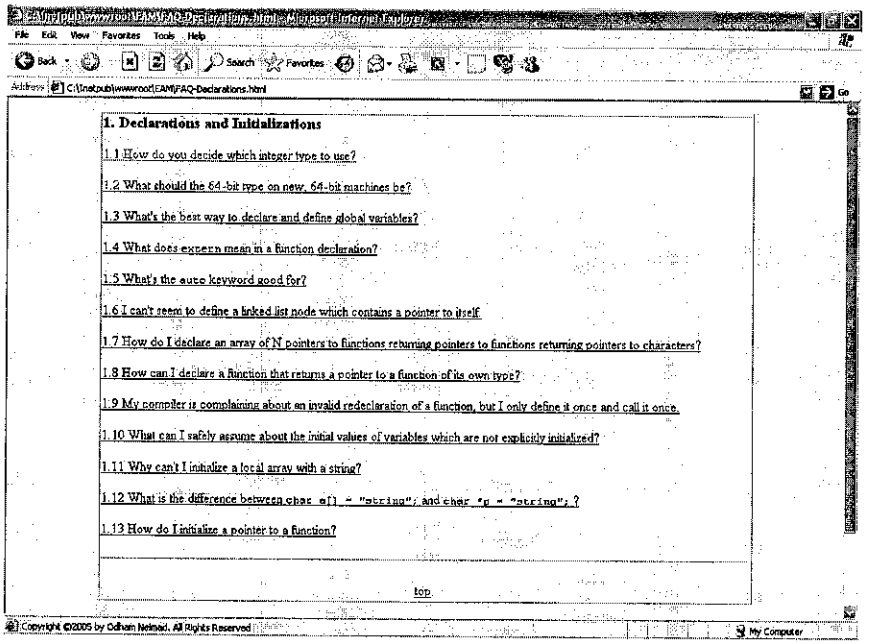

Figure 4.6: Expert's Pedagogical Approach

4.1.2 System Development & Unit Testing Phase

The development phase consist of several main activities such as the database development (testbank), website development (ITS), test module development (EAM), compiler module deployment and configuration, and arrangement of the course contents. These modules are made accordingly to work individually, and to complement each other when integrated later.

Database Development

The database for Cerebral-C.Com was developed using Microsoft Access. The reason for the selection of this tool is because it is easily available anywhere and comes bundled in Microsoft Office® Products. Access is fully compatible with Active Server Pages (ASP) scripting which is only available only on NT virtual servers. The database was constructed accordingly to the database schema (class diagram) that had been produced in the design phase. There are 9 tables all together including table Student, Profile, Expertise, Chap_Finish, Test_Score, TestBank, Test_Info, C_Mentor, and Search. Detailed explanations of those tables were given under Chapter 3.

Website Development

The front-end user interfaces of Cerebral-C.Com was developed using plain HTML documents by Macromedia Dreamweaver MX. However, in order to make a more dynamic website that is able to retrieve and store information from and into the database, Active Server Pages (ASP) had been used to develop the *codes behind* that connect the webpage with the database. Below are several snapshots of the graphical user interfaces:

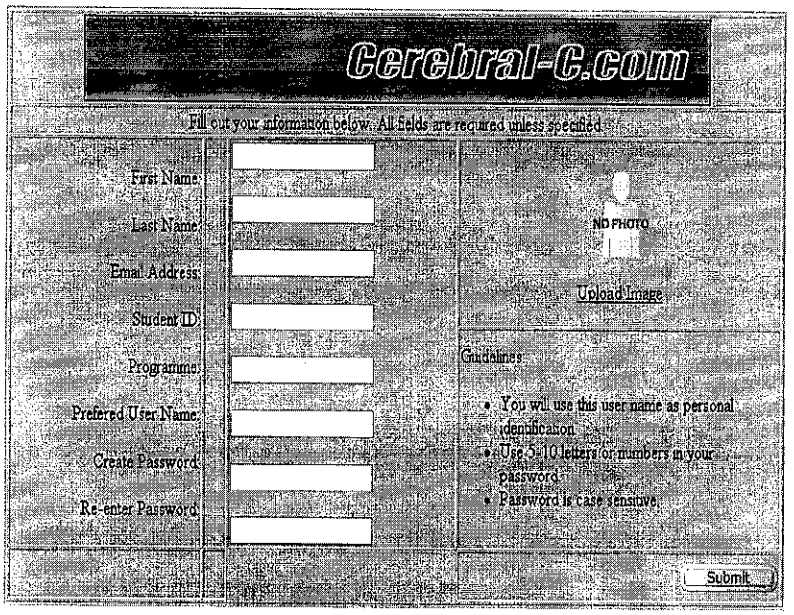

Figure 4.7: Registration Page

Figure 4.7 above shows the registration page for a new user. Personal information such as first name, last name, email address and etc are compulsory to be filled as a record for the lecturer to keep track on those who enrolled for that subject.

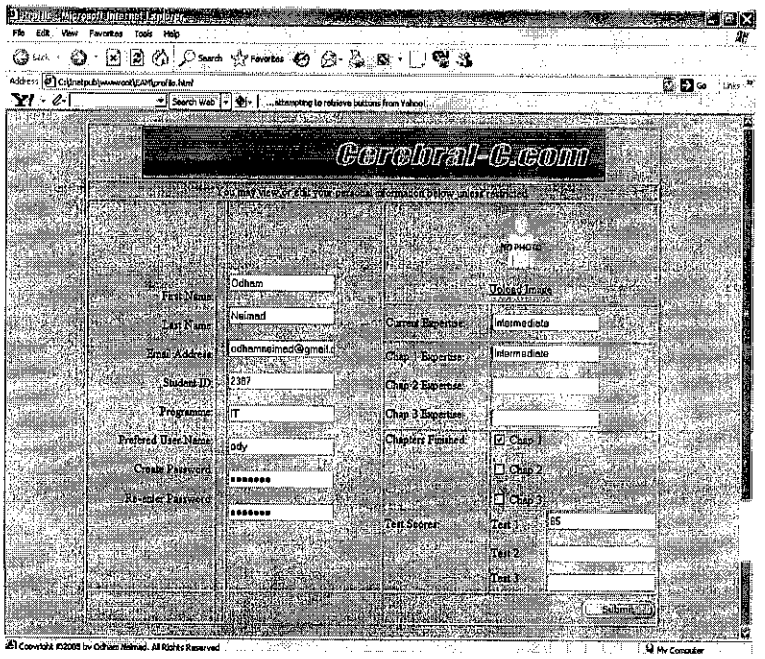

Figure 4.8: Student's Profile

Figure 4.8 above shows the information of the student's profile. Take note on the difference between the registration page and the student's profile page. At the right-bottom corner of the student's profile page, the current level of expertise, chapters finished, and test scores for each chapter are displayed. However, those fields are made disable for students to edit because they should be automatically defined by the EAM.

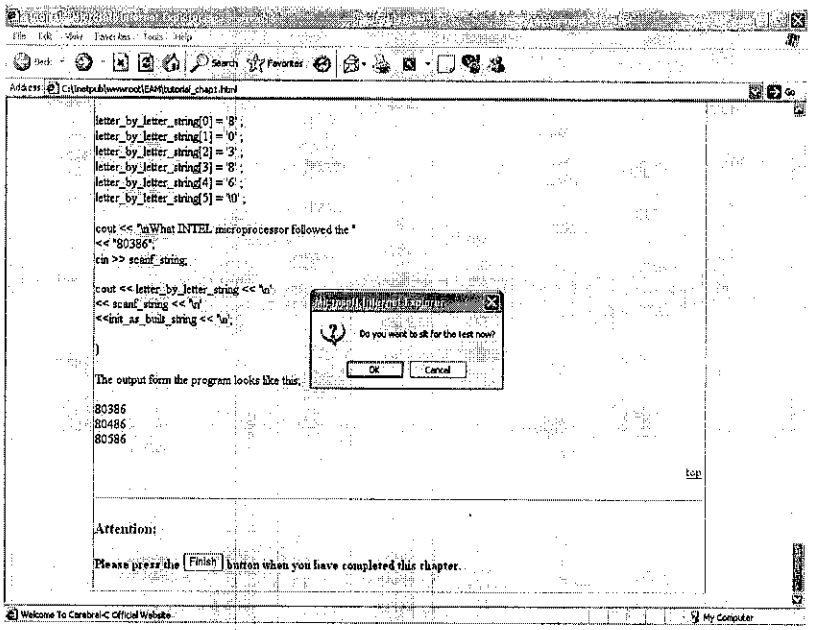

Figure 4.9: Tutorial Page

Figure 4.9 above shows the tutorial page of the Cerebral-C.Com. Students are required to click on the Finish button at the bottom of the page whenever he or she has completed the particular topic. Once the button is clicked, the student's profile will be updated and a message will be prompt to ask whether the student wants to sit for the test now or later.

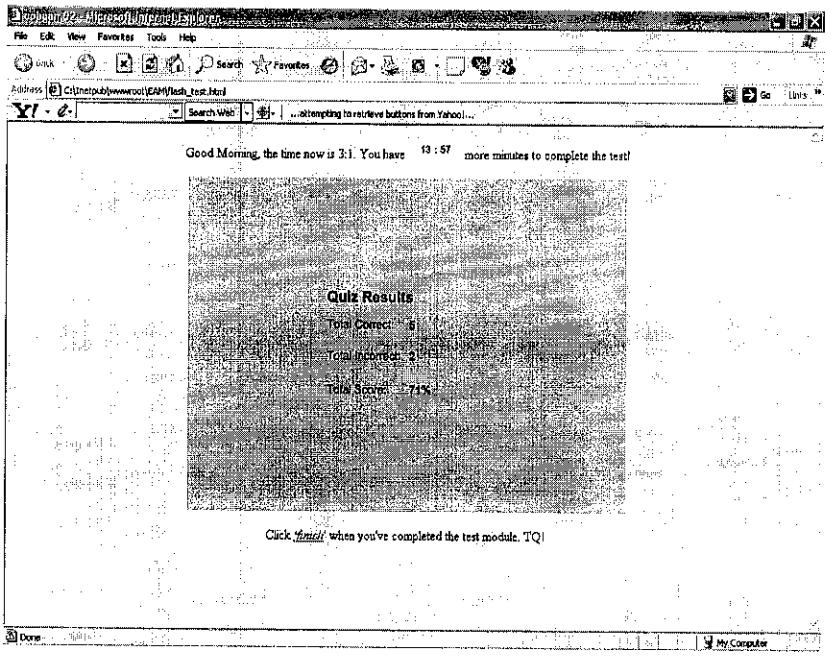

Figure 4.10: Test Result

Figure 4.10 above shows the test result once the student has completed the test. The total correct and incorrect answers, and the total scores gained are displayed for reference. The student can check his or her latest updates by clicking on the user ID hyperlink or continue with the preceding tutorial by clicking the continue button.

Compiler Module Deployment & Configuration

The user's capability to compile the source codes online without having to install a third-party compiler is an additional feature that has been identified as useful to guide the learning process. By installing a Microsoft Visual Studio.Net that recites on the server, the readily packaged C-Compiler can be invoked by using a simple command line "*system.diagnostics.process.start*" from the ASP. However, this feature is not under the scope as far as this project is concern. Therefore, this portion will not be developed.

Arrangement of the Course Content

For the purpose of this project, only two early chapters of C programming will be covered. The first chapter is basically regarding the use of array while chapter two is about dynamic memory allocation. With the time-frame allocated to complete this project, it is almost impossible to be able to cover all the topics. Thus, the first two chapters were selected just for the sake of showing how the EAM will affects the presentation of the contents of ITS.

It is believed that proper understanding of the course contents and the best approaches used to present them may affect the effectiveness of this project. Thus, the ITS is structured in such a way, that all students are initially assumed as beginners so that the system will be able to give the same amount of 'attention' to them. From there, the EAM will try to adapt to the student's level of expertise by modifying the website's layout into the most suitable cascading style sheet to guide them through the learning process from chapter-to-chapter. In between every chapter, a test module will be provided so that the EAM can assess the students' performance and determine the best approach to present the preceding learning materials based on the test score. Students will also be able to ask for help at any point of time during the learning process.

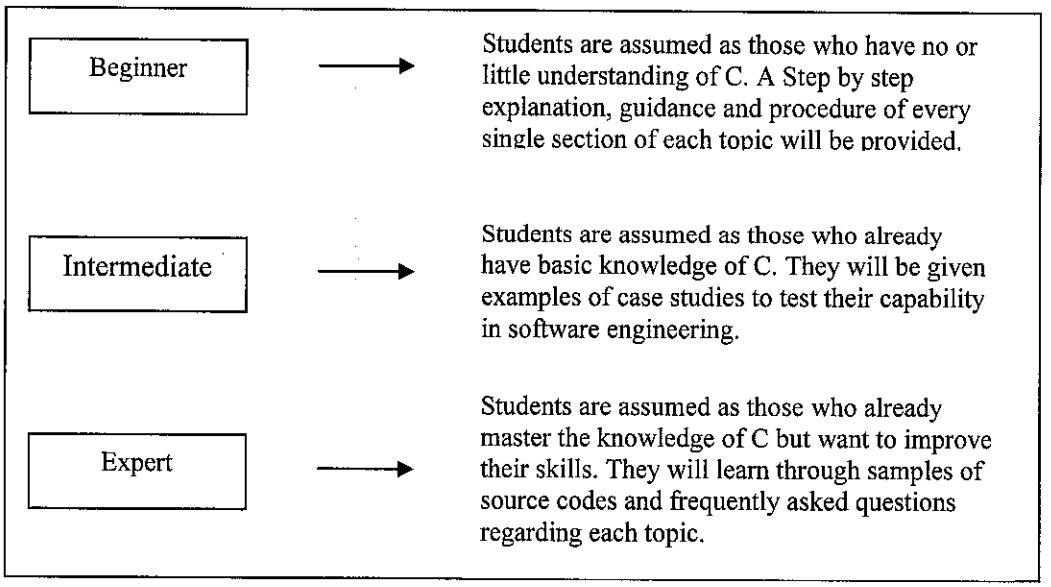

Figure 4.11: Pedagogical Approaches for Students with Different Level of Expertise

4.1.3 Implementation / Integration & System Testing Phase

During the implementation phase, the main components of the system are integrated together. These components including the ITS, EAM, C-Compiler and TestBank are linked to each other through the provided hyperlinks. By clicking on certain links, information are sent to the server and corresponding information will be processed and used to retrieve appropriate data from the database.

An Internet Information Server (IIS) will be setup to host the complete system online in which all the components will be stored in the root folder of the local host. The main concern of this activity is to ensure the availability, reliability, traffic congestion and speed of the internet connection are sufficiently meet a satisfactory level as it will give serious impact to the successfulness of the system testing.

Nevertheless, the system will be tested as a whole to check for its validity of the paths or links between each component, system's usability in terms of its functionality and bottom-up test to check for individual's capability to run on its own. Detail explanations of each test were given under Chapter Three.

A User Acceptance Test (UAT) had been conducted successfully under this phase. Questionnaire is chosen as a mean for data gathering method because it is a fast and effective mechanism as well as it gives a higher return rate compare to other methods such as interview or observation. The questionnaires had been randomly distributed to a group of 30 students of University Technology PETRONAS which compromises of 15 male students and 15 female students. Respondents were asked to answer several questions which cover three main issues including the people, process and technology. Several conclusions are gained from the analysis on the information gathered as in Figure 4.12 shown below:

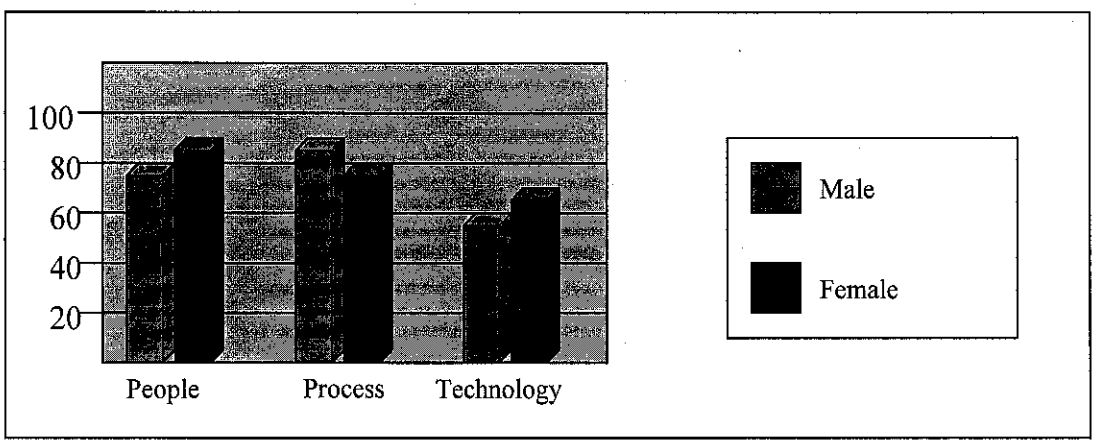

Figure 4.12: Users' Satisfaction Level on the People, Process and Technology Issues

From the graph above, we can see that in general, users are highly satisfied with the overall system. Most of the students are comfortable with the development and implementation of the new system and find its Graphical User Interface (GUI) as easy to understand and convenient to use. This is denoted by the total of 85% of both male and female students are satisfied with the new system regarding the people issues.

Nevertheless, another 85% of students are agreed to the fact that the new system has been identified to be effective to guide the learning curve. The process flow has helped students to master the subject of C Programming more efficiently by improving the current online learning system. Students are now able to learn the lecture materials and practice the knowledge gained through the given test module. They can also personally monitor their performances and become more motivated to complete the course.

However, 65% of the students are not very satisfied with the technological issues of the new system. They had faced several minor difficulties when accessing the system due to the slow connection of the network. Other than that, a compatibility issue had also risen as there are a few students who use other Operating System than Windows. But needless to worry, the students had been advised to get an appropriate browser technology that could support the functionalities of the system in order to solve the problem. Most of the problems arise because the users do not have the latest version of Macromedia Flash Player to run the test module. The questionnaire's template is given under Appendix A.

4.2 DISCUSSION

This project is aimed to provide a realistic knowledge based system that associates relevant exercises to enable an effective evaluation of the potential use of the system in teaching C Programming for university students. A thorough research and survey had been conducted in order to strengthen a solid foundation for knowledge-wise and the development activities. However, while developing the system, several problems had likely to rise.

Firstly, it was apparent that the system needs to be flexible as learners might come from different backgrounds, level of knowledge and expertise. Students could not always be expected to complete an exercise to the level of detail expected by the system. Therefore, the EAM is developed to be flexible in such a way it can randomly chose the test questions from the TestBank based on its level of difficulty that suits the students' level of expertise.

Secondly, it is doubt whether the C compiler is capable to give feedback up to the expectation of third-degree error reporting to EAM when the students compile the source codes. What is possible is that to export the compiled result into a temporary text file so the system can cross-reference with the sample answer schema stored in the database.

Thirdly, from the research conducted earlier, it is understood that the C compiler can be executed by sending messages from a ShellProg program that runs on UNIX. Unfortunately, to date there is still no other similar research has been conducted to prove the compatibility of the C compiler to be 'called' from a Windows based platform. However, a solution has been gained and that is to develop the system using Microsoft Visual Studio.Net. The already pre-packaged C-Compiler bundled with the software can be 'called' easily using a simple command line "*system.diagnostics.process.start*" from an ASP application.

Last but not least, some university faculty members are strong proponents of internet use. They believe web-based courses can provide educational opportunities to students who would otherwise have to do without, and they believe those courses can be of a quality comparable to traditional lecture courses. At the same time there are many university faculty members who are suspicious of such courses and have significant doubts about a medium that does not include face-to-face contact between instructor and student.

According to a research conducted by John Dutton, North Carolina State University, had demonstrated that students taking an entirely web-based course perform as well as or better than students taking the same course in a traditional lecture format. He compared two sections of the same computer science course, taught side-by-side by the same instructor and graded in the same way. The findings showed that students in the online section learned as much as their traditional lecture counterparts, as demonstrated by somewhat better examination and course grade scores. However, although the average course grades were at least as good, the online students were less likely to complete the course. The higher dropout rate for online classes has also been noted maybe due to less supervision of the lecturer over his students.

Therefore, a thorough research must be conducted earlier in order to identify who are likely to enroll for the online course and what are the mechanisms that can be used to control and monitor the students' performance. Nevertheless, we also need to determine what are the factors influencing performance among online students and whether those factors might differ for online and lecture students. Information about success in online classes would prove useful for both guidance and course development purposes.

Other problems can be considered as minor, but still need to be carefully soughed out such as the contents of the subject, the representation of learning materials, students' grading issue, and the reliability of the system to be made online. It is important to make sure that the modules or components are able to interact with each other in a proper manner to produce good result. Data sent by users must be "sanitized" properly to avoid

data processing error, and in the same time must be stored in a proper format at the correct location. All information must be considered as equally important. The main purpose is to produce a good integrated system to ensure a fully tested, verified and error-free system.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

This project is hoped to improve the effectiveness of existing online learning system so that learners will find it more convenient to use, motivated and determined to master the subject of C Programming. It is expected that the output obtained could assist both the students and lecturers in learning and teaching the subject more efficiently.

5.1 RELEVANCY TO THE OBJECTIVES

In the new era of technology advancement, e-learning systems has fast becoming one of the latest and increasingly gaining reputation among learners, business associations and the other IT users. To maximize the usefulness of information, a business must manage it correctly, just as it manages other resources. Although information is all around us but it is not free, thus a strategic plan in manipulating them must be taken into consideration seriously.

But when we talk about *online-learning*, what does it really means? Online-Learning or E-Learning occurs when both education and training are delivered and supported by networks such as the Internet or Intranets. By which, learners are able to learn at any time from any place convenient to them. Nowadays, thousands of university courses have been developed for delivery entirely via the web. This trend will only accelerate as more colleges and universities urge faculty to create online versions of their courses. It has been proven to be helpful in other sectors including Human Resource training in many organizations. In any e-learning project, there are three main factors that should be considered from the outset including:

1. The effect of the final product on the intended learners.
2. The ability of the organization to support and adjust to e-learning.
3. The role and requirement for e-learning instructors.

Experience has shown that most e-learning efforts focus on the first two factors exclusively and only give a few seconds thought to the third. This is a serious mistake. To be effective, any e-learning project must ensure that equal weight and consideration is given to all three factors. Failure to do will yield poor or less then desirable results.

Therefore, this research is aimed to understand the importance of a web-based tutoring system and the field of Artificial Intelligence and how this concept can be utilised as a learning method for programming students. The main objective is to provide an internet or intranet access for university students to learn, practice, and master the knowledge of C Programming, effectively and efficiently. Through this system, students are able to do so from anywhere and at their own convenient time.

The field of Artificial Intelligence should be explored widely as there is a potential for it to evolve due to the high demands from the education, medical, and military prospects just to name a few. The development and integration of a prototype of EAM with the ITS that consists of AI components has helped to guide the students with step-by-step procedures by providing hints and tips of important topics and diagnosing their performances through the given test modules.

A structured pedagogical approach is adopted to guide students throughout the learning curve. Students are required to complete the syllabus from one chapter to another in a gradually manner. In between every chapter, students will have to sit for a test module that is generated automatically by the EAM before advancing to the preceding chapter. The test module conducted online is seen as a control mechanism to monitor the student's performance. Based on the test result, the students will then be further categorized into their respective level of expertise so that EAM can determine the best pedagogical approach to present the next learning material.

5.2 SUGGESTED FUTURE WORK FOR EXPANSION

Successful e-learning systems must have the basic skills required to teach online including the ability to introduce topics, engage participants, move topics ahead and summarize discussions. Nevertheless, these basic skills should also be supported with a solid knowledge of computers and the learning management system through which the organization intended to deliver its online learning system. The only problem is that there are probabilities to be unable to monitor the participants, read their non-verbal messages and influence their participation through out the course. Therefore, the people and process issues need to be seriously considered from the technological perspective before designing an online learning system.

Should there is an opportunity for improvement in the future, more functionalities are thought useful to be added into several areas. Among others are:

1. To include user interface personalization, where users are able to choose their preferred representation of the look and feel of the system.
2. To include the usage of multimedia elements such as sounds, videos, or animations to make the learning experience more enjoy full for students.
3. To develop an internal forum / discussion board so that students and lecturers can exchange knowledge and latest information faster and more conveniently.
4. To develop an extra feature for EAM that is capable of generating a report or summary of the tests conducted on registered students.
5. To develop the back-end interfaces for administrators to updates, monitor, or change the learning modules of the system.

Those functionalities mentioned above do not only make the learning experience more enjoy full and convenient for students, but at the same time, they are also seen as capable to produce better results and sustain longer assurance that students will complete the course than compared to the traditional learning method.

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APPENDIX A: SAMPLE OF QUESTIONAIRE

Instructions:

This questionnaire is for evaluation of the Final Year Project (FYP) entitled Expert Assessment Module (EAM) for Intelligent Tutoring System (ITS). You may browse through the website at http://160.0.106.32/eam/login(id).asp. It is intended to teach tertiary students the subject of C-Programming with the support of Artificial Intelligent components.

Your participation is important to us. The responses are the feedback we need in order to make a proper assessment of the course. It is our goal to develop courses which attract, stimulate and educate students. This evaluation will help to meet that goal. Please, feel free to complete the questionnaire and submit back to us through the MIRC.

General Questions:

1. Student ID: _____
2. Programme: _____
3. Semester: Year ____ Sem ____
4. Gender: ☐ Male ☐ Female

Questions Related to the Project:

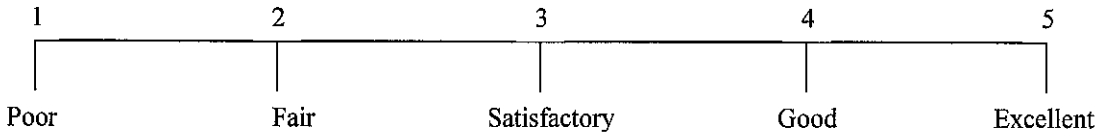
1. How did you learn about this course?

   ☐ College publication
   ☐ Referred by a friend
   ☐ By yourself
   ☐ The internet

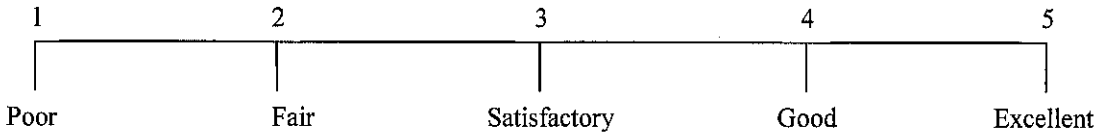
2. Why did you take this course?

   ☐ Personal Interest
   ☐ To earn college credits
   ☐ Degree requirements
   ☐ As an elective subject

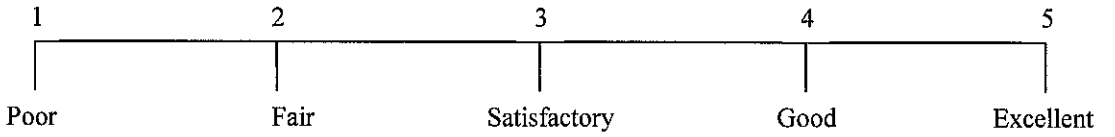
3. How do you rate the course web pages regarding: ease of use, functionality, and appearance?



4. How do you rate the instructions found in the syllabus and welcome pages?

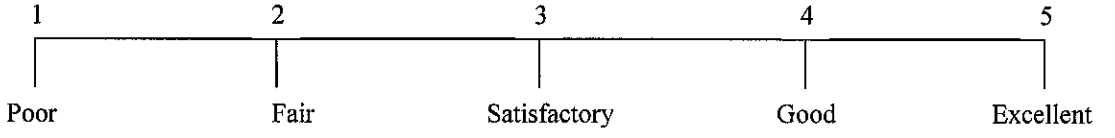


5. How do you rate the course lectures and content?

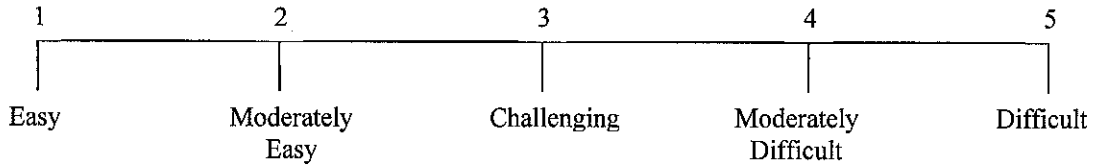


6. How do you rate the course workload?

7. How do you rate the web assignments?



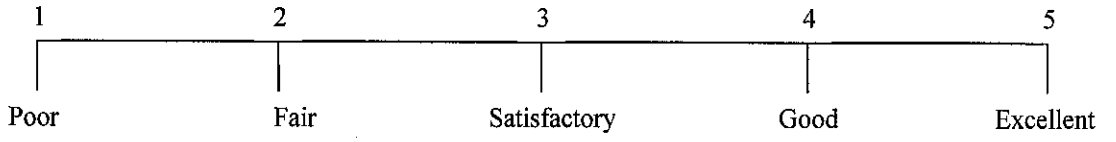
8. How do you rate the quizzes and tests?



9. Regarding the course workload, which of the following would you suggest? (Select all that apply.)

- ☐ Add extra-credit assignments
- ☐ Add writing assignments
- ☐ Add web assignments
- ☐ Add questions to the quizzes
- ☐ Make no changes. Leave the workload as it is.

10. Overall, how do you rate this course?



11. Comments:

-Thank You-

APPENDIX B: SUGGESTED MILESTONE FOR FINAL YEAR PROJECT

No.	Detail / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	**Requirement Definition**														
	- Preliminary research work														
	- Identify problem statement														
	- Set objective & scope of study														
	- Define system's requirements														
	- Submission of Preliminary Report		●												
2.	**System & Software Design**														
	- Reference / Literature														
	- Define detailed system's specifications														
	- Project planning														
3.	**Development & Unit Testing**														
	- Interface design & development														
	- Functional module development														
	- Database development														
	- Submission of Progress Report					●									
4.	**Integration & System Testing**														
	- Modules integration														
	- User Acceptance Test														
	- Pre-EDX presentation								●						
5.	**Project Closing & Submission**														
	- Submission of Final Draft Report														
	- Oral Presentation														
	- Submission of Dissertation Report														●

● Suggested Milestone

Phase / Process