Structural Example-Oriented Tutoring System

By

MIRWAN ASHRAN MUSTAFA

FINAL PROJECT DISSERTATION REPORT

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(Information System)

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Universiti Teknologi Petronas

Bandar Seri Iskandar

31750 Tronoh

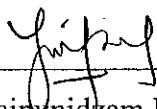Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information Technology Programme
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In partial fulfillment of the requirement for the
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Approved:

_____
Mr. Saipunidzam Mahamad
Project Supervisor

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

JUNE 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 the original work contained herein have not been undertaken or done by unspecified sources or persons.

Mirwan Ashran Mustafa

ABSTRACT

Structural Example-Oriented Tutoring System is a web-based tutoring system that uses examples as the main form of knowledge management that is structured to the level of the difficulties. The objective of this project is primarily to develop the system by implementing the structural and example-oriented tutorial concept. The scope of study for this project is generally down to the course of developing the system, including research about the system and the subject that the system is tutoring for. The intended user for this system is for UTP students who are taking Introduction to Finance subject. The methodology used for developing the system is an evolutionary approach, which followed five main processes namely project identification, requirement analysis, system specification, system development and system testing. The finished product will hopefully be used in the market, uploaded to a host site for users to access through the internet. Side by side with the traditional tutoring system, the system will complement the current system in helping the process of learning the subject matter for the users.

ACKNOWLEDGEMENTS

In the name of ALLAH, the Beneficent and the Merciful.

The utmost gratitude to Mr. Saipunidzam Mahamad for being my supervisor who has tirelessly guiding the author in his Final Year Project development. The author has been fortunate enough to be under you supervision for which you have shown him a lot of things that are very useful and helping for him to complete this project. Even with tight time schedule, you have managed to support and give advices that are they key factor of finishing the project in time. Without your relentless effort to guide and supervise him, the project will not have been successful. Thanks again for being so patient and if given a chance, the author would be very happy to be working under you again. Thank You.

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Special thanks to the author's parents who have brought him up and support him from behind especially during the completion of his degree in UTP. The author's appreciation goes to his family and relatives for giving support and guidance unimaginable.

Last but not least, the author would like to thank everybody that have been directly or indirectly involved in this project whether by giving support, opinions and critics for this project. And finally again to his parents who have been supporting him since day one, and to his entire colleague who are taking this Final Year Project together. Thank You.

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

1. UTP - Universiti Teknologi Petronas
2. IS - Information System
3. HTML - Hyper Text Markup Language
4. SDLC - System Development Life Cycle
5. ITF - Introduction to Finance
6. GHz - Giga Hertz
7. GB - Giga Bytes
8. VB - Visual Basic
9. VB.NET - Visual Basic.Net
10. DB - Database'
11. IIS - Internet Information Services

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Ideas and concepts that students develop in current education environment are usually based on classes, lectures and tutorial/laboratory exercises. But according to students, they learn a lot more during the tutorial period rather than the lectures itself. This is mainly because of the increased size of classes, students find it hard to concentrate let alone participate, and lecturers also have problems to find the ways of presenting the content, with some essential topics often left behind as they try to keep up with the current schedule and teaching scheme.

Much effort has been devoted to find alternative ways of improving the effectiveness of large class teaching, and they have come up with the tutorial system. Basically, the tutorial system is a gathering that consists of several students and a tutor whom will answer any question that the students don't understand during their classes/lectures.

This tutorial system then evolves from the traditional tutorial classes into an online tutorial system. With the online system, students can spend a lot more time on the tutorial at their own preferred time from the convenient of their home/hostels.

This project will be focusing on developing a structural example-oriented tutoring system. It is basically a tutoring system that uses examples as the method to pass the knowledge to the students, while structurally divide the tutorials according to the level of difficulties..

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1.2 BACKGROUND OF STUDY

The project is about developing a tutorial system that is accessible as a web-based application. A tutorial system is a system that helps students understand more about the subject that they have learned in their classes/lectures. In essence, the system contains questions and examples on how to answer the question.

Examples are used because the natural instinct of human to imitate what they see. Imitation can be a fundamental basis of human learning. Early on, children learn by repeating what adults do, and gradually learn more and more sophisticated ways of incorporating aspects of the observed behavior of others, into their own behavior. It is clear that observation and imitation from examples are the best way in education, learning and tutoring.

In order to develop a tutoring system as required in this project, a web-based system will be used as the platform. This platform is better than a stand-alone system because it can reach the user more easily. Users can access the tutoring system by using their internet-connected personal computers/laptops from their hostels/home. This system allows access over the World Wide Web using web browsers and will be available most of the time.

1.3 PROBLEM STATEMENT

The system is developed to overcome the problem identified in the preliminary stages of the system problem identification analysis.

1.3.1 Problem Identification

Students might be facing problems and complications to learn and understand everything by just attending the lectures. Too much lectures itself would probably not help or just not clear enough for students to understand the actual meaning of the subject learned. This could lead to misleading information about the subject because the students might not be able to interpret and use the information learned, as they might just understand the theory but can never relate it to the actual environment because they have never seen it done in the real world.

The major problem in developing this system will probably be on how to develop a tutoring system using only examples. It means that the only way for the system to give out the tutorial to the user/student is by using examples such as illustrations and models. My knowledge about the subject that the system will be tutoring on must be accurate and reliable in order to tutor the user/student to the correct outcome. In order to do this, the author has to fully understand the specific subject and also take into notice any problems that might show up during the tutoring process. The failure of doing this may result an unreliable outcome for the user/student to consume.

1.3.2 Significant of the Project

The Structural Example-Oriented Tutoring System is developed in order to overcome those disadvantages mentioned above and also to improve user's knowledge on the subject matter. Basically, the system is worth it in terms of cost and time. It will practically behave like a tutoring system and it will probably be more effective because of the examples method.

1.4 OBJECTIVES AND SCOPE OF STUDY

This project is developed with its objectives to be achieved and within the scope specified.

1.4.1 Objectives

The objectives of the project are:

1. To develop a web-based tutorial system that uses examples as the main form of knowledge management.
2. To implement a design of structural tutoring system according to the level of the difficulties.

1.4.2 Scope of Study

The scopes of study for this project are:

1. To develop a web-based structural example-oriented tutoring system.
2. The targeted user for this system is for UTP students who are taking Introduction to Finance subject.

1.4.3 Feasibility of the Project within the Scope and Time Frame

This project can be deemed as technically feasible as the scope of the project is limited to developing a tutoring system. There is no relative cost related to the project as the tutoring system can be developed using software that is already available in the laboratory here in UTP. There are also adequate resources available to support the project, such as books, online resources, lecturers and students.

The time frame given to complete the project is also sufficient. The Gantt chart produced indicates the time allocated for each task it serves as guidance for project execution. Please refer to *Appendix A* for reference of the project Gantt chart.

CHAPTER 2

LITERATURE REVIEW AND THEORY

2.1 TUTORING SYSTEM

Tutoring system is a system that helps student to further understand more about the things that they have learned during their classes/lectures. Study has shown that "the design approach enhances student's satisfaction and performance" (Marian W. Radny & Aime B. Duval, 2004).

Ideas and concepts that students develop are usually based on lectures and tutorial/laboratory exercises. This traditional instruction scheme is, however, becoming more and more ineffective. This is mainly because of the increased size of classes, lecturers having problems to find the ways of presenting the prescribed content, with some essential topics often left behind as not fitted to the strictly prescribed course syllabus, and due to lack of meaningful class participation by students. Much effort in education has thus been devoted to find alternative ways of improving the effectiveness of large class. Among many ideas, a substantial number of IT software packages have been developed to support the teaching. [1]

2.2 WEB-BASED DESIGN

The current traditional tutorial system is becoming more and more ineffective. So, the alternative for the traditional sit-down-in-class tutorial system is the online tutorial system. This is because the online system will further the student to do the tutorial and understand the subject better. The online system is an assessment instrument designed mainly to probe a conceptual understating of the topics discussed in courses.

Research and study also has shown that online tutoring system can increase lecture participation by encouraging students to take an active part in tutorials and actively engage with the subject on a regular basis by making the course more prescribed (especially for not well prepared students). Students are also encouraged to develop skills to critically examine the subject matter and build on their personal confidence in the subject and develop a structured approach to problem solving. Last but not least, it encourages students to take responsibility for their own learning and develop skills for independent and individual learning.

2.3   EXAMPLE ORIENTED

As we already know, learning by examples is very much similar to imitation. The idea is that first we see, then we observe, and finally we do [2]. Imitation can be a fundamental basis of learning, in both animals and human beings. Early on, children learn by repeating what adults do, and gradually learn more and more sophisticated ways of incorporating aspects of the observed behavior of others, into their own behavior. We do not yet know to what extent we can ascribe imitative behavior in animals to an instinct to copy others or to some form of learning. It is clear, however, that observation and imitation are central capabilities for many forms of learning.

This is exactly why example-oriented tutoring system is the way to go nowadays. Since human don't even have language to speak, we can learn just by observing our elders and then do it ourselves. So, why do we need to change the way we have learn all along this time, the education that makes us human survives in this world until today.

So, by doing this project, the knowledge can be passed on the next generation by giving examples and demonstration in the form of illustrations and models so that they can really understand what they are learning.

2.4 STRUCTURAL CONCEPT

Structuring of individual class diagrams at a given level of abstraction is important to under-stand and manage the contained development information. Unstructured and overly complex class diagrams hinder the communication about the system. Structuring of a set of class diagrams at different levels of abstraction is necessary to trace the progressing system development from analysis to implementation. A flexible concept of refinement is used to connect the individual class diagrams and their contained model elements from a logical point of view. [7]

CHAPTER 3

METHODOLOGY

3.1 PROCEDURE IDENTIFICATION

This project is about the development of an example-oriented tutoring system. The development process of this project will consist of several phases; Project Identification and Requirement Analysis, and System Specification, System Development and System Testing.

The evolutionary prototyping approach was applied in this project system development. In evolutionary approach, the development is open to any changes in requirement that may suddenly appear in any phases through out the system development timeline. In other words, we don't necessarily have to follow exactly stage by stage of the project development cycle. Development goes on corresponding to the requirement changes. This could boost up the working progress and feasible within the time scope defined.

In the Project Identification phase, the author has held several meetings with his supervisor, and they discussed a little bit on the course of this project. Then, the author does some research in the library and also the internet to collect as many information as the author can to help him with this project. This is when the author does the requirement definition of the project, and also identifies any problems that might arise in the process of completing this project.

In the Requirement Analysis phase the author planned the schedule and the timeline of this project. The author also decided to make this tutoring system a web-based application system. And after several discussions with his supervisor, the author has decided to make a tutoring system that is targeted to UTP students. This is because of the facilities that are provided in the university are adequate enough to support this kind of tutoring system. Students nowadays also are exposed to computer is the early ages, so the internet is not a foreign place for them. So, the web-based tutoring system looks like the best platform for this project. And the author has also decided to use Introduction to Finance subject as the subject for this tutoring system.

In the development phase, the first thing the author did is start making the interface layout of the system using Macromedia Dreamweaver MX. The HTML that is built will be a platform for the tutoring module, which the author develop next using Microsoft Visual Studio.Net. A lot of system specification changes are done throughout the development stage of the project to avoid any surfacing constrains while meeting the system's requirements. System testing is also done parallel to the development of the system. This is to make sure that the system is fully functional and ready to be used when the project is completed.
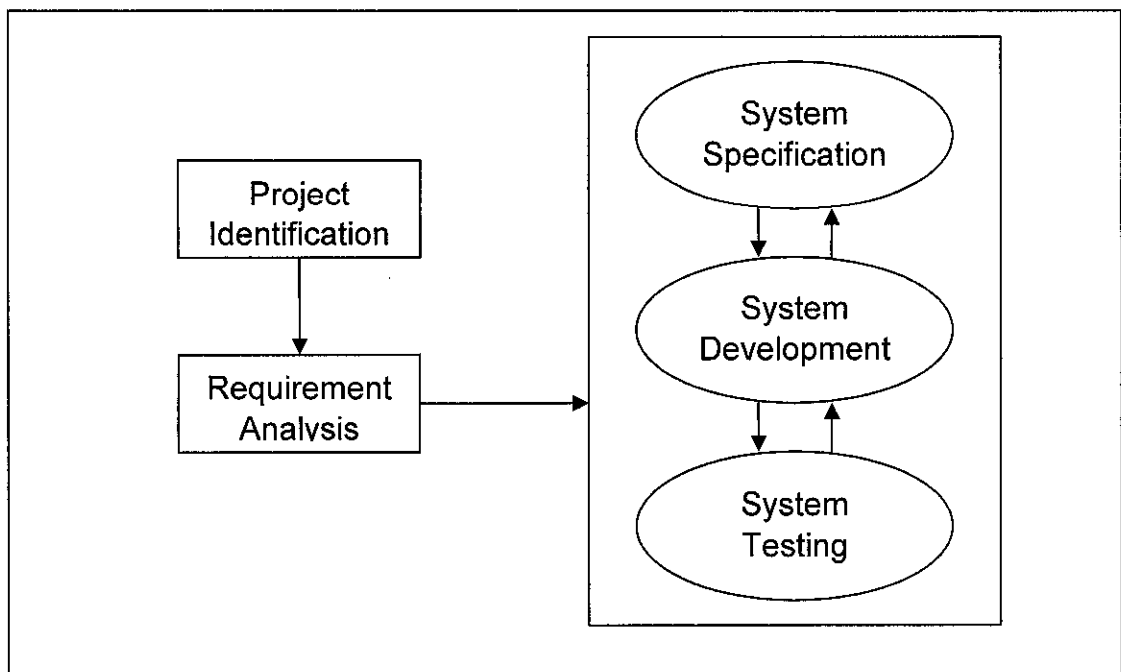
Figure 3.1 System Development Life Cycle

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3.2 TOOLS REQUIRED

These are the tools and applications software required in the development of the system:

3.2.1 Hardware

A Personal Computer (PC) with Pentium 4 3.01GHz processor, 1 GB RAM memory, and hard disk storage of 80GB.

3.2.2 Software

These are the tools and applications software required in the development of the system:

- Visual Studio.Net

  The software is used to build the tutoring system which includes notes, quiz and the tutorial itself.

- Macromedia Dreamweaver

  The software is used to build the platform for the tutoring system. The tutoring system that is built with Visual Basic is integrated and embedded into the platform that is made using this software.

- Microsoft Access

  This database system is used to store all the data that are needed in the system. Microsoft Jet 4.0 OLE DB Provider is used to connect the database to the system.

- Microsoft Office

  Basically, it is used to write reports, outputs and documentations.

- Internet Information Service (IIS)

  It is used for a computer to be a host of web server for the system.

- Internet Explorer/Mozilla Firefox

  These web browsers are used to gather information and data prior to making this project. These applications are also used to display the finished system to the user.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 KNOWLEDGE ACQUISITION

The knowledge obtained for this Structural Example-Oriented Tutoring System is done through knowledge acquisition process as follows:
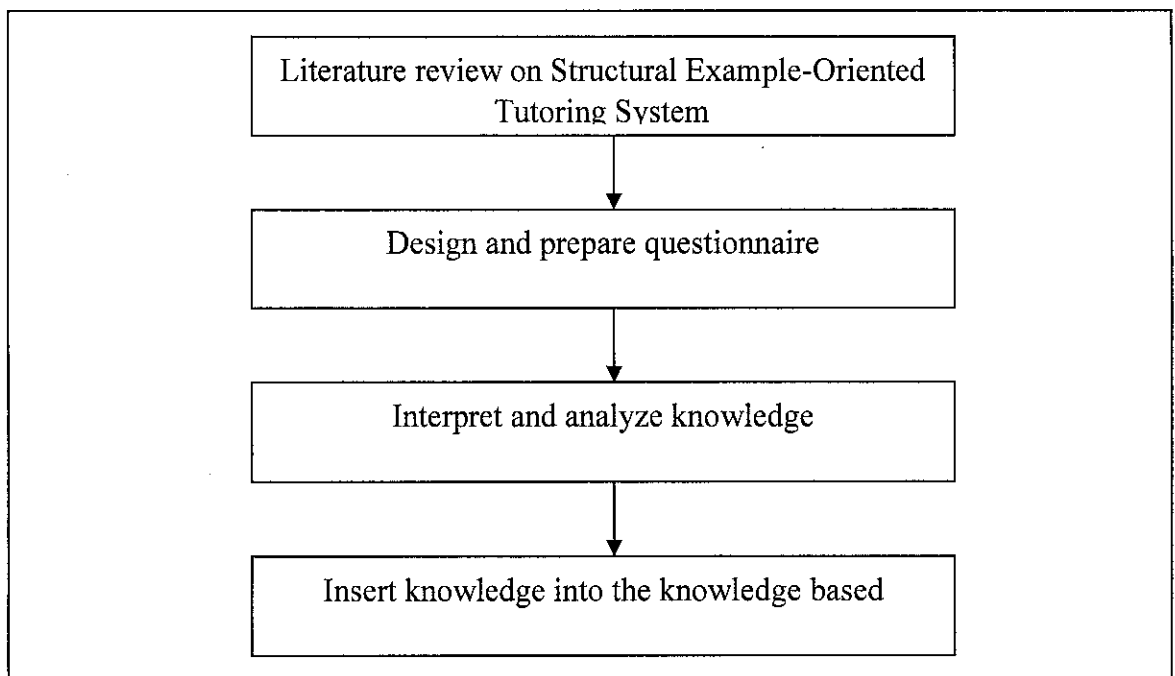
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┌─────────────────────────────────────────────────────┐
│   ┌─────────────────────────────────────────┐       │
│   │  Literature review on Structural        │       │
│   │  Example-Oriented Tutoring System       │       │
│   └─────────────────────────────────────────┘       │
│                        ↓                              │
│   ┌─────────────────────────────────────────┐       │
│   │  Design and prepare questionnaire       │       │
│   └─────────────────────────────────────────┘       │
│                        ↓                              │
│   ┌─────────────────────────────────────────┐       │
│   │  Interpret and analyze knowledge        │       │
│   └─────────────────────────────────────────┘       │
│                        ↓                              │
│   ┌─────────────────────────────────────────┐       │
│   │  Insert knowledge into the knowledge based │    │
│   └─────────────────────────────────────────┘       │
└─────────────────────────────────────────────────────┘
```

Figure 4.1 Knowledge Acquisition Flowchart

The knowledge acquisition started with a literature study on tutorial systems, and focusing on the structural and the example-oriented part. Literature study is done through research from books and other online literature resources. The purpose of having literature study is to learn the concept and theory related to this project which would be helpful in the system development process.

After getting the main picture of how the system should be and work, a questionnaire is prepared for the targeted users - in this case, UTP students who are currently taking Introduction to Finance course - to seek information and users' preferences. The important issues that need to be clarified from these surveys are:

1. Are tutorials needed in the subject (ITF)?
2. What are the problems with current tutorial system?
3. Do students prefer traditional class tutorials or online tutorial systems?
4. Which part of the subject need most tutorials on?
5. How do students think the Structural Example-Oriented Tutoring System will fare against traditional tutoring system?

All the data gathered from the process of research and questionnaire were then being interpreted and analyzed to build up the author's knowledge on structural example-oriented tutoring system. The analyzed data is constructed systematically to develop the rules of knowledge which were then inserted to the system knowledge based.

4.2 PROBLEM IDENTIFICATION AND ANALYSIS

The requirements of the system have been identified using the techniques as being mentioned before under the subtopic above. The data which has been analyzed shows that there is a need to address some of the problems identified. The system developed should cater the users' requirements in order to achieve the project goals.

4.2.1 Tutorials in Introduction to Finance

Introduction to Finance is a subject that most student rely mostly on its tutorials as the main way to learn the subject. This is because during the lectures, the lecturer always focuses on the theory and the concept of the subject. But it is during the tutorials where students get hands on activities on the subject.

To proceed with this project, the author has to gathered data from the students who are currently taking ITF here at UTP, to know about their opinions and preferences on their tutorials. Questionnaire with relevant question were distributed to the students in the ITF class. 30 respondents had answered the questionnaire and the result can be concluded as followed. Please refer to *Appendix B* for reference of the sample of questionnaire.
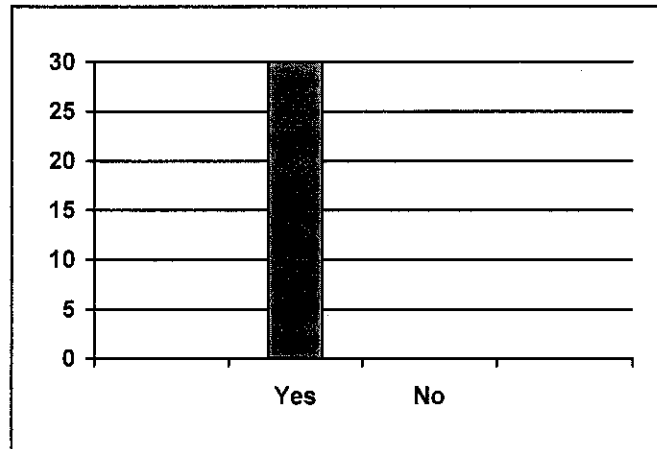

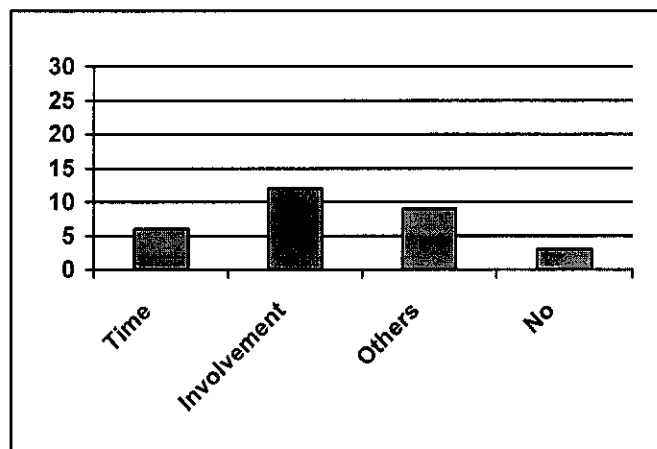**Figure 4.2** Importances of Tutorials in ITF

Figure 4.3 Problems with Current Tutorials

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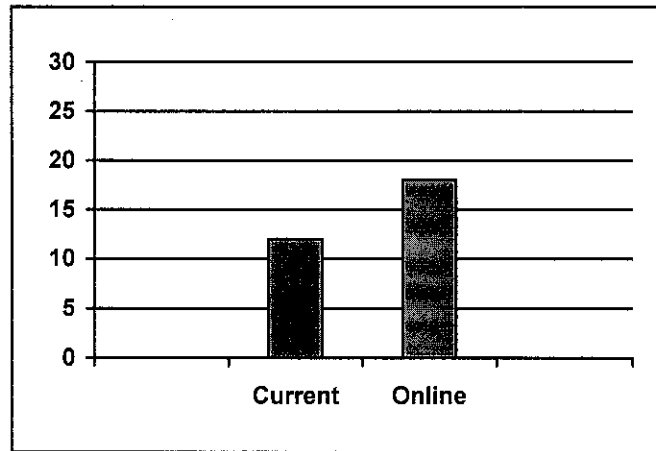
Figure 4.4 User Preferences
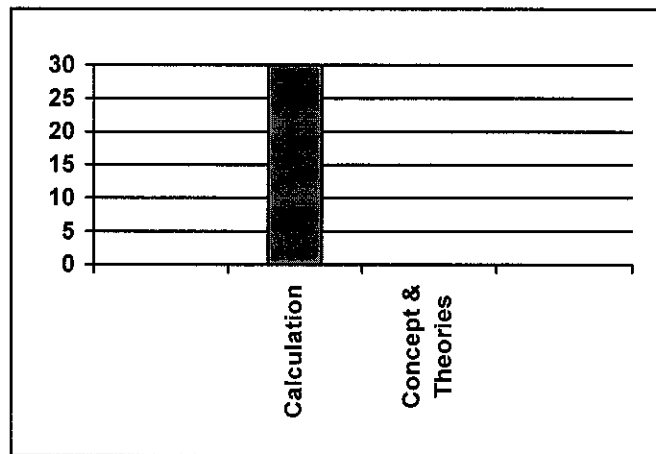
Figure 4.5 Parts Mostly Needed Tutorials

From the result, the author can finalize the students' most common option and preferences. The result can be summarized as follows:

Table 4.1 Summary of Questionnaire

Fields	The most chosen answer
The importance of tutorials in ITF.	Important
Problems with current tutorials.	Lack of participation.
User preferences of tutorial system.	Online.
Part that mostly needed tutorials.	Calculations.

Based on the result above, the author can conclude that tutorials are very important in subjects like Introduction to Finance. The main problem that they found in current tutorials is the lack of involvement from them. This is probably because the sheer size of the tutorial group is not sufficient to cater each and every students need. Thus, they prefer an online system to supplement their current tutorials because it is easier to access, and user involvement is purely decided by the hand of the user. According to the survey, the tutorial that they are currently had is mostly on the calculation part of the subject.

4.3 PROTOTYPE DEVELOPMENT

As stated in this report, the tutoring system that the author has developed is a web-based system. The system consists of three sections; Introduction to Finance notes from the respective chapter, a self test section (quizzes) and the tutoring system itself.

In the notes section, the system will display the notes according to the chapters selected by the user. The notes will be displayed slide by slide, PowerPoint style. The notes are stored in a database at the server.

The next section is the self test section that consist of questions and quizzes for the user to answer. The questions will be randomly picked from a database that is stored at the host workstation. The questions will be in the form of multiple-choice question and true or false question. After finishing the quiz, the system will calculate the user's score.

The main section is the tutoring section. In this section, the system will give questions for the user to answer. The question will be in form of multiple-choice. After the user has answered the question, the system will show the user the right way to answer the question with examples. If the user answered the question correctly, the system will take the user to the next level by giving a harder question. But if the user failed to answer correctly, the system will give another question with the same level of the difficulty as before. This process will repeat until the user manages to answer one question from each level correctly.

This is how the tutorial system works:

1. A question will be given for the user to answer.

Consider a bond with a coupon rate of 10% and coupons paid annually. The par value is $1000 and the bond has 5 years to maturity. The yield to maturity is 11%. What is the value of the bond?

2. The user answers the question by choosing one of the answers given.

A. $963.04

B. $1036.96

C. $918.18

D. $1081.82

3. The system will check whether the user answers the question correctly. While doing that, the system displays an example on how to answer the question.

C = 10%, PV = $1000, Yield = 11%, Years = 5

Bond Value = C * PV [1 - 1 / (1 + Yield) ^{Years} *] / Yield + PV / (1 + Yield)* ^{Years}

Bond Value = 10% * $1000 [1 - 1 / (1 + 11%)^{5}] / 11% + $1000 / (1 + 11%)^{5}

Bond Value = $963.04

4. If the user fails to answer correctly, the system will give another question of similar difficulty. Else if user manages to answer correctly, the system will raise the level of difficulty for the next question.

5. Repeat step 1 to 4 until the user reaches the highest level.

4.3.1 System Flow

The system flow for the Structural Example-Oriented Tutoring System will basically look like this:
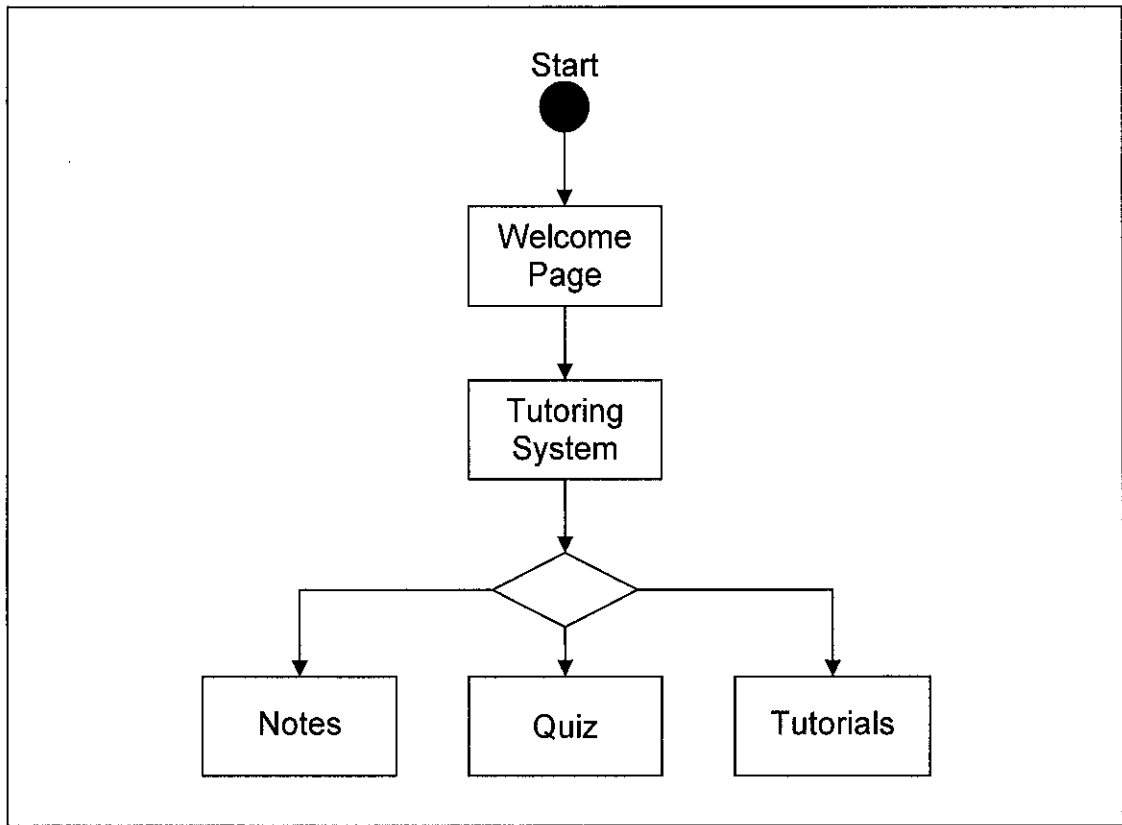
Figure 4.6 System Flow

The Structural Example-Oriented Tutoring System started with the welcome page. The user has to click a link to the tutoring system to start using the system. Then the system will pop-up and the user need to choose between the 3 modules: Notes, Quiz, or Tutorials.

In the notes section, the user will have to choose which chapter that the user wants to go to. Then the system will display the notes as slides, PowerPoint style.

In the quiz section, the system will give out questions to the user to answer. User have to choose correct answer the multiple choice answers given, or have to choose true or false during a true or false question. And user has to answer all questions. After finish answering all questions, the system will calculate the scores.

The tutorial section consists of both the notes and quiz elements. In this section, the system will give questions to the user to answer. After each questions, the system will show the user how to answer the question correctly. This is where the examples are shown to the user. This way, the user can compare their steps with the steps that are given by the system. If the user answered the question correctly, the system will take the user to the next level by giving a harder question. But if the user failed to answer correctly, the system will give another question with the same level of the difficulty as before. This process will repeat until the user manages to answer one question from each level correctly.
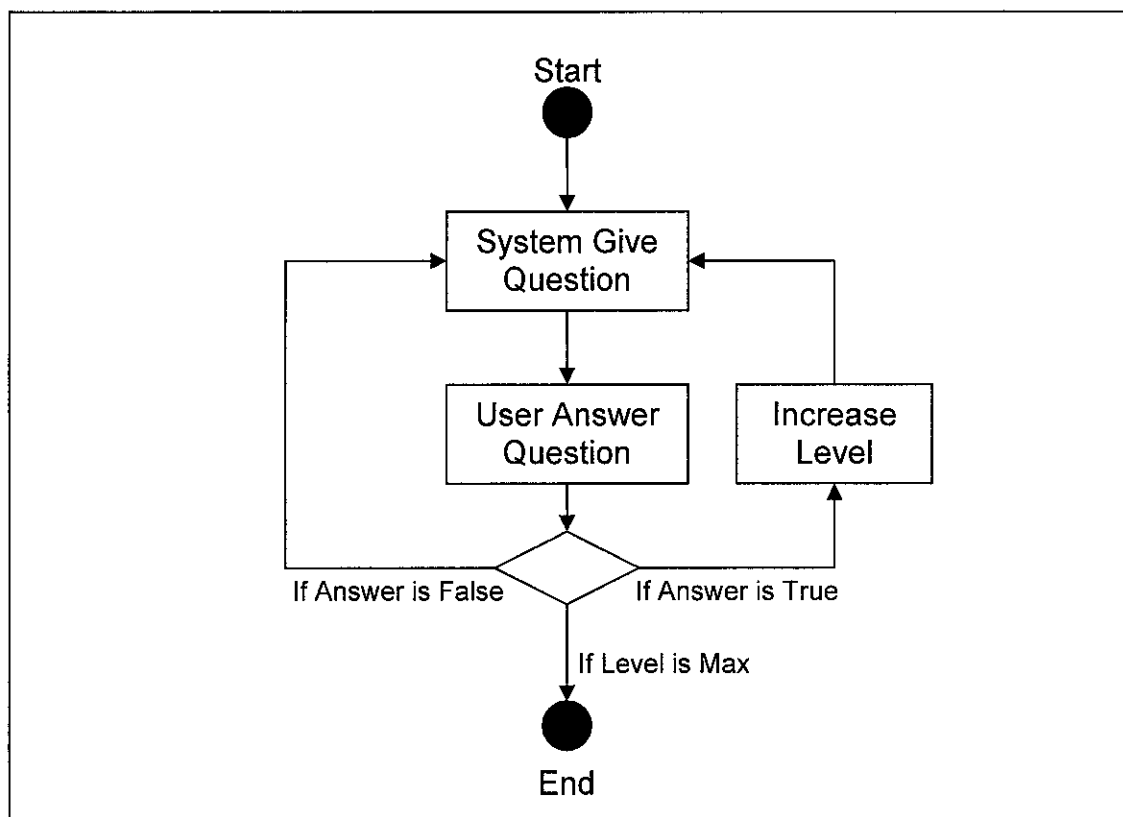

Figure 4.7 System Flow: Tutorial

4.3.2 Interface Design and System Integration

The interface was designed base on the discipline of web base heuristic approaches. The color scheme of grey and red is chosen as the main color, and every single pages of the system is developed in the same range of color to make it consistence and standardized. The software being used in web editing is the Macromedia Dreamweaver. Please refer to Appendix 3 to see the sample source code of interface design.
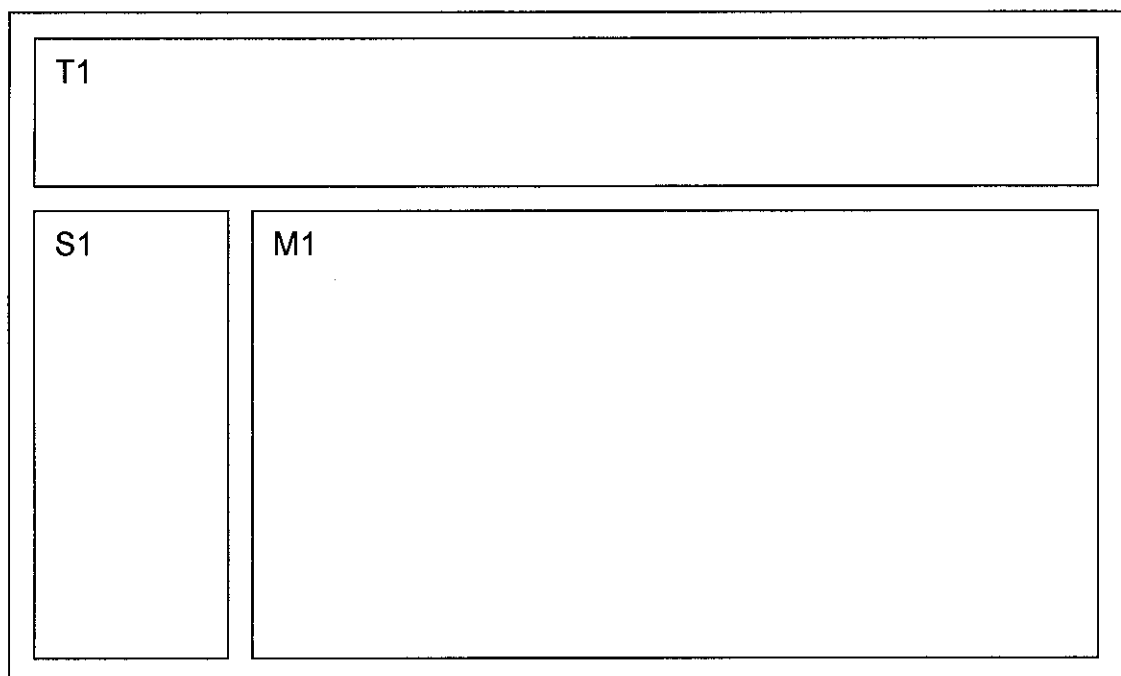
Figure 4.8 Web Platform Storyboard

T1:   Title - Structural Example-Oriented Tutoring System
S1:   Sidebar - Contain links to launch the Tutorial System and other pages
M1:   Main - The Tutorial System

The design template for the tutorial system also uses grey and red color to make it consistent with the web platform. The layout also must remain constant in every page so that the system will look consistent and organized. The storyboard of the tutorial system will basically look like this:
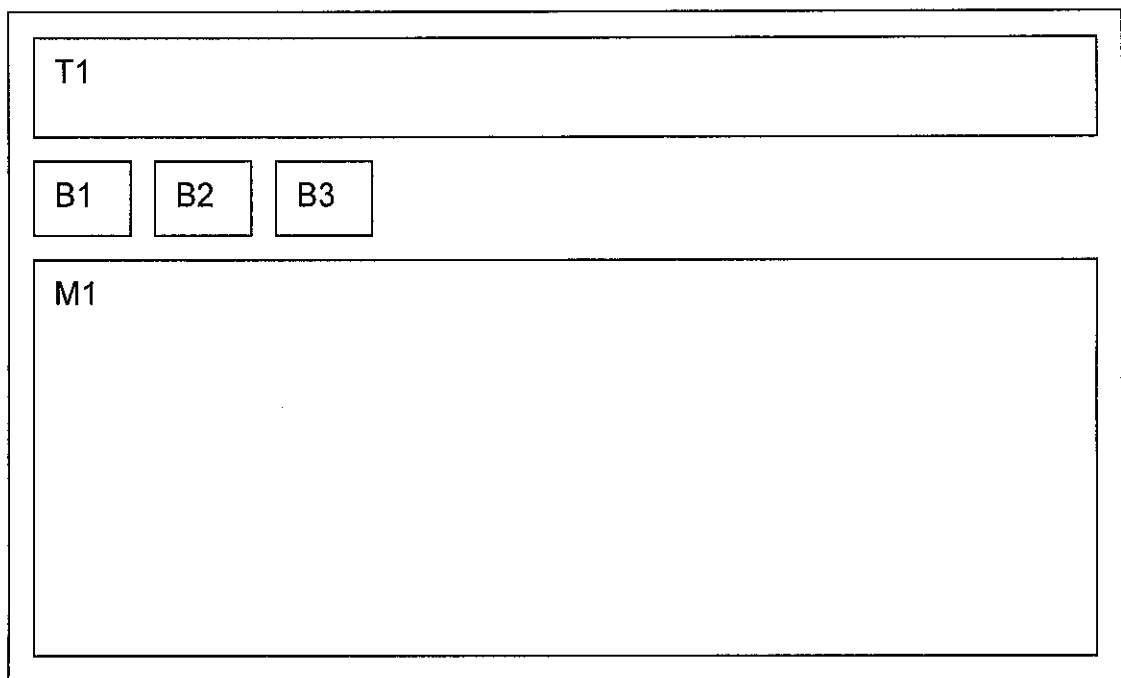
Figure 4.9 Tutorial System Storyboard

T1: Title - Structural Example-Oriented Tutoring System

B1: Button - Notes

B2: Button - Quiz

B3: Button - Tutorial

M1: Main - Main area for system

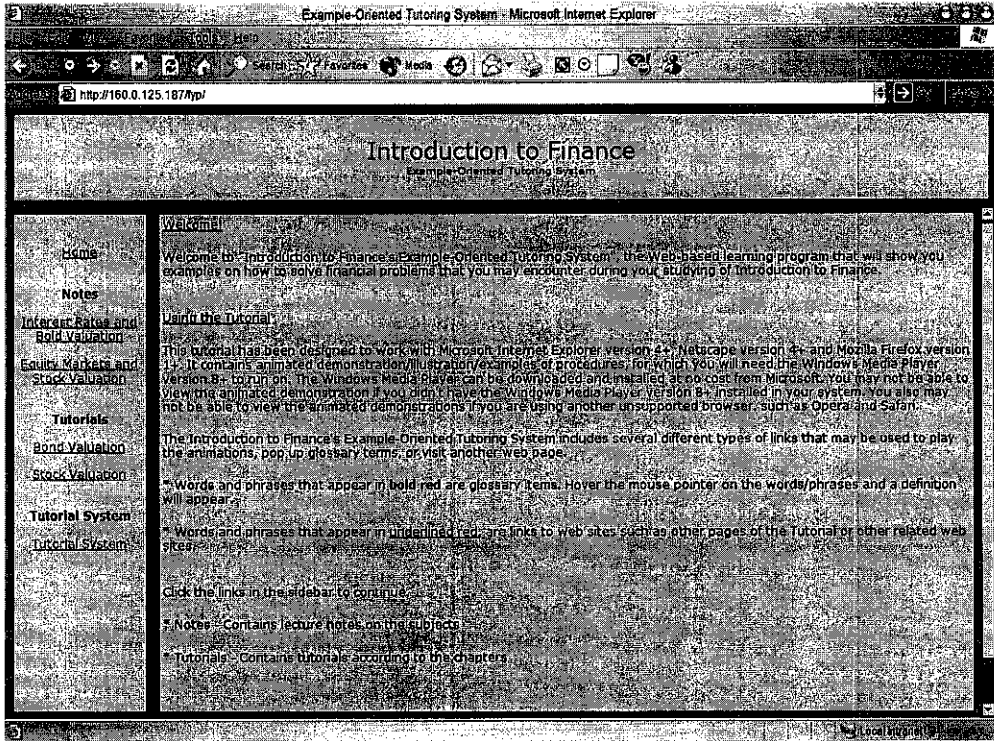Below are some of the output screens for the Structural Example-Oriented Tutoring System:

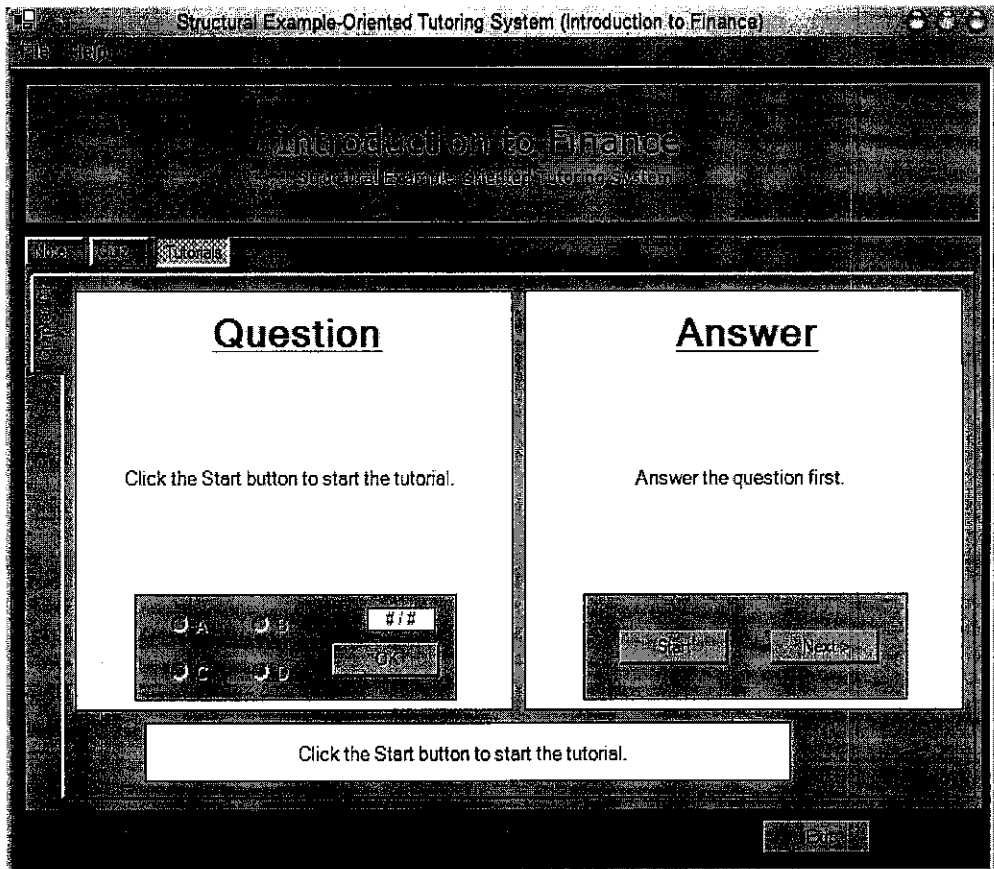**Figure 4.10** Structural Example-Oriented Tutoring System - Welcome Screen

Figure 4.11 Structural Example-Oriented Tutoring System - Tutorial Screen

4.4 SYSTEM TESTING

System testing occurred during the entire development process. The reliability of the system is one of the most important issues in knowledge-based systems. Reliability ensures that the system delivers its analysis and identification with consistency, accuracy and integrity.

The system functionality is tested by doing a system walkthrough. Every link and button is clicked to test the functionality and to ensure that it performs as it is intended to. The system input should present the related logic output. Any divergence happen on the predicted output indicates that there is a problem with the system prototype. The prototype cycle has to be started again until it becomes credible and acceptable. Only after that, the Structural Example-Oriented Tutoring System can be call complete.

The system testing is basically divided into two, which are:

1. Developer testing

    Developer will do a test during the entire stage of development. The testing would consider the system functionality and accomplishment. The developer will make sure that the system will work as it is intended to be based on the development done. The system is tested every single function that it has like buttons and links. The tutorial system flow is also revised by testing every single answer and possibilities to ensure that the tutorial system executes as wanted and able to help user gain knowledge from it.

2. User testing

    In this case, the system has to be used by the actual user (ITF students). They will use the system in real condition, where the system is used necessarily if it were to complement the current system. The reliability and usability of the system is measured here. Any lacking or incompleteness is added up to the system, and flaws will be improved based on the users' requirements.

4.5 RESULTS AND FINDINGS

Observation and analysis have been done through out the development process as to assess the system performance and achievements. Every flaws and problems identified were then immediately corrected and improved. From the developer testing, the author will only acquire the developer's point of view which is not necessarily 100% accurate. User testing has been conducted to measure the reliability and usability of the system in other perspective. Both of these testing are important as it is interconnected and crucial to produce a good expert system. The requirements made by users will influence on how the system will looks like, and the requirements identified will be manipulated and interpreted by developers as the system outcome.

As the author have already indicated before, there are two type of testing have been conducted during the development process. They are:

1. Developer testing
2. User testing

Both of them give different practice and result. Each of them is happen to have their own purposes and the result acquire would lead to improvements and adjustments to the expert system. Testing is one of the opportunities for the system to obtain new requirements that will be used for further enhancement to finally produce a sound tutorial system.

From the developer testing implemented, the result is as follows:

Table 4.2 Developer Testing Result and Action Taken

Area	Testing	Result	Action taken
Links and buttons	Click every link and button created in the system.	All links and buttons are connected.	-
Notes	Observe every slide one by one.	Found typing mistake in the notes.	Correct the typing mistakes.
Quiz & Tutorial	Test every possible selection by user, and see whether the system has a bug or not.	Some of the logic is nonsense and need to be revised.	Modify the logic block to make thing synchronize.
System Interface	Analyze the system interface by testing the usability and ergonomic value.	The interface is simple and easy to use.	-

From the result, it seems that the system developed meet the specification defined in the preliminary stage of system development. The development went through well and smoothly. Developer is able to develop the system as it is wanted to be. The first prototype is fully developed and ready to be tested by the user. 5 respondents have been chosen to test the system. The main purpose of doing this is to know the following characteristics from the user's perspectives. They are:

1. System reliability
2. System usability
3. System integrity
4. System accuracy

The questions rise regarding to this user testing are:

1. Does the system really help the user understand the subject?
2. Can the user fully utilize and gain benefits from the system?
3. How does the system help the user?
4. Is it a success or a failure?

All the 5 users were requested to do a tutorial using the Structural Example-Oriented Tutoring. But before that, the users are given a little time to adjust and familiarized themselves with the system. They were also asked to find any flaw in the system. Observation was made and the users were asked regarding to their opinion and experience acquired after using the system.

Several factors have been taken into consideration during this testing. The factors are as stated below:

1. Unfamiliarity to the new system.
2. Concentration divided.
3. Level of knowledge in Introduction to Finance.

These 3 factors may influence the result and makes it imprecise. As that matter several facts and assumptions has been made and they are:

1. The users selected are students who are taking Introduction to Finance class in UTP. They are learning the same subject from the same lecturer. Their level of knowledge regarding to the subject would be quite similar.
2. The testing was conducted in different day and time for every respective user. Observation and analysis is done systematically without rush or full loads. The data gathered would be more reliable.

From the testing and observation done, some of the features in the tutorial system need to be reworked and redefined. Below is the table illustrating the result of the number of success and failure that the user found during the user testing.

Table 4.3 Number of Correct Answers per Question

Users	Correct	Question
User 1	5	8
User 2	5	10
User 3	5	5
User 4	5	6
User 5	5	7
Average	**5**	**7.2**

From the testing made, the result can be concluded as follows:

1. The average number of Questions needed to complete the tutorial is 7.5. This means that; only 69.4% of the answers answered by the user are correct. It is just a bit more than half, which cannot guarantee the tutorial system reliability.

2. The users themselves don't really understand the subject and how to solve the problem given. But after the system shows the example, almost every user answers the next question correctly.

3. The testing is done over the network, which validate with the objective of developing an easily accessible web-based application for user to use.

Overall, the system cannot be fully acceptable yet as it does not guarantee that it can replace the current tutorial system. However so far, the benchmark for the system is 69.4% of success rate.

4.6 SYSTEM ADVANTAGES

Obviously, the main advantage of the Structural Example-Oriented Tutoring System is that it is easily accessible from the comfort of users own PC. Unlike traditional tutorials, users don't even have to get up from their seat to take this tutorial. Furthermore, many students can access the system at a given time. The structural part of the system (the part where the system repeats the question at the same level if user answers incorrectly) is very much a representation of a human tutor. Like a tutor, he/she won't continue with the next level until the students fully understand the previous level. Furthermore, some students may feel embarrassed to frequently ask their tutor the same type of question over and over again if they really didn't understand with what they tutor said. With this system, the system will recognize if the user didn't understand the subject (by the user giving the wrong answer), and the system will show example on how to answer the question. This will hopefully make the students understand the subject better. The system performance and usability is consistent as it is not being affected by emotion (like human) or other external environment.

4.7 DRAWBACKS AND LIMITATIONS

The tutorial system cannot think like human being can. People have common sense which a computerized system hasn't. For example, in Introduction to Finance, students know how to solve the problems by following the examples, but probably the students don't know why the questions are answered like that. The presence of a tutor could settle this kind of problem easily by explaining this and that. The tutorial system is apparently limited to the knowledge of the one who build it. The system need to be updated consequently and this is not an easy task as it may require the whole system to be formalized and restructured again.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

A Structural Example-Oriented Tutoring System is a structured tutorial system that uses examples as the main method to pass the information to the user of the system. The main purpose of the system would be to assist the user to increase their knowledge and understanding of the subject matter. The system is also infused with notes and quizzes for the user to learn and evaluate their comprehension on the subject. The Structural Example-Oriented Tutoring System is basically a web-based application, which can be uploaded into a host server and can be access throughout the network. This can assure the availability and reliability of the system.

5.2 RECOMMENDATION

Based on what have been done so far, it is better if the system could be tested out by the external user, for example other college or university students. By doing that, the system requirement can be identified further more and the real situation can be assessed. The system will then would be able to be improved and pretty much likely to suit the actual world.

They system also would be much efficient if it could applies fuzzy logic base system where uncertainties should be taken into account. As we know, logic errors are tricky and uncertainty is not expectable which can cause confusion and inability of the user to settle down the problem. In other words, the system should be improvised so that it could think like human tutor can.

When the Structural Example-Oriented Tutoring System has been fully accepted and being utilized in the real world, a system which take care of this system can be developed. The new system will be the GUI that is used to insert, update and delete data from this Structural Example-Oriented Tutoring System.

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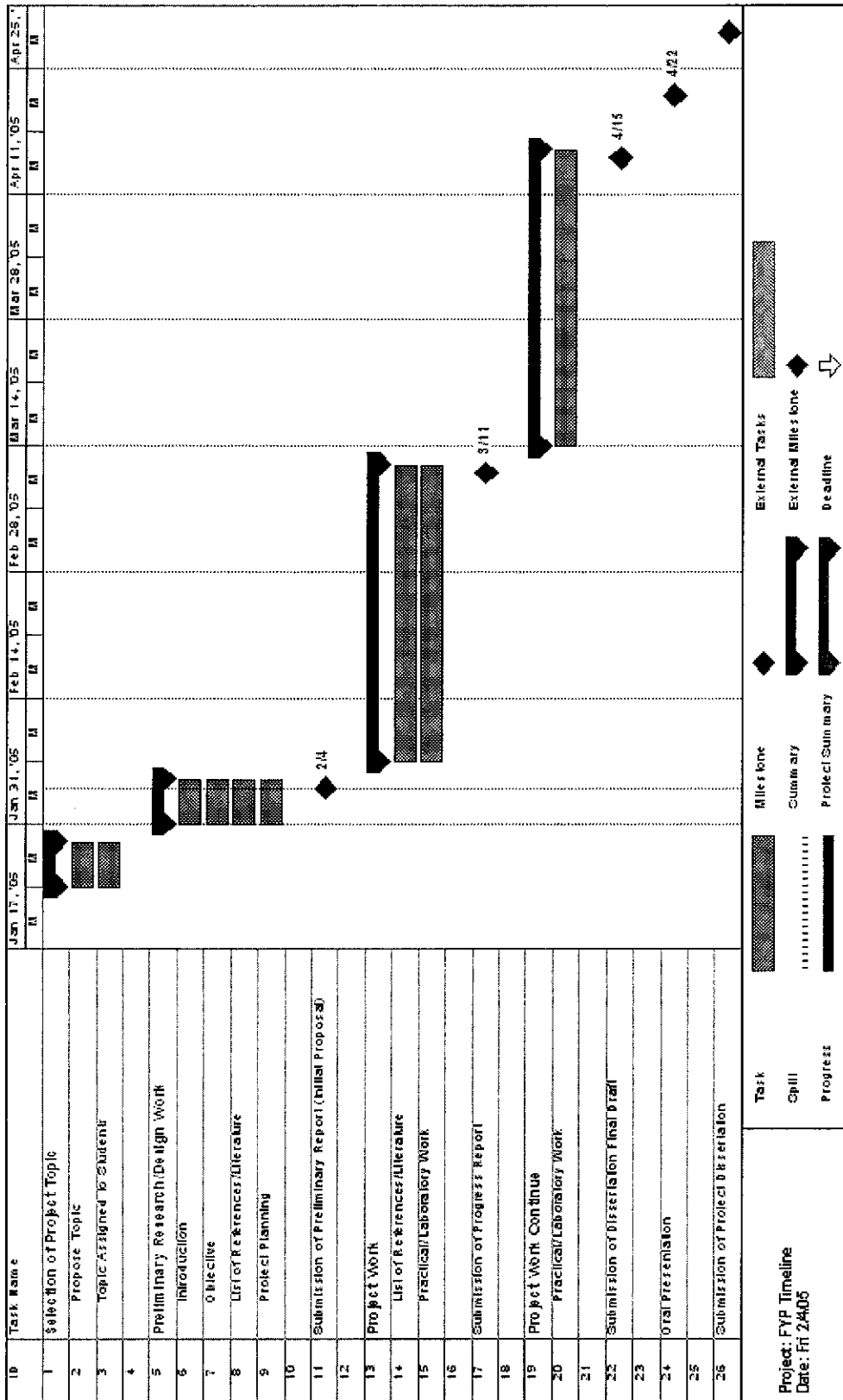
APPENDICES

Appendix A   -   Project Gantt Chart

Appendix B   -   Questionnaire

Appendix C   -   Sample Source Code

APPENDIX A

PROJECT GANTT CHART

APPENDIX A
PROJECT GANTT CHART

APPENDIX B

QUESTIONNAIRE

APPENDIX B

Questionnaire – Tutorials & Introduction to Finance

This questionnaire is developed on a purpose of finding information regarding to tutorials problems faced by the students who are taking Introduction to Finance. The information will then be used in the development of a final year project titled Structural Example Oriented Tutoring System. This questionnaire is anonymous and confidential. Your co-operation is very much appreciated.

1. Do you think that tutorial sessions are important in Introduction to Finance?
   - ☐ Yes, it is important.
   - ☐ No, I can do well without it.

2. What are the most problem faced with current tutorial session?
   - ☐ Time

   (Not enough time, tutorial time is not strategic, other: ....)

   - ☐ Insufficient involvement

   (Too many students per tutorial session, shy, other: ....)

   - ☐ Others - ....

   - ☐ No problem at all.

3. Do you prefer current tutorial session or online tutorial systems?
   - ☐ Stick with current.
   - ☐ Change to online system.

   Why? ....

4. Which part of the subject need tutorials?
   (You may tick more than one answer)
   - ☐ Calculations
   - ☐ Theories & Concepts
   - ☐ Others: ....

APPENDIX C

SAMPLE SOURCE CODE

APPENDIX C

SAMPLE SOURCE CODE

```
    Private Sub btnStart01_Click(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles btnStart01.Click

        lblInterface02.SendToBack()

        OleDbDataAdapter4.Fill(DataSet41)
        Me.BindingContext(DataSet41, "tbltutorial").Position =
Rand.Next(0, 4)
        OleDbDataAdapter5.Fill(DataSet51)
        Me.BindingContext(DataSet51, "tbltutorial").Position =
Rand.Next(0, 4)
        OleDbDataAdapter6.Fill(DataSet61)
        Me.BindingContext(DataSet61, "tbltutorial").Position =
Rand.Next(0, 4)
        OleDbDataAdapter7.Fill(DataSet71)
        Me.BindingContext(DataSet71, "tbltutorial").Position =
Rand.Next(0, 4)
        OleDbDataAdapter8.Fill(DataSet81)
        Me.BindingContext(DataSet81, "tbltutorial").Position =
Rand.Next(0, 4)

        intLevel = 1
        intCounter = 0
        intTotalQuiz = 5
        Label8.Text = intLevel & " / " & intTotalQuiz

        tabPage1.Enabled = False
        tabPage2.Enabled = False
        Panel1.Visible = False
        Panel2.Visible = False
        Panel9.Enabled = True
        btnStart01.Enabled = False
        btnOK01.Enabled = True

    End Sub

    Private Sub btnOK01_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles btnOK01.Click

        strAnswer02 = 0

        Panel9.Enabled = False

        btnNext01.Enabled = True
```

```
    If RadioButton1.Checked = True Or RadioButton2.Checked = True
Or RadioButton3.Checked = True Or RadioButton4.Checked = True Then

        If intLevel = 1 Then
            strAnswer = lblAnswer01.Text
            lblExample00.Text = lblExample01.Text
        ElseIf intLevel = 2 Then
            strAnswer = lblAnswer02.Text
            lblExample00.Text = lblExample02.Text
        ElseIf intLevel = 3 Then
            strAnswer = lblAnswer03.Text
            lblExample00.Text = lblExample03.Text
        ElseIf intLevel = 4 Then
            strAnswer = lblAnswer04.Text
            lblExample00.Text = lblExample04.Text
        ElseIf intLevel = 5 Then
            strAnswer = lblAnswer05.Text
            lblExample00.Text = lblExample05.Text
        End If

        If RadioButton1.Checked = True Then
            If strAnswer = "A" Then
                intLevel += 1
                strAnswer02 = 1
            Else
                strAnswer02 = 2
            End If
        ElseIf RadioButton2.Checked = True Then
            If strAnswer = "B" Then
                intLevel += 1
                strAnswer02 = 1
            Else
                strAnswer02 = 2
            End If
        ElseIf RadioButton3.Checked = True Then
            If strAnswer = "C" Then
                intLevel += 1
                strAnswer02 = 1
            Else
                strAnswer02 = 2
            End If
        ElseIf RadioButton4.Checked = True Then
            If strAnswer = "D" Then
                intLevel += 1
                strAnswer02 = 1
            Else
                strAnswer02 = 2
            End If
        End If

        RadioButton1.Checked = False
        RadioButton2.Checked = False
        RadioButton3.Checked = False
        RadioButton4.Checked = False

    Else
        lblComment.Text = "You must choose an answer."
        MsgBox("You must choose an answer.",
MsgBoxStyle.Critical, "Error!")
        Panel9.Enabled = True
        btnNext01.Enabled = False
    End If
```

```
        If strAnswer02 = 1 Then
            lblComment.Text = "Correct!"
            lblExample00.BringToFront()
        ElseIf strAnswer02 = 2 Then
            lblComment.Text = "Wrong!"
            lblExample00.BringToFront()
        End If

        intCounter += 1

    End Sub

    Private Sub btnNext01_Click(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles btnNext01.Click

        Me.BindingContext(DataSet41, "tbltutorial").Position =
Rand.Next(0, 4)
        Me.BindingContext(DataSet51, "tbltutorial").Position =
Rand.Next(0, 4)
        Me.BindingContext(DataSet61, "tbltutorial").Position =
Rand.Next(0, 4)
        Me.BindingContext(DataSet71, "tbltutorial").Position =
Rand.Next(0, 4)
        Me.BindingContext(DataSet81, "tbltutorial").Position =
Rand.Next(0, 4)

        lblExample00.SendToBack()

        btnNext01.Enabled = False

        If strAnswer02 = 1 Then
            lblComment.Text = "You have proceed to the next level!"
            If intLevel = 2 Then
                lblQuestion00.Text = lblQuestion02.Text
            ElseIf intLevel = 3 Then
                lblQuestion00.Text = lblQuestion03.Text
            ElseIf intLevel = 4 Then
                lblQuestion00.Text = lblQuestion04.Text
            ElseIf intLevel = 5 Then
                lblQuestion00.Text = lblQuestion05.Text
            End If
        ElseIf strAnswer02 = 2 Then
            lblComment.Text = "You have to answer correctly before
moving up a level."
            If intLevel = 1 Then
                lblQuestion00.Text = lblQuestion01.Text
            ElseIf intLevel = 2 Then
                lblQuestion00.Text = lblQuestion02.Text
            ElseIf intLevel = 3 Then
                lblQuestion00.Text = lblQuestion03.Text
            ElseIf intLevel = 4 Then
                lblQuestion00.Text = lblQuestion04.Text
            ElseIf intLevel = 5 Then
                lblQuestion00.Text = lblQuestion05.Text
            End If

        End If

        Panel9.Enabled = True
        btnOK01.Enabled = True

        Label8.Text = intLevel & " / " & intTotalQuiz
```

```
        If intLevel = 6 Then
            btnNext01.Enabled = False
            Panel9.Enabled = False
            btnStart01.Enabled = True
            lblComment.Text = "You have successfully finished the
tutorial!" & vbCrLf & "Your answered 5 out of " & intCounter & "
correctly."
            lblQuestion00.Text = "Click the Start button to start
the tutorial."
            Label8.Text = 5 & " / " & intTotalQuiz
            Panel1.Visible = True
            Panel2.Visible = True
            tabPage1.Enabled = True
            tabPage2.Enabled = True
            lblInterface02.BringToFront()
        End If

    End Sub
```