CHAPTER 5

SYSTEM ANALYSIS

5.0 Introduction

System analysis is a software-engineering task that bridges the gap between system levels requirements engineering and software design. Figure 5.1 illustrates the analysis as a bridge between system engineering and software design. System analysis provides a representation of information, function, and behavior that can be translated to data, architectural, interface, and component-level design. While system design is an iterative process through which requirements are translated into a 'blueprint' for constructing the software (Pressman, 2001).
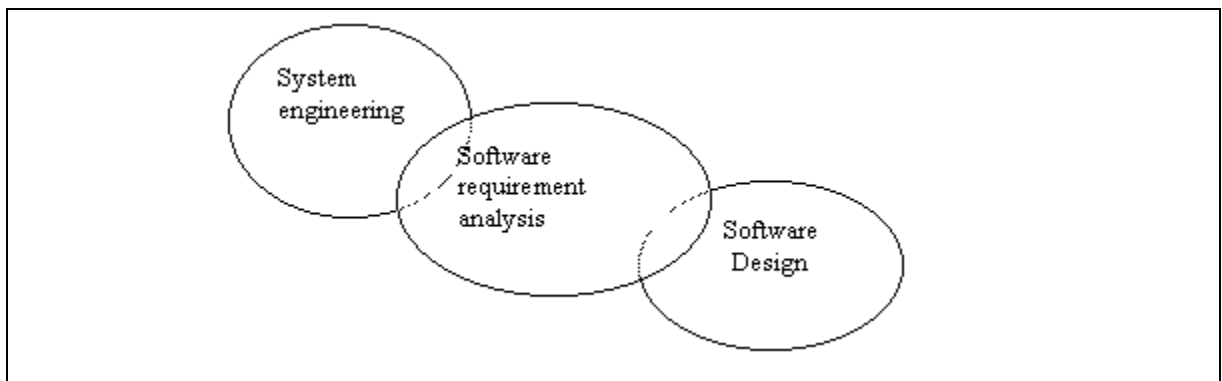

Figure 5.1 Analysis As Bridge Between Engineering And Software Design

The topics discussed in this chapter included analysis of LOOOP, analysis of survey, functional and non-functional requirements, system requirements and application used. Analysis of LOOOP discusses the ways of LOOOP meets the identified features that have discussed in literature review. Analysis of survey discusses the results of survey that have been done. Functional and non-functional requirements discuss the requirements that

is included in LOOOP. System requirements discusses the system specification to execute LOOOP. Application used discusses the software used to develop the system and success this project.

5.1   Analysis Of LOOOP

In Section 2.1.10, eight software functions have been selected for analysis with this project. The eight functions were searching, browsing, personal collections, context usage illustrators, accessibility, customized look and feel, multiple collections and media transformation and display. The analysis of LOOOP with those functions and its descriptions are as follows.

1.   Searching

LOOOP supports keyword, phrase searching from the contents of Learning Objects and Internet.

2.   Browsing

Users may browse the contents of Learning Objects which are saved in the database.

3.   Personal collections

Every registered users can add new contents of Learning Objects into their personal learning contents from time to time. Besides, the pages found from internet also can also be saved as their personal learning contents.

4.   Context Usage Illustrators

Any creation of new contents of Learning Objects can be saved in the database as sharable Learning Objects. The subject of the contents is not only fixed to specific subject.

5.   Accessibility

LOOOP registered users who save their learning contents on the server are able to access their learning content through any computer that has internet access and with LOOOP system installed.

6.   Customized Look and Feel

A simple LOOOP system GUI is designed to let registered or new users easy to perform any feature provided.

7.   Multiple Collections

LOOOP system supports multiple collection of learning contents, depending on the number of registered user.

8.   Media Transformation and Display

The system autogenerates media file and picture file to string and stores them in database. The string will be converted to file again if the file is requested.

5.2   A Survey On Learning Styles Among Higher Education Students

Below is the analysis of survey based on the results gathered from questionnaire that is carried out.

5.2.1   Justification of the survey

The main objective of the survey is to collect data on the respondents' learning style and the currently used learning material from both information technology and non-information technology field students. The learning style and behavior asked include information finding, note taking styles and ideal combination of learning resource types. The result of the survey is used for the study and system development.

5.2.2 Survey method

The survey is made on fifty people from the Faculty of Computer Science and Information Technology, University of Malaya and fifty people from Systematic College Petaling Jaya Campus. Eighty people have given their complete responds to this survey. The respondents are from both information technology (IT) students and non-information technology (non-IT) students. IT students are chosen to make the survey a success because they are the people who frequently use the computer in their learning. Non-IT students are chosen because they may have different learning style.

The questionnaires are a mixture of closed-ended and open-ended types of question. Closed-ended question is used to limit or restrict the responses, while open-ended question is used to encourage spontaneous and unstructured responses. Besides, the range-of-response question is also used to evaluate the results by providing limited answers to specific responses or on a numeric scale. The scales used are 'most seldom=1', 'seldom=2', 'moderate=3', 'frequent=4' and 'most frequent=5'.

5.2.3 Learning styles results

The survey consists of three sections, 'respondent information', 'about the study – Learning Objects' and 'recommendation'.

5.2.3.1 Respondent information

The objective of respondent information section is to collect the information about respondents age range and gender. From that survey, forty-five percent respondents are from age eighteen to twenty-two, forty-four percent are from twenty to twenty-two, five percent are from twenty-two to twenty-four, four percent are from twenty-four to twenty-six and two percent respondents are from over twenty-six years of age. Most of the

respondents are from age ranging from eighteen to twenty-two because this is the majority age range for higher education students. Among eighty respondents, forty-six percent of them are male and fifty-four percent are female. Figure 5.2 illustrates the respondents' age range in the column chart and Figure 5.3 illustrates the respondents gender in the pie chart.
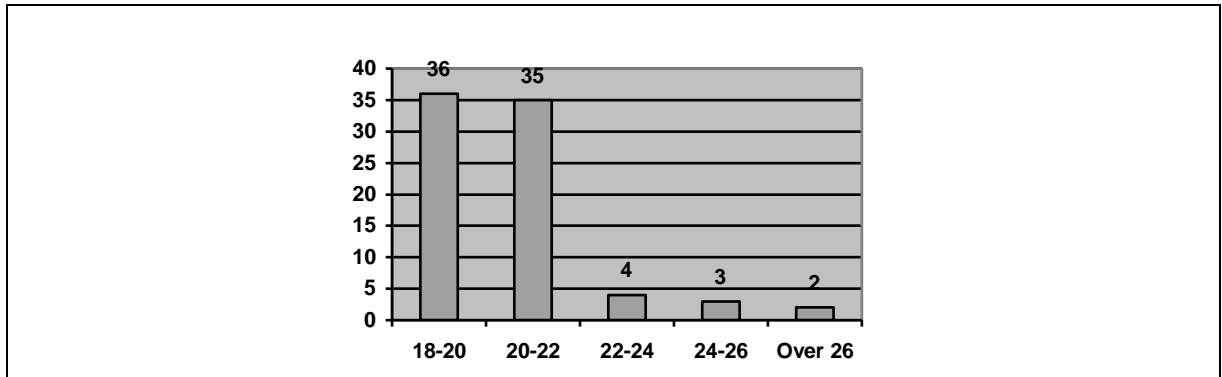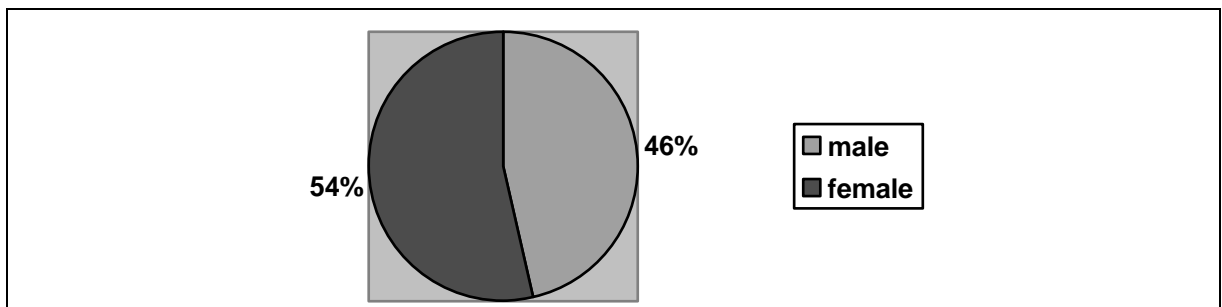

Figure 5.2 Respondents' Age Range

Figure 5.3 Respondents' Gender

5.2.3.2 About the study

The objective for this section is to collect the learning behavior and the efficiency of existing learning materials used.

5.2.3.2.1 Concentration on study

From the survey, it is found that more than half of the total respondents can often concentrate on their study (sixty-one percent), twenty-one percent frequently and eighteen percent seldom concentrate on study. Figure 5.4 illustrates the pie chart for respondents' concentration on study.
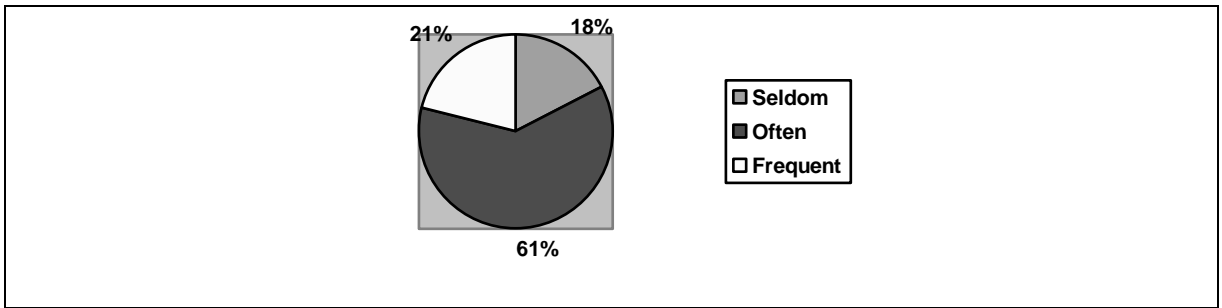
Figure 5.4 Respondents' Concentration On Study

5.2.3.2.2 Material used on study

Question Four is related to the learning material usage. This question is a range of response question. The results show that the respondents most frequently use the notes on their studies and most seldom use media such as video on their studies. Using notes are the first selection among the respondents because the contents of the notes are easier to understand and memorize than using other material. Figure 5.5 shows the learning material usage.
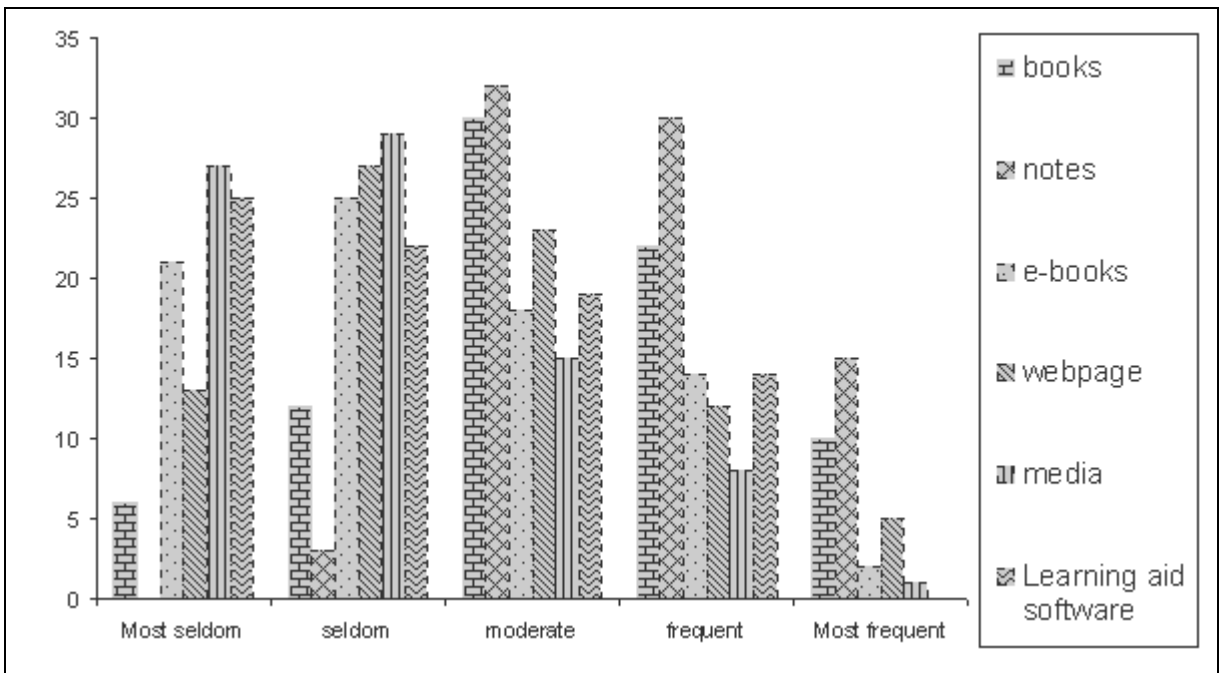

Figure 5.5 Learning Material Usage

Questions Five are related to respondents taking notes during study. Question Five is a multi selection question, respondents can select more than one answer from the answers given. The purpose of this question is to get to know the materials used to write down their important notes. As a result, sixty-two people answer they use blank paper to take notes, four answer notebook, twenty-five answer textbook, sixteen answer using softcopy and two people use the notes given by lecturers. Figure 5.6 illustrates the column chart for the materials used to write down the important notes.
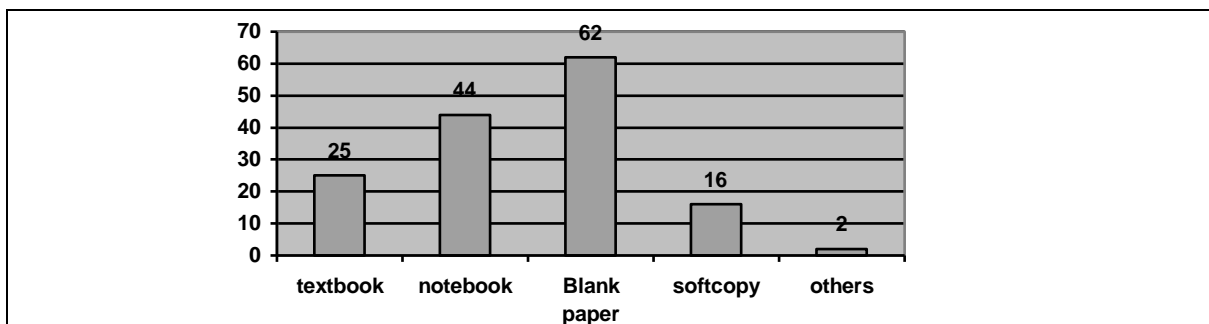

Figure 5.6 Materials Used To Write Down The Important Notes

Questions Twelve to Fourteen relate to the 'learning aid software' that respondents currently use. Fifty-two percent of them currently use 'learning aid software' in their study while forty-eight percent do not. Seventy-four percent of them who currently use 'learning aid software' are likely to use it in their study and twenty-four percent definitely like to use it. The main reason of why the respondents do not prefer to use 'learning aid software' in their study is because there are lack of learning aid software that is compatible for use in their study. Figure 5.7 illustrates the percentages of 'learning aid software' used. Figure 5.8 illustrates the percentages of respondents likely to use 'learning aid software'.
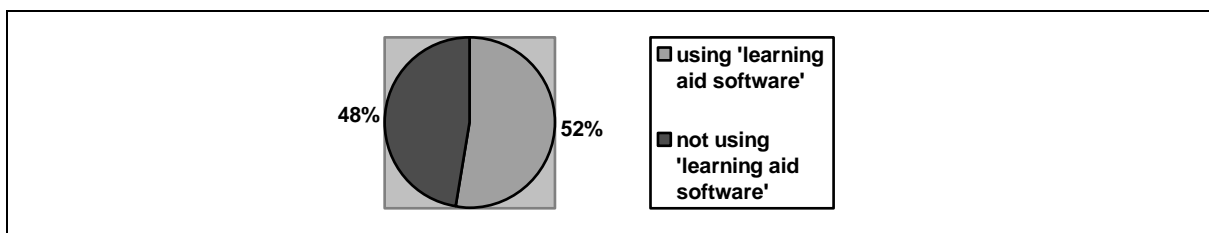

Figure 5.7 Percentages Of 'Learning Aid Software' Used
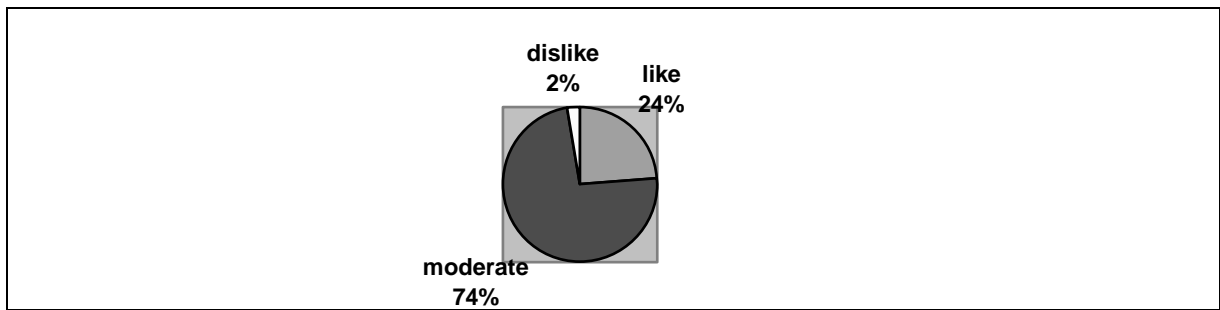
dislike 2% **like 24%**

moderate 74%

Figure 5.8 Percentages Of Respondents Like To Use 'Learning Aid Software'

Question Fifteen relates to the types of learning resource combinations that can cause respondents to study well. This is also a multi-selection question and respondents may select to answer one or more than one answer. Six selections of resources are provided for them to select, such as text, image, animation, sound, video and others. Fifteen people prefer to have the combinations of text, image, animation, sound and video. Ten people prefer to have the combinations of image, animation, sound and video. Nine people prefer to have the combinations of text, image and animation. Figure 5.9 illustrates the types of learning resource combinations and the numbers of respondents.

Text – T   Image – I   Animation – A   Sound – S   Video – V   Others –O

	Combination of types	People			Combination of types	People
1	T	2		9	T,S,V	1
2	T,I	4		10	I	2
3	T,I,A	9		11	I,S	1
4	T,I,S	2		12	I,A	3
5	T,I,A,S	4		13	I,A,V	2
6	T,I,A,S,V	15		14	I,A,S,V	10
7	T,I,A,V	1		15	I,A,S	3
8	T,I,S,V	3		16	I,V	1
17	T,I,A,S,O	1		22	A	1
18	T,A	3		23	A,S	2
19	T,A,S	1		24	A,S,V	3
20	T,A,S,V	1		25	O	1
21	T,I,O	1		26	-	3

Figure 5.9 Types Of Learning Resource Combinations And The Numbers Of Respondents

5.2.3.2.3 Learning behavior

Question Six to Seven relate to the behavior of taking notes among the respondents. Sixty-nine of eighty respondents highlight the important text during study and sixty-six people of sixty-nine respondents answer that they highlight the text because the text is important. Figure 5.10 illustrates the pie chart for the percentages of respondents highlighting the important text. Figure 5.11 illustrates the pie chart for the reasons of respondents highlighting the important text.
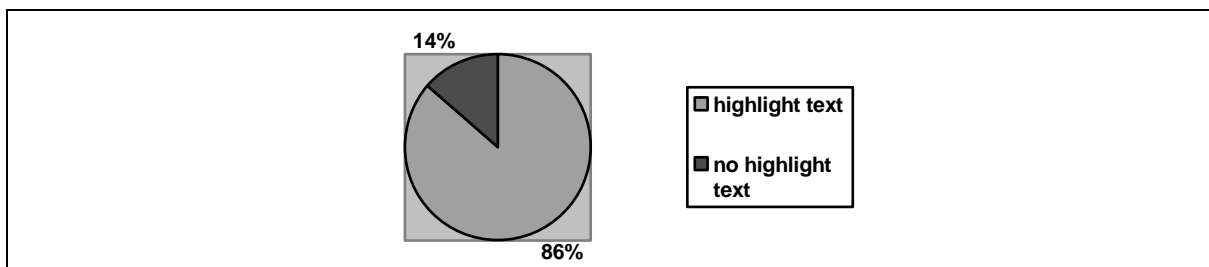

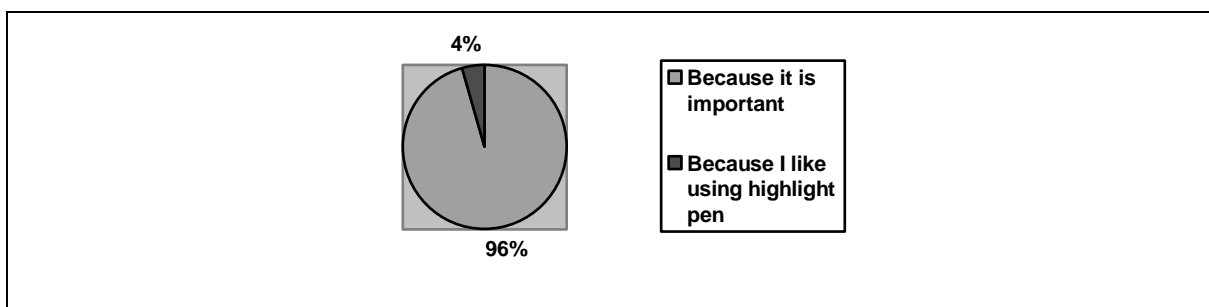Figure 5.10 Percentages Of Respondents Highlighting Important Text

Figure 5.11 Reasons Of Respondents Highlighting The Important Text

Question Eight to Nine relate to respondents' understanding level during study. Thirty percent of them answer they definitely do not understand the text studied and all of them use memorize method to remember the important text. Figure 5.12 illustrates the percentages of respondents that understand what have been studied. Figure 5.13 illustrates the percentages of respondents who do not understand the text and use memorize method in their study.
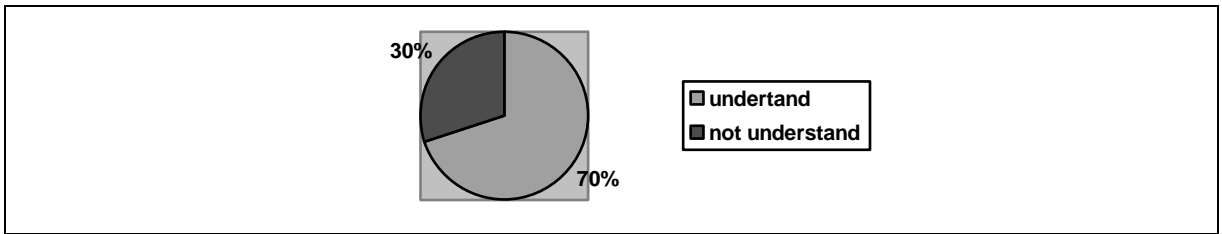
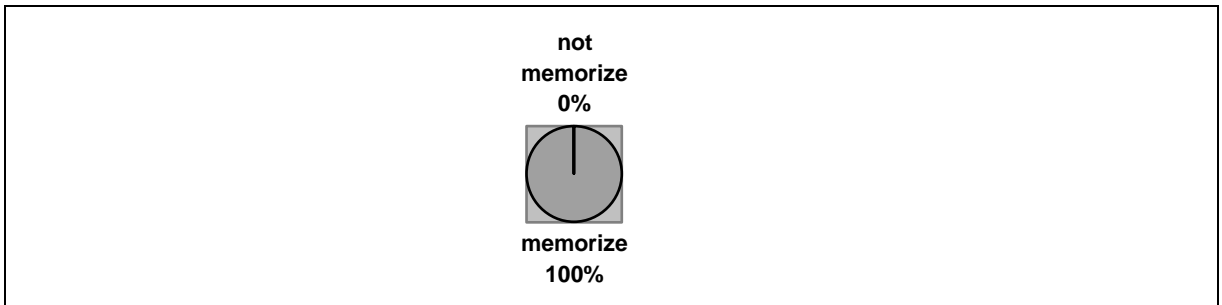Figure 5.12 Percentages Of Respondents Understand What Have Been Studied

Figure 5.13 Percentages Of Respondents Who Do Not Understand The Text And Use Memorize Method In Their Study

Question Ten to Eleven relate to file sharing or notes sharing within respondents and their friends. Fifty-nine percent of them prefer to share the notes using softcopy and forty-one percent prefer to share notes using hardcopy. Fifty-five percent respondents often share notes using softcopy, thirty-two percent seldom and thirteen percent frequently. Figure 5.14 illustrates the percentages of notes sharing using softcopy and hardcopy. Figure 5.15 illustrates the frequency of notes sharing using softcopy.
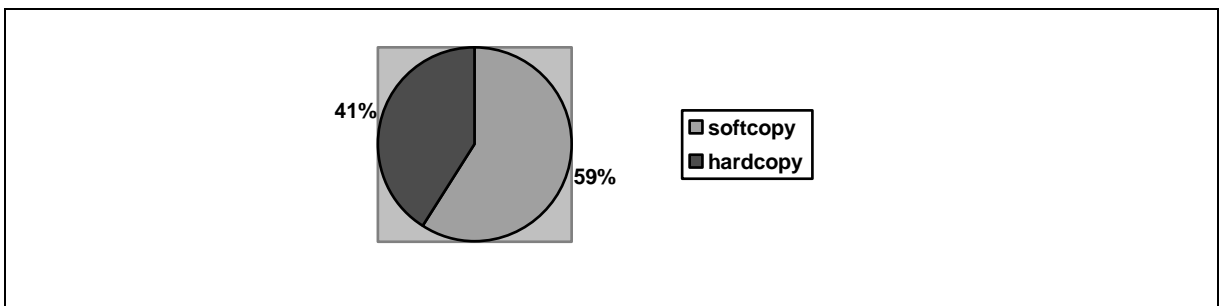

Figure 5.14 Percentages Of Notes Sharing Using Softcopy And Hardcopy
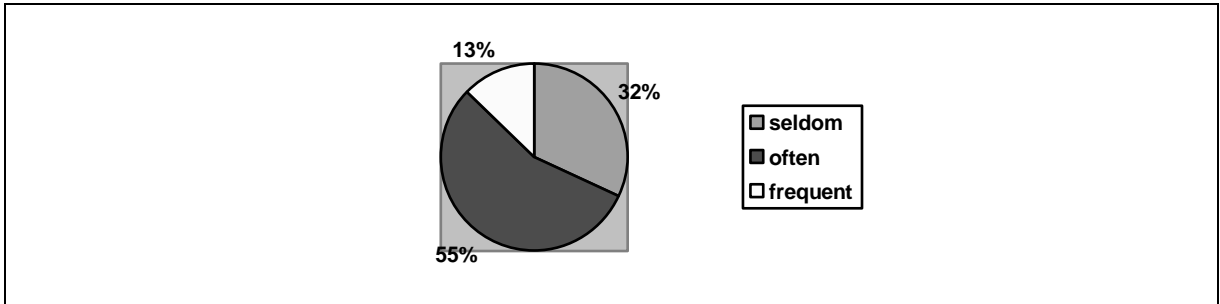
Figure 5.15 Frequency Of Notes Sharing Using Softcopy

5.2.3.2.4 Recommendation

The objective of the recommendation section is to collect the ideal features that respondents hope to include in the new system. This section only contains one multi-selection question that allows respondents to select one or more than one answer. Fifty-six people hope that future 'learning aid software' will allow user to take note. Fifty-two people want the learning contents can be updated from time to time.

Figure 5.16 Suggested Features And The Numbers Of People Suggested

Fifty-two people suggest that the system can play media file and print out the textual text. Forty-nine suggest that the system provide In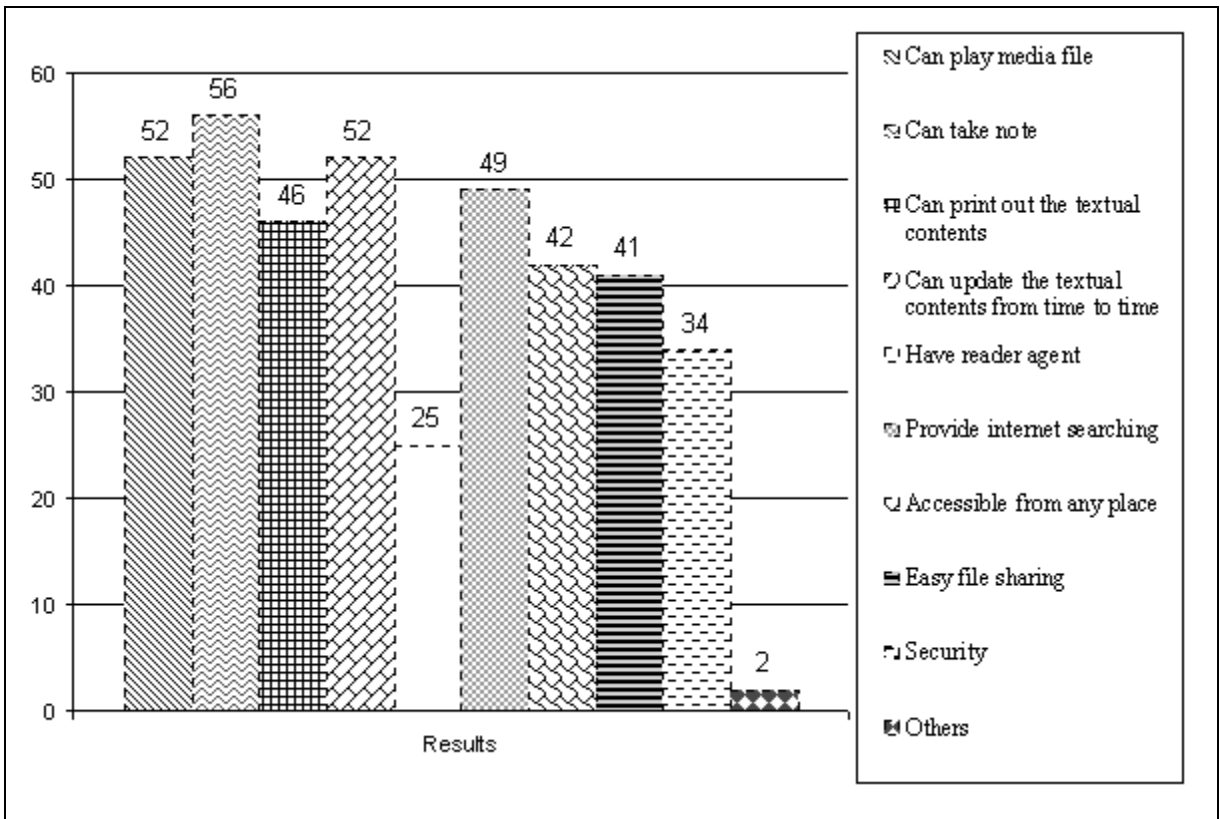ternet searching for keyword and others. Forty-one people suggest that the system can share the contents of learning easily. Forty-two people suggest that the system can access from any place. Twenty-five people suggest that the system has reader agent and thirty-four people suggest that the system has its own security to avoid others people modifying their personal learning contents. Figure 5.16 illustrates the column chart for suggested features and the numbers of suggestions by the people.

5.2.4 Survey Conclusion

As a conclusion to the survey, the results show that the usage of learning aid software is lower than the usage rate of paper notes and books in study. Lack of learning aid software suitable for the certain subject is the main reason for this problem. Besides, it is easier for them to take down the important text by highlighting the text or writing down the extra notes. Base on the analysis results of the survey, learners prefer to study with a learning resource that includes text, images, animation, sound and video, which is a type of Learning Objects, integrated Learning Objects. Thus, learners also prefer the learning aid software that can take note, plays media file and also updates the contents from time to time.

5.3   Functional And Non-functional Requirements

In order to meet the requirements of Learning Objects approach, LOOOP system has a list of functional requirements and non-functional requirements. Both requirements specify the needs of LOOOP to be completed by the end of the project.

5.3.1 Functional requirements
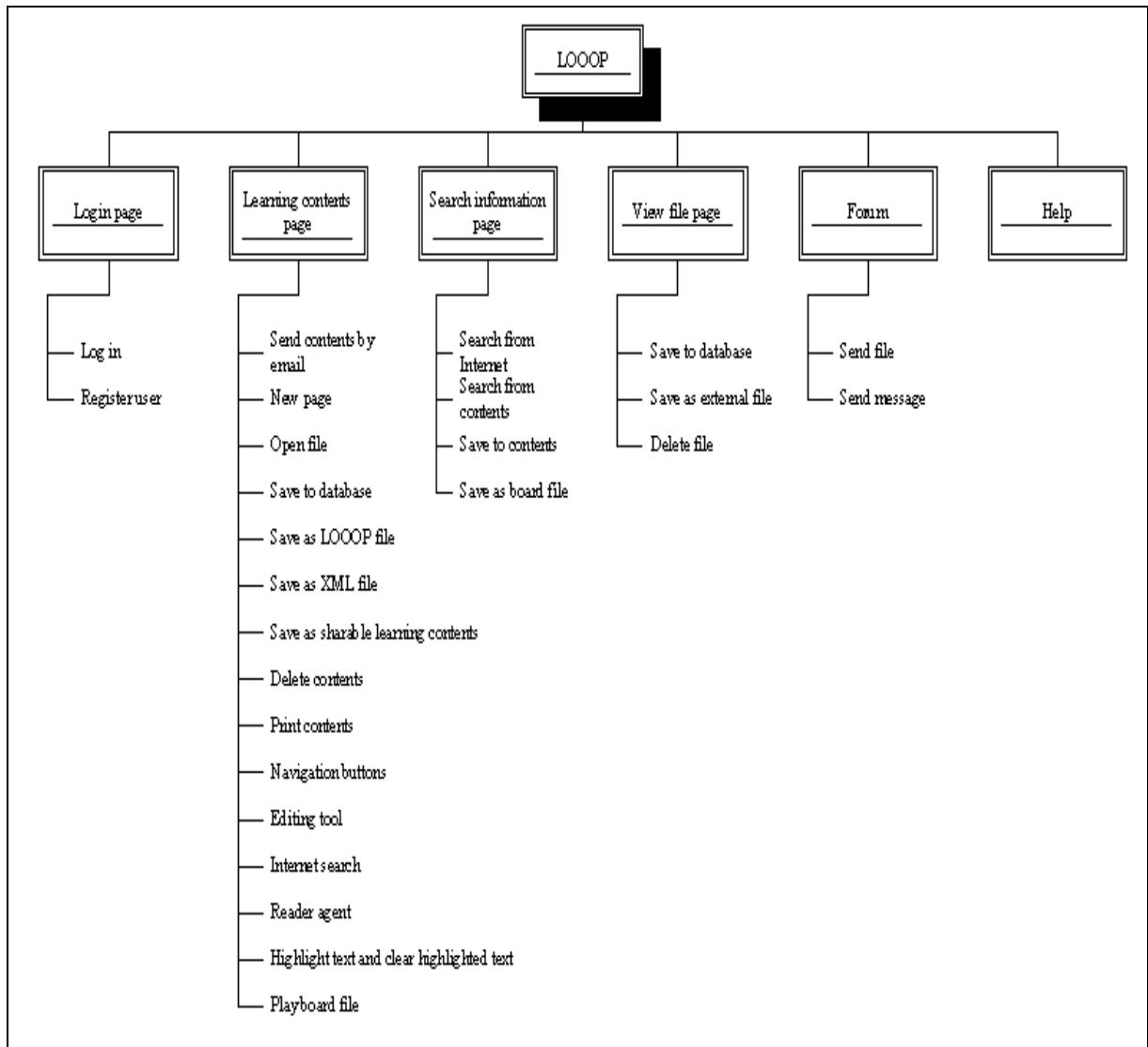
Figure 5.17 System Design For LOOOP

Functional requirements is a requirement that specify a function that a system or system component performed. Figure 5.17 illustrates the system design for LOOOP. The system design describes the features needed or functional requirements for LOOOP in a hierarchy chart. The overall LOOOP system has four main pages and two windows. The four main pages are login page, learning contents page, search information page and view file page. The two windows are forum window and help window.

The functions or features that are included in login page are 'log in user' and 'register user'. These two features are the main requirements for the system to recognize

the users. 'Log in user' is the function for registered user to access again to the system. 'Register user' is the function for new user to register him or her to the system and enabling him or her to use the system in future.

Most of the required functions are included in learning contents page because this page deals with the learning contents editing. The 'search contents by email' is the function that writes content into LOOOP language and sending it to other user using client mailing system, such as Microsoft Outlook. The 'new page' feature is the feature that allows user to add a blank page or a content of Learning Objects to his or her personal learning contents. The 'open page' feature allows user to open LOOOP language file, web page, XML file, supported picture file or supported multimedia file. Besides, learning content page also includes four types of saving content function, such as 'save to database', 'save as LOOOP language file', 'save as XML file' and 'save to sharable learning contents'.

The page not only provides 'save content' function, but also 'delete content' function. User is only able to delete the current viewed content in his or her personal learning contents. The 'print content' function also provides user to print out the hardcopy of the currently viewed content. 'Navigation buttons' is the function that provides user to navigate the content in his or her personal learning contents, including browse to first content, browse to previous content, browse to next content and browse to last content. 'Editing tool' provides user some content editing features such as cut, copy, paste, underline, bold, italic, hyperlink, find, undo and redo. 'Internet search' is a function that direct user to search information page and searches the result of selected text from the Internet. Reader agent is a function that provides a system reading on the currently view content. 'Highlight text' and 'clear highlighted text' are the functions that provide user highlighting the important text on currently viewed content or clearing the highlighted text

to normal view. Lastly, the 'play board file' is the function that plays the associated file to each content.

There are four functions for 'search information page', including 'search from Internet', 'search from contents', 'save to contents' and 'save as board file'. 'Search from Internet' is the function that searches information from the Internet and 'search from contents' is the function that searches information from the sharable learning contents. 'Save to contents' function is the function that saves the currently viewed web page to personal learning contents. 'Save as board file' is the function that saves non-web page file to personal learning contents.

View file page has three features, 'save to database', 'save as external file' and 'delete file'. 'Save to database' is the function that saves currently viewed and modified file to database. 'Save as external file' is the function that saves the currently viewed file in their original format at user defined file location. 'Delete file' is the function that allows user to delete the currently viewed file. Finally is the forum window. The forum window contains two features, 'send file' and 'send message'. 'Send file' is a function that allows user to send file to another online LOOOP registered user. 'Send message' is the function that allows user to leave a message to the forum.

5.3.2 Non-functional requirements

Besides functional requirements, LOOOP system also has non-functional requirements. A non-functional requirement is a requirement that constrained design of a system, but does not describe the service provided. There are four main LOOOP non-functional requirements that are like the functional requirements for Learning Objects approach.

The first main LOOOP non-functional requirement is reusability. The learning contents are modularized into small chunks of instruction and save into the database. The learning contents saved can be assemble and reassemble into other instructional context. For example, the content with title 'Constants' for learning C programming subject can be used in learning VB programming subject.

The second main LOOOP non-functional requirement is interoperability. The Learning Objects that are placed in the database as records can be retrieved independently without LOOOP system. The Learning Objects can be retrieved either from the database or using other learning system that is merged with LOOOP DLL file.

The third requirement is durability. The content of Learning Objects in LOOOP can always be modified to enable the content to be up to date and not unusable. Besides, the Learning Objects are saved into a database and can be retrieved by other system that develop in other programming languages. Because of the interopebility, the durability of the Learning Objects is increased.

The last main LOOOP non-functional requirement is accessibility. In LOOOP system, the database is placed on the client's machine and also the server. For the database that is placed on the server, the Learning Objects can be retrieved and accessible with any client's machine that has an Internet connection.

Besides the four main non-functional requirements, LOOOP system also needs other non-functional requirements, such as maintainability, reliability and efficiency. The ways of LOOOP needing the another three non-functional requirements are described as follows.

1.   Maintainability

The maintenance of LOOOP refers to the learning content maintenance by user. User can modify, add or remove the personal learning contents from time to time.

2. Reliability

The sharable learning contents can be used in LOOOP on other client's computer. Besides, learning contents that are recorded in specific table on the database can ensure no mixed contents within multiple registered users learning contents.

3. Efficiency

The results of Internet searching are retrieved from Google.com. Google.com is known as an Internet leading search engine on Internet (THES, 2004).

5.4   System Requirements

System requirements are important in developing an application because it describes the best environments for the application to run. A short list is shown in table 5.1. The following system requirements are best fitted for both server and client's machine, unless server system requirement needs to have at least Internet Information Server to process.

Table 5.1 System Requirements

System	Description
OS	Microsoft Windows 2000 or above
CPU	Intel 486, Pentium, or 100% compatible
Memory	8 MB RAM
Disk Space	At least 10 MB
Monitor	800x600 or higher resolution; 256 colors or above
CD-ROM	2x or faster for program installation using CD
Internet	Available.
ActiveX	Support
Web Server (Server only)	Internet Information Server (IIS 4.0) or higher

For best performance, users need to run this application under Microsoft Windows 2000 or above OS. The requirement for CPU is using an Intel 486 or 100% compatible

CPU. LOOOP needs at least 8 MB RAM of memory and at least 10 MB hard disk space. A CD-ROM is required for LOOOP system installation using CD. Internet access is a must for users in order to get connected to the LOOOP socket for online version. Just because LOOOP itself is an ActiveX control and using several of ActiveX controls in development, an operating system that can support various ActiveX controls is a must for running the application.

5.5 Application Used

In LOOOP development, there are many applications used. Some are used for case study and some are used for software developments. The applications and its description are as follows.

1.   Adobe Reader 5.0

This application is used for reading the Adobe PDF format file.

2.   IconEdit32

This application is used for creating and modifying the icon file.

3.   Microsoft Visual Basic 6.0

This application is used for developing ActiveX control and DLL file for LOOOP.

4.   Microsoft Access 97

This application is used for creating and managing the database file.

5.   Microsoft Internet Explorer

This application is used for reading the HTML file.

6.   Microsoft Word 97

This application is used for creating, reading and managing relative information for LOOOP.

7.   Microsoft Visio 2000

This application is used for drawing the ERD, DFD, contest diagram, process flow and Gantt Chart.

8.   MindVision Installer VISE

This application is used for packaging LOOOP related files to installer.

9.   Nero Burning Enterprise Edition

This application is used for installation CD creation.

5.6 Summary

From the analysis, the Learning Objects technology is applied in LOOOP on the functions related with contents of Learning Objects modification and sharing including 'new page', 'open file', 'save to database', 'save as LOOOP file', 'save as XML file', 'save as sharable learning contents', 'search from contents', 'play board file', 'editing tool', 'send contents by email' and the function regards to learning style including 'highlight and clear highlighted text' and 'internet search'. On non-functional requirements, the Learning Objects technology is applied in reusability, interoperability, durability, accessibility, maintainability, reliability and efficiency.