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**THE USE OF INTERACTIVE MULTIMEDIA-BASED LEARNING
FOR NETWORK CABLE INSTALLATION COURSE**

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ABSTRAK

Kajian ini dilakukan untuk menentukan keberkesanan pelaksanaan Interaktif Multimedia Courseware dalam mempelajari kursus Rangkaian Pemasangan Kabel di Kolej Komuniti, Kementerian Pengajian Tinggi (Mohe). Kelemahan dan masalah yang ada dalam pendekatan pembelajaran konvensional di Kolej Komuniti akan dijelaskan dan penyelesaian akan dicadangkan oleh penyelidik. Langkah pertama adalah merancang sebuah courseware yang berpadanan yang berkaitan dengan kursus Pemasangan Kabel Rangkaian yang boleh digunakan dalam proses pengajaran dan pembelajaran. Selanjutnya, courseware itu dilaksanakan di kelas dan kemudian dinilai kegunaannya dalam hal persepsi kegunaan, persepsi kemudahan penggunaan, kemampuan belajar dan penggunaan masa depan bagi courseware di kalangan pelajar dan pensyarah. Alat yang digunakan untuk penilaian adalah satu set soal selidik. Pengamatan pada pelajar selepas mereka menggunakan courseware juga dilakukan. Keputusan penilaian menunjukkan bahawa pelajar telah menilai courseware dalam hal kegunaan.

ABSTRACT

This research was conducted to determine the effectiveness of implementing Interactive Multimedia Courseware in learning the Network Cables Installation course at the Community College, Ministry of Higher Education (MoHE). The weaknesses and problems that exist in the conventional learning approach at the Community College will be described and the solution will be proposed by the researcher. The first step was to design a suitable courseware related to Network Cable Installation course that can be used in the teaching and learning process. Next, the courseware was implemented in the class and then evaluated for its usability in terms of perceived of usefulness, perceived of ease of use, learnability and future use of the courseware among students and lecturers. The instrument used for evaluation was a set of questionnaire. Observations on the students after they had used the courseware were also made. The results of the evaluation indicated that students have highly rated courseware in terms of usability.

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LIST OF ABBREVIATION

CCBD	Community College Bandar Darulaman
CD	Compact Disc
NCI	Network Cable Installation
GDC	General Design Cycle
ICT	Information and Communication Technology
IS	Information System
IT	Information Technology
MAP	Multimedia Authoring Process
MDP	Multimedia Development Process
MoHE	Ministry of Higher Education
PC	Personal Computer
SCORM	Sharable Content Object Reference Model
SDRM	System Development Research Methodology
SPM	<i>Sijil Pelajaran Malaysia</i>
SPSS	Statistical Package for Social Sciences
STP	Shielded Twisted Pair
UTP	Unshielded Twisted Pair

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Network Cable Installation is one of the courses offered in the Certificate of System Computer and Support Program at the Community College, Ministry of Higher Education. This program is offered to all candidates especially *Sijil Pelajaran Malaysia (SPM)* school leavers. The Network Cable Installation course consists of various topics which include; cable types, connectors, equipment, cable patching and network wiring. Two approaches will be used by lecturers in teaching their students; theoretical and practical. These two approaches are based on the syllabus requirements at the Community College where 25% is theoretical while 75% is practical. This course is offered to students during the last semester or fourth semester in order to complete the requirements of the program before they are able to graduate.

Teaching and learning process is the main focus of this study whether it is effective or less amongst students in Community College especially the Bandar Darulaman Community College, Jitra, Kedah. Usually, there are two lecturers conducting one class, with the average students from 25 to 30. The College also has

2 to 3 classes for each semester, first until fourth semesters. Conventionally, lecturer completed the syllabus on theoretical through lectures, question and answer sessions, giving notes, discussion, Power Point presentation and online browsing.

Generally, there are two types of network cable, copper cable and fiber optic cable. The copper cable can be divided into several types for examples coaxial cable and twisted pair cable. Coaxial cable is very good in protection against electrical interference compared to twisted pair. This cable consists of two types, thicknet or 10Base5 and thinnet or 10Base2. Nowadays, twisted pair cable is most popular especially for computer networking. There are two types of twisted pair, Shielded Twisted Pair (STP) and Unshielded Twisted Pair (UTP).

1.2 Problem Statements

The Network Cable Installation course is taught at the Network Lab or Computer Lab equipped with network equipments. The students have to work in group during the practical session. Unfortunately, the equipments in the lab are limited, only a set of equipment prepared for each group. There are 2 to 3 members in a group sharing a set of equipment during the learning process which results that some students have no opportunities in using it during the practical session. Since each class consists of 50 to 60 students and sometimes can be up to 90 students, it is impossible to provide the equipment to every students. Sometimes not all equipments are fully functional which escalates the problem that already exist.

Normally in teaching this course at the community college, lecturer will demonstrate to their students based on the equipment available. Students will initially observe their lecturer and then proceed to conduct the cable installation in a group. It depends on the group creativity in making sure that all members have the opportunity to perform the cable installation process. For the theoretical session, most of the lecturers use conventional teaching techniques such as 'chalk and talk', printed notes and Powerpoint presentation to teach their students.

Students are assessed theoretically and practically through continuous assessments and final examination. For these assessments, students will have to make preparation or revision to ensure that they will score in that course. Normally, their main source of reference are books and lecture notes. However, most of the books and notes have more texts with limited diagrams that are related to the course. The diagrams are static, non-interactive and could not present step-by-step process in network cable installation.

Online materials related to network cable installation are available for students to access such as from Youtube (Hamilton, 2010). But sometimes, not all students own a notebook or computer with Internet access. Moreover, it is quite slow to download and streaming Youtube materials through online access. Students should provide more budget to register and monthly payment for Internet Service Provider at home. Although they can use the College computer facilities, sometimes several web sites especially related to streaming, will be blocked.

Therefore, in order to overcome the limitations that exist with the existing teaching/learning process and students' conditions, a supplementary teaching/learning approach is proposed in this study.

1.3 Research Question

Based on the problem statements, the research questions are as follows.

- i. How to design and develop an interactive multimedia courseware for teaching/learning about network cable installation?
- ii. What is the perception of users in terms of perceived usefulness, perceived ease of use, learnability and future use of interactive multimedia courseware for teaching/learning about network cable installation?

1.4 Research Objectives

The main objective is to study the use of interactive multimedia courseware for teaching/learning about network cable installation. Specifically, the sub-objectives are:

- i. To develop an interactive multimedia courseware for teaching/learning about network cable installation.

- ii. To evaluate the interactive multimedia courseware for teaching/learning about network cable installation amongst students and lecturer in terms of perceived usefulness, perceived ease of use, learnability and future use.

1.5 Scope

This study focuses on the development of the interactive multimedia courseware for teaching/learning about network cable installation at the Community College Bandar Darulaman, Kedah. The CCBD is one of the 41 community colleges under the Ministry of Higher Education (MoHE). The developed courseware focuses on Topic 3: Connector Installation, which is one of the four topics in Network Cable Installation course with a code of ESS311 (Technical Planning Committee Community College, 2002). The courseware covers types of cable and connectors, color code of cable, and cable installation. However, this study did not include faceplate installation due to constraint of time. Likewise, the network cable only covered the UTP Cat5e for the network cable installation.

The courseware was developed using Lecture Maker 2.0. This software allows developer to save the content in the universal accepted Flash format, and its output is SCORM compliant. Lecture Maker allows multimedia elements such as text, pictures, video, sound, and flash files to be used to accomplish the interactive multimedia courseware. Multimedia files can be inserted directly into a large-

capacity video link, however, in this development, additional software has been used to support the video recording namely Cyberlink YouCam3.

In determining the usability of the courseware, 46 students from the fourth semester Certificate of Computer System and Support Program and two lecturers were involved. A convenient sampling technique was applied and the instrument of evaluation is a set of questionnaire. The measurements used include perceived usefulness, perceived ease of use, learnability and future use. Observation method was also applied to support this evaluation.

1.6 Significance of Study

The significance of this study are as follows:

- a. The courseware can be implemented in the class to the students at Community Colleges, Polytechnics, computer training centers and other institution including computer companies or vendors.
- b. The courseware could be an alternative way to improve learning process in class or self learning anywhere and anytime.

1.7 Structure of the Report

This report consists of six chapters as follows:

- Chapter 1** - describes the background of study, the problem statement, research questions and objectives, scope of study and the significance of study.
- Chapter 2** - discusses on the literature review that is related to the study especially on interactive multimedia, courseware and the approaches of usability's evaluation.
- Chapter 3** - describes the suitable research methodology including the development methodology of the courseware.
- Chapter 4** - discusses detail on courseware development used in this study.
- Chapter 5** - discusses the data analysis and also the finding of this study then discusses on the results after the data has been analyzed.
- Chapter 6** - Discusses on the conclusion and recommendation for future study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter is important to get the first view of related work, ideas, suggestions and previous finding. In addition, this chapter also supports the issues of enhancement of teaching and learning process, the general definition of interactivity, multimedia, courseware and the method used by other researchers.

2.2 Interactive

Interactive terms are set by the free dictionary (2011), published by Collins English Dictionary, which means it divides the two categories of interactive. In terms of electronic and computer science where information can be transferred in two directions between the user and the central communications systems such as computers or television. While the terms of two or more people are acting on someone or have a close relationship with each other. In the same source, Houghton Mifflin expressed that interactive state in 3 parts, a person can act or can act against another person while in Computer Science, a program that is responsive to user

activity. Finally, Houghton Mifflin in the free dictionary, states that the form of interactive television entertainment in which a signal will activate the electronic devices in the home audience or display using the tools to influence events on the screen, or both. In addition, interactive is a message there is a correlation with the number of previous messages and the relationships between messages. In addition, interactive is a message there is a correlation with the number of previous messages and the relationships between messages (Wikipedia, 2011).

Multimedia learning process cultivates interaction between the user and the PC and the learner with the content. "Interaction is commonly viewed as motivation response reinforcement encounters action, an integrated form of between the learner and the instruction". They indicated that the major difference between traditional and multimedia instructional strategy is interaction (Teo & Neo, 2006).

2.3 Multimedia

According to Vaughan (2006), multimedia is a grouping of media elements, such as text, graphic art, animation, video, sound, etc. involving the use of computers. Therefore, an individual needs to be achieved by this combination (Farhana, 2010).

Uden, Alderson, & Gilchrist (2000) state that previous studies have exposed that computer-based multimedia can assist people be trained better than conventional classroom lectures.

Referred to Wikitionary (2011), the free dictionary through online, multimedia is use of different media to express information consist text together with audio, graphics and animation, often packaged on CD-ROM with links to the Internet.

2.4 Courseware

Courseware is learner-centered, which encourage students to self-paced learning. The good courseware provides an entire learning environment, including target content, personalization, feedback, remediation, and various learning and evaluation methods (Sung, 2003, & Wan Malini, et al., 2010). The use of courseware integrates assorted skills such as listening, reading, and comprehension, together with real learning experiments, learners' control over their learning and a focus on the content of subject (Warschauer, 1996, & Wan Malini, et al., 2010).

In Wikipedia, the free encyclopedia (2011) mentioned that the *Courseware* is a term that combines the words 'course' with 'software'. It was an additional tool package of education environment for kids, students, teachers or instructors. It is useful as self learning material for students at home and usually the courseware is

saved in CD-ROM, so they must have computer or notebook. Another meaning of courseware is educational software which is suitable with the function that consists of modules, exercises, test or quiz, feedback and so on. The courseware itself can be in different formats, some are only available online such as html pages, while others can be downloaded in pdf files or other types of document files.

E-learning course materials are usually found in the form of a courseware. A courseware is computer-based educational multimedia software. It provides interactive learning sessions that may contain text, computer graphics, images, animation, sound and motion video. These media elements and interactivity coupled with a well structured content helps learner to gain better retention of the subject matter. The interactive course content of an e-learning courseware compensates for the absence of a trainer. A courseware can provide a high level of simulation that can be adjusted according to the learners' proficiency. Learners can access the courseware anytime, learn at their own pace and review the course material as often as needed. When a learner has more control over their learning process, they are able to better understand the material, leading to a 60% faster learning curve compared to the traditional instructor-led training (Wan Adli, 2007).

In online resource namely Whatis.com (2008) defined courseware is educational material intended as kits for teachers or trainers or as tutorials for students, usually packaged for use with a computer. It can cover any knowledge area, but information technology subjects are most common. Courseware is

frequently used for delivering education about the personal computer and its most popular business applications, such as word processing and spreadsheet programs. Besides that, courseware is also widely used in information technology industry certification programs, such as the Microsoft Certified Systems Engineer (MCSE) and the Computing Technology Industry Association's A+ examination.

Courseware can include:

- Material for instructor-led classes
- Material for self-directed computer-based training (CBT)
- Web sites that offer interactive tutorials
- Material that is coordinated with distance learning, such as live classes conducted over the Internet
- Videos for use individually or as part of classes

2.5 Teaching and Learning Issues

Adapting instructions to individual behavior is not always possible due to large classroom size and limited teacher's time, but with the development of ICT, instructional software can be developed at a cheaper cost and used to help in tutoring students with learning problems. Since individual differs in cognitive ability, earlier knowledge and learning styles, adapting instruction to these differences can make easy learning. Interactive multimedia courseware can be easily designed to provide individualized instruction for students who fail to learn through

conventional way. They have been used effectively to teach various subjects. (Mat Zin, & Nor Azan, 2009),

In education, software packages become more important for using in the classroom because it can be motivated in learning process. However, the resources available on the market, with the designation of educational software, often have uncertain quality. This leads us to the constitution of a multidisciplinary team with different competencies (Science Education, Educational Technology and Design) aiming the development of educational software for teaching and learning environments and tools to properly evaluate the software quality (Costa, Loureiro, Reis,Sá,Guerra., & Vieira, 2009)

Li & Tang (2010) emphasizes that teaching courseware is an important resource of teaching. It is the supplementary teaching software which is based on one or several points of the implementation of relatively complete teaching and it is the natural combination of teaching strategies and teaching contents. To improving the quality of classroom instruction, it is very important to design and develop high quality courseware. But due to the own characteristics of multimedia courseware, its manufacture process particularity is determined. Some teachers' knowledge in this aspect are limited, so in the design of multimedia courseware they always feel overwhelmed when facing the multifarious design software, pictures, animations and sound material. Multimedia courseware making is a teaching production process, making a perfect function of courseware must involve more software and

computer technology, pedagogy, psychology and professional knowledge of what the curriculum of understanding and mastering situation. Therefore, the basic theory of education technology research is very important. Curriculum development theory research is an important part of the basic theory of education technology, and courseware development mode is the important content of the theory of curriculum development.

Teo & Neo (2006) described that apart from the potential graphics and digital innovation multimedia brings to classrooms, it is also the powerful manipulation and participation in learning it has on the users. What has been the conventional learning process, teacher-centered approach is now seeing a move into one which emphasizes on student-centered learning. Traditional educational content can now be transformed into interactive multimedia content by using authoring packages. It has enabled the teacher to innovate his/her instructional design by presenting the educational content in an interactive and multisensory manner rather than the traditional single media format. Method of teaching and learning using multimedia has changed the learning strategies in educational institutions. Therefore, it has a lot of colleges and universities including in Malaysia, the teaching and learning with information technology or multimedia technology that is widely to enhance the learning process. Develop interactive multimedia courseware in a way storytelling presents the learning process more interesting and knowledge can be communicated and acknowledged easier (Zurina, 2006).

Mat (2000, as cited in Neo & Neo, 2004), mentioned that in an opening address at the conference on E-Learning held in Kuala Lumpur, Malaysia on 25th May 2000, the Secretary-General from the Ministry of Education, Dr. Johari Bin Mat stated that:

"Technology has been and is becoming an important component of teaching and learning in our educational system. Information and Communication Technology (ICT) provides powerful tools for accessing, storing, and disseminating information. Our approaches to teaching, preparing contents and delivering learning materials need to be adjusted according to the existence of this technology. The classroom is no more a static physical set-up, but a rather dynamic existence. Teachers should be able to integrate technology in their process of teaching and learning. Technology supports learning. It will enable teachers to pursue traditional goals with new fervor and success. This impact of technology will give a new dimension to the quality of our education system. Technology supports the learners to bring about significant change in learning. Group of students at different schools work together on collaborative projects, other learning skills and social relationships"

In the face of rapid technology progression, educators in this age of digital information and technology not only have to be competently knowledgeable in the field that they are teaching, but must also be skilled in the technologies that are

being used to convey the educational content. As a result, in the educational arena today, there is an emerging breed of technologically proficient educators who are using the information and communication technology (ICT) to create a better teaching and learning environment. The marriage of content and technology not only provides the teacher with a more effective way to transfer knowledge and information to students, but also enables them to learn in a more productive way. It is fast gaining popularity as a powerful instructional tool for disseminating knowledge and information to the learners. The interactive multimedia learning courseware presented here displayed several characteristics that would make it a more effective way to teach and learn, such as the following:

- i It incorporates multimedia and interactive features which is a fundamental departure from the traditional presentation of educational content.
- ii It establishes a two-way interaction between the computer and the user, thus enabling he/she to be an active learner instead of being a passive recipient of information as in the traditional mode of learning.
- iii It is a visually-based module which allows the user to see the concepts and information presented in a more graphical and interesting manner.
- iv It contains materials that allow students to view them at their own pace, time and place.
- v It contains features that allow students to control the flow and path of the navigation and be responsible for the information acquired.

Currently, the multimedia technology resources available to educators to help them to develop ICT curricula are many and able to address different modes of teaching. The ability to incorporate multiple media elements in conjunction with interactive features into teaching and learning will modify and enhance the traditional instructional approaches. This will inevitably change the way teachers teach and students learn. The permeation of multimedia elements into the teaching and learning environments has also pushed educators to becoming more technology-oriented. Incorporating multimedia technology into the classroom has become a global trend, and in recent years, institutions of higher learning in Malaysia and the world over are incorporating multimedia into their educational curricula to enhance the teaching and learning process. (Johns, 1999; Kachian & Wieser, 1999, Kamsah, Mokhtar, Ahmad, & Yaakob, 2000).

In the traditional education area, the role of the teacher is to provide content and information to students. This can be done in the form of many instructional media, such as notes, diagrams, overhead transparencies, models and more. The information or content that is presented is based on the teacher's curriculum and other relevant information for the class. With technology, especially with multimedia authoring technology, the very same content can be converted into the electronic form and presented on the PC. The multimedia technologies used will transform the traditional materials into an interactive multimedia courseware. One of the driving factors that changes standard textbook and engineering curriculum is the integration of multimedia courseware. Traditional textbook learning is one

component for teaching subject, lab projects provide students with hands-on experience, but multimedia can produce and expand the learning process (Griffith, Lamancusa, Jorgensen, & Velez, 1997).

Beyond curriculum and facility innovation, another change in engineering education is the inclusion and exploitation of electronic means for teaching of course material. Engineering courseware with computer-based material can be used to assist engineering students in their learning process. Typically, this courseware takes advantage of multiple media formats, such as graphics, images, sound, video, and animation to illustrate engineering concepts, products, or practices. This multimedia software provides a new level of interactive learning, where the philosophy is that multimedia courseware will cross over all student's learning styles and even make learning fun (Griffith, Lamancusa, Jorgensen, & Velez, 1997).

2.6 Usability Evaluation

Bushro & Halimah (2008) wrote a paper related on courseware area which they divided the usability evaluation of the courseware on five constructs: effectiveness, learnability, ease of use, flexibility and user attitude. Significantly higher results were obtained for the matched group compared with the mismatched group while Trigui (2009) emphasized four construct of usability evaluation. The construct that he discussed were perceived of usefulness, perceived os ease of use, learnability and outcome or future work of the courseware.

Costa, Loureiro, Reis, Sá, Guerra., & Vieira (2009) wrote a paper and they report the final results achieved in the software evaluation made by teachers of the 1st and 2nd basic education cycles. The evaluation concerned the software technical (software and user's manual) and educational (guidelines for the Didactic Exploration – Teacher and guidelines of Records - Student/User) aspects. With the data gathered and results achieved, it is possible to assess the usefulness of the end user's evaluation of educational resources and the quality of the courseware. This evaluation enables to improve aspects related with the usability (navigation and interaction) and enables us to ensure the capability of the courseware to the target educational level.

2.7 Development of Courseware

Researcher interested the developing multimedia courseware by Neo & Neo (1998), used the Multimedia Authoring Process (MAP) which is a 3-stage procedure as Figure 2.1 below. The three stages are:

1. Pre-authoring
2. Authoring process, and
3. Post-authoring

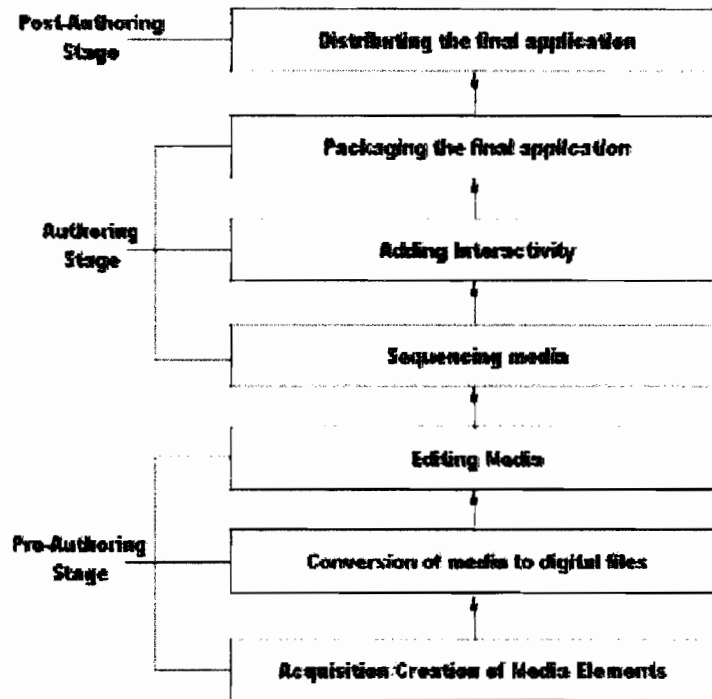


Figure 2.1: Diagram of the Multimedia Authoring Process (MAP).

Then, this process was adapted by Neo & Neo (2004) as a Multimedia Design Process (MDP), shown as Figure 2.2 whereby had been used by Rozaina (2008) in her thesis accomplishment. There are 5 steps of processes to authoring the courseware:

1. Assembling the media elements needed to represent the educational content.
2. Digitizing the analogue media.
3. Editing the media elements.
4. Multimedia authoring.
5. Packaging for delivery on a CD-ROM

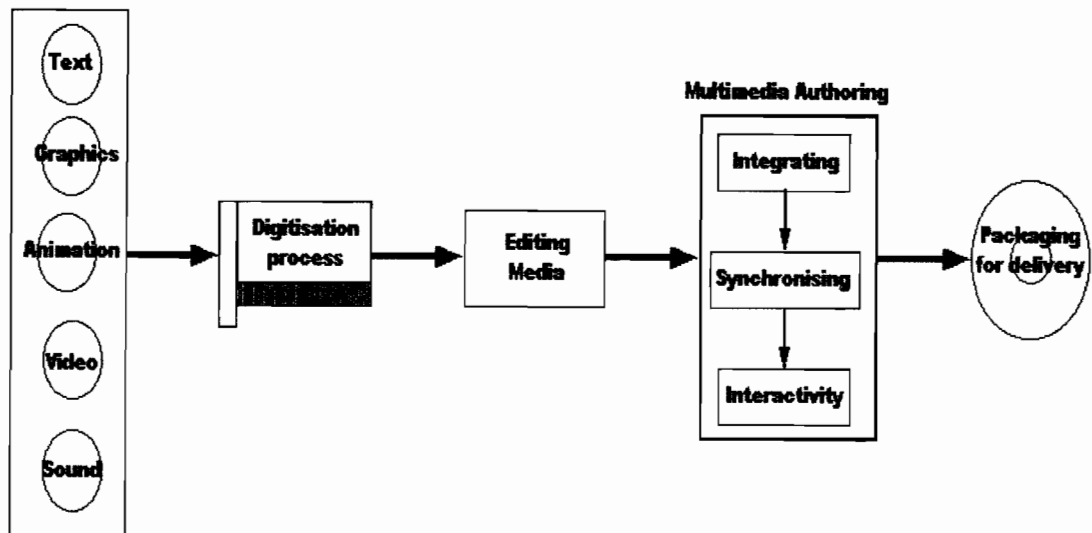


Figure 2.2: Diagram of the Multimedia Design Process (MDP)

This five steps of process looked not very complicated to follow and quite suitable with NCI Courseware development. NCI Courseware was not e-learning concept but it was a standalone courseware whereby using the CD-ROM as a packaging for delivery. Users implement the courseware using PC or notebook by their own or computer lab.

2.8 Conclusion

All information has been collected to review by the researcher. Finally, as a conclusion, the traditional learning process is still usable in actual education environment especially in Malaysia, even though, nowadays so many issues of technology were implemented in education whether at home, kindergarten, primary school, secondary school, college, university and also disabled school. Currently,

enhancement of learning process existed is needed in the class even the students can learn by self learning method at home. Most of literatures, give a positive view on developing interactive multimedia for subject or course and implement it in teaching and learning environment.

CHAPTER 3

RESEARCH METHODOLOGY

In the previous chapter, we have reviewed about the literature related work to interactive multimedia courseware and identified the approaches used to develop this application. Now, this chapter explains and elaborates the research methodology which was used for this study. Actually, there are many excellent diagrams of the process of design research in IS such as Hevner, et al. (2004); Puro (2002); Gregg, et al. (2001); March, & Smith (1995); Nunamaker, et al. (1991).

Researcher chose the design research methodology in Information System (IS) which adapted from Vaishnavi and Kuechler (2004). The reason is because the methodology emphasizes the knowledge generation natural in the method. Besides that it originated in an analysis of the processes natural in any design effort.

3.1 Background of Design Research Methodology

Takeda, et al (1990) have analyzed the reasoning that occurs in the course of a General Design Cycle (GDC) then it was extended by Vaishnavi and Kuechler (2004) as illustrated in Figure 3.1. In following the flow chart of this creative effort

by a new type of knowledge that arises from the design activities and the reason that this knowledge is most easily found during the design effort will be clear. In this model all design begin with **Awareness of a problem**. This process step is sometimes called “Improvement Research” and this term emphasizes the problem-solving/performance-improving environment of the activity. The further detail are described on sub-chapter 3.2. Suggestions for solving problems are taken from the existing knowledge / theory base for problem areas either through experience, opinions or literature review. Next, make an effort to implement the courseware according to the suggestion settlement. This stage is made known as **Development** in the diagram.

Partially or fully successful implementations are then **Evaluated** (according to the functional specification implicit or explicit in the suggestion step process). Development, Evaluation and further Suggestion are normally iteratively performed in the course of the research effort. The basis of the recurrence, the flow from partial completion of the cycle back to **Awareness of the Problem**, is indicated by the *Circumscription* arrow. **Conclusion** shows termination of a precise design project that consist the finding of the evaluation and objectives achievement.

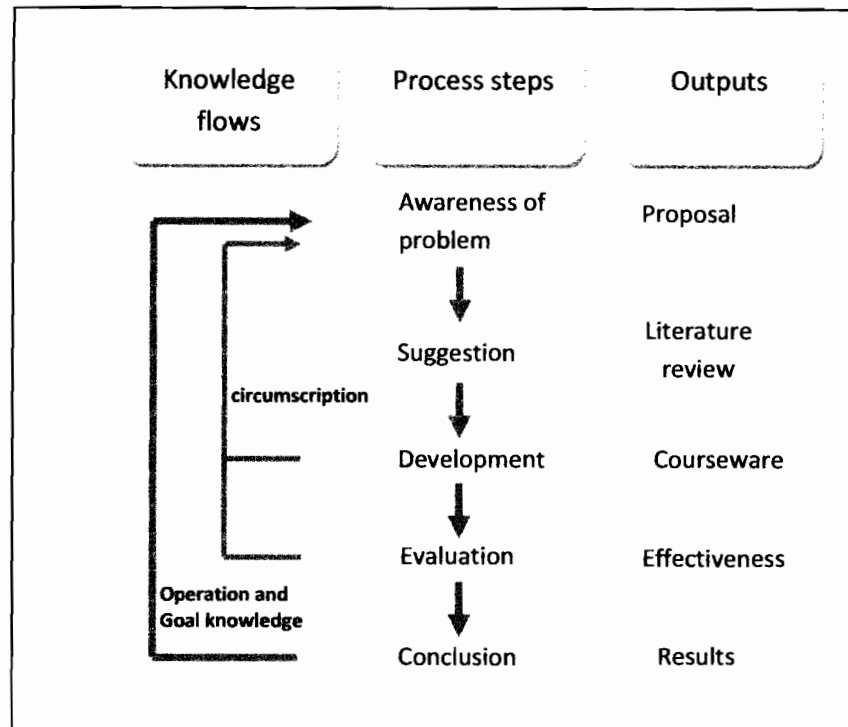


Figure 3.1: The Design Research Methodology
 (adapted from Vaishnavi & Kuechler, 2004)

Researcher used this research methodology to accomplish the project as following steps:

3.2 Awareness of Problem

An awareness of an interesting problem may come from multiple sources for a new course developments in Community College especially at Jitra, Kedah or in a reference discipline. Reading in an allied discipline may also provide the

opportunity for application of new findings to the researcher's field. The output of this step is a proposal, formal or informal, for a new research effort.

Based on researcher experience for about 8 years teach the NCI course, there are no specific courseware used in teaching and learning process. According to the problem statement in Chapter 1, students only got the knowledge through the conventional method in the class.

Researcher made the interview to two lecturers who teaching or ever teach students on the course in terms of teaching method in the class and the note preparation. The interview finding that they got the notes from accessing Internet, book and previous notes provided. They also still using the traditional method in learning process however they tried to improve by using Internet (used Youtube services) and presenting to student during class whether through online or slide show tool such as Ms Power Point. Enhancement of learning process is needed to make the student more enjoyable and useful especially during at home, they have no interactive references to make revision, because not all students have Internet accessed but majority of them have notebook or personal computer (PC). According to verbal surveying in the class, only 7 of 13 students have Internet accessing at home whether broadband or streamyx services meanwhile 12 of 13 students got a notebook (laptop) or PC at home.

3.3 Suggestion

The Suggestion step follows immediately behind the proposal and is intimately connected with it as the dotted line around Proposal and Literature Review (the output of the Suggestion step) indicates. The several previous ideas from literature will help to solve the problems existence. By using the literature also could be get the idea and guideline how to design the suitable prototype and creative. There are many kind of program that can be used as the tool to design courseware.

Literature review also will make the paper complete by giving the information or suggestions on evaluation and assessment to the courseware. However the step has necessary analogues in all research methods, for example, in positivist research creativity is inherent in the increase from curiosity about an organizational phenomena to the development of appropriate constructs that operationalize the phenomena and an appropriate research design for their measurement.

Used curriculum as a guideline and used it as an idea in this step. The starting point is ironically the visualization of the ending point. It involves identifying a relevant theme for the multimedia software title.

Researcher discussed with supervisor to get ideas and suggestions to start this research. His suggestion to develop courseware on learning process and evaluate it on perception of users. Searched information that related courseware development tool that simple and easy to design. At the same time, keeping in mind usability, best design practices, and ease of use were very important.

3.4 Development of Courseware

In this step, the designing and developing of courseware will be discussed. Nunamaker Jr & Chen (1990) elaborated the System Development Research Methodology (SDRM) which Trigui (2009) had chosen this methodology to accomplish his thesis. However, Rozaina (2008), had chosen the idea Neo & Neo (2004) as her courseware development methodology. Researcher made decision to choose the methodology of Neo & Neo (2004) and will be adapted the methodology to match with NCI Courseware. The multimedia for learning course using a tool consists of the following steps:

- i. Assembling the media elements needed to represent the educational content.
- ii. Digitizing the analogue media.
- iii. Editing the media elements.
- iv. Multimedia authoring.
- v. Packaging for delivery on a CD-ROM

3.5 Evaluation

Researcher made evaluation the perception of users in terms of perceived of usefulness, perceived of ease of use, learnability and future use of courseware to 48 respondents consist 46 students fourth semester in Certificate of Computer System and Support and two lecturers randomly used a questionnaire in the class.

However, before distribute the questionnaire to the respondents, researcher gave the courseware to the respondents, therefore they can used it and feel how easy and useful that courseware which covered the topic of the NCI course. After that, the respondents have given the simple briefing to them before they fill a set of questionnaire.

Idea to make items for the questionnaire is recommended by the supervisor and then get more information from a working paper on Information Systems (IS) by Chuttur (2009). In the working paper states that user acceptance of technology has become an important area of research for more than two decades now. This model became the preferred model by researchers in the field of information systems, though many models have been proposed to explain and predict the use of the system. Thus, he feel that it is important for anyone willing to study user acceptance of technology to have an understanding of the Technology Acceptance Model (TAM). Observations made at that time showed that while TAM is a highly cited model, he shares his opinions on theoretical assumptions and practical

effectiveness. This study concluded that TAM did not have adequate and relevant conclusions that will make a sustained theory of the people involved with the IS. In his writings, states that Davis (1985) defined TAM idea of usefulness, ease of use (Chuttur, 2009).

Trigui (2009) have made Arab Language Learning for kids thesis which he uses the techniques of questionnaire respondents to measure respondents' perception of the courseware in terms of perceived of usefulness, perceived of ease of use, learnability and future use. He uses items such as table below which researcher will modify it as the items for this study.

Perceived of Usefulness	
1	Using (ALL) would enable me to accomplish tasks more quickly.
2	Using (ALL) would improve my job performance.
3	Using (ALL) in my job would increase my productivity.
4	Using (ALL) would enhance my effectiveness on the job.
5	Using (ALL) would make it easier to do my tasks
6	I would find (ALL) useful in my job

Table 3.1: Sample of items for perceived of Usefulness

Perceived of Ease of Use	
1	Learning to operate (ALL) would be easy for me
2	I would find it easy to get (ALL) to do what I want it to do
3	My interaction with (ALL) would be clear and understandable
4	I would find (ALL) to be flexible to interact with
5	It would be easy for me to become skillful at using (ALL)
6	I would find (ALL) easy to use

Table 3.2: Sample of items for perceived of Ease of Use

Learnability	
1	It was easy to learn to use ALL.
2	The information provided by ALL was easy to understand.
3	The information provided in ALL helped me in teaching process.
4	It provides clarity of wording.
5	Data grouping is reasonable for easy teaching.
6	The ordering of information is logical.
7	The command names are meaningful.
8	It provides no penalty teaching.

Table 3.3: Sample of items for Learnability

Outcome/Future of work	
1	I was able to complete my teaching quickly using ALL.
2	I could effectively complete my teaching using ALL.
3	I was able to efficiently complete the teaching using ALL.
4	From my current experience with using ALL, think I would use it regularly.

Table 3.4: Sample of items for Future of Work

While the measurement scale for all items using a 5-point Likert scale as in the table 3.5 below. Actually, there are typically between four and seven options. However five is very common.

	Strongly agree	Tend to agree	Neither agree nor disagree	Tend to disagree	Strongly disagree
Items	1	2	3	4	5

Table 3.5: Five-point traditional Likert scale

The general form is a reality, with which people can agree or disagree with different degrees. In scoring, numbers are usually assigned to each option (such as 1 to 5). The Likert scale is named after its creator, Rensis Likert. It is also called summative scale, as a result of this questionnaire is often achieved by adding up the

numerical task of response given. Usually the questions used are easy to understand and so lead to consistent answers. But it only a few options are offered, with which respondents may not fully agree (Changing Minds, 2011)

At the same time, researcher made observation during the respondents use the courseware through their reaction, face and smiling. All information about observation had written on the observation note.

3.6 Conclusion

Conclusion is the final step of this research methodology effort. Researcher will concluded the method used to develop NCI Courseware and the result of the finding after researcher made the evaluation on users especially students and lecturer at CCBD.

CHAPTER 4

DEVELOPMENT OF COURSEWARE

The developments of courseware are discussed in this chapter. As stated in the previous chapter, the methodology of Neo & Neo (2004) namely Multimedia Design Process (MDP) has been chosen as the instrument because it is similar with related work especially in the education trend in Malaysia. Adaptation of the methodology is made to match with NCI Courseware. The multimedia used for this learning course are Lecture Maker 2.0 as an authoring tool with others editing tool to support the development of courseware such as YouCam3 with the notebook webcam (camera), Paint, Audio recorder with microphone device and Windows Media Player.

The development of this methodology consists of:

- i. Create the media elements.
- ii. Convert the media to digital format.
- iii. Editing the media elements.
- iv. Multimedia authoring.
- v. Packaging for delivery on a CD-ROM

4.1 Create the Media Elements

Creating the media elements is the first step of process in a courseware development. The syllabus is used to get the content guideline to ensure the validation. References are made from the notes, books and Internet as a source of content of courseware. Researcher develops a new courseware as a tool to make evaluation in this study because of no specific courseware about NCI.

Next, researcher trying to get information about authoring software for examples Macromedia Flash, Authorware, Director and LectureMaker. At the same time, researcher constructed the flowchart of the courseware as a general view for implementation, design story boards, collected the suitable images or graphics (format file .jpg or .png), audios (format file .mp3 or .wma), videos (format file .mp4 or .wmv) and finally is authoring the contents in authoring tool.

4.1.1 Hierarchy Diagram and Flow chart

Flowchart and hierarchy mode diagram is a strategy to show how courseware works and the navigation between screens as in Figure 4.1 below.

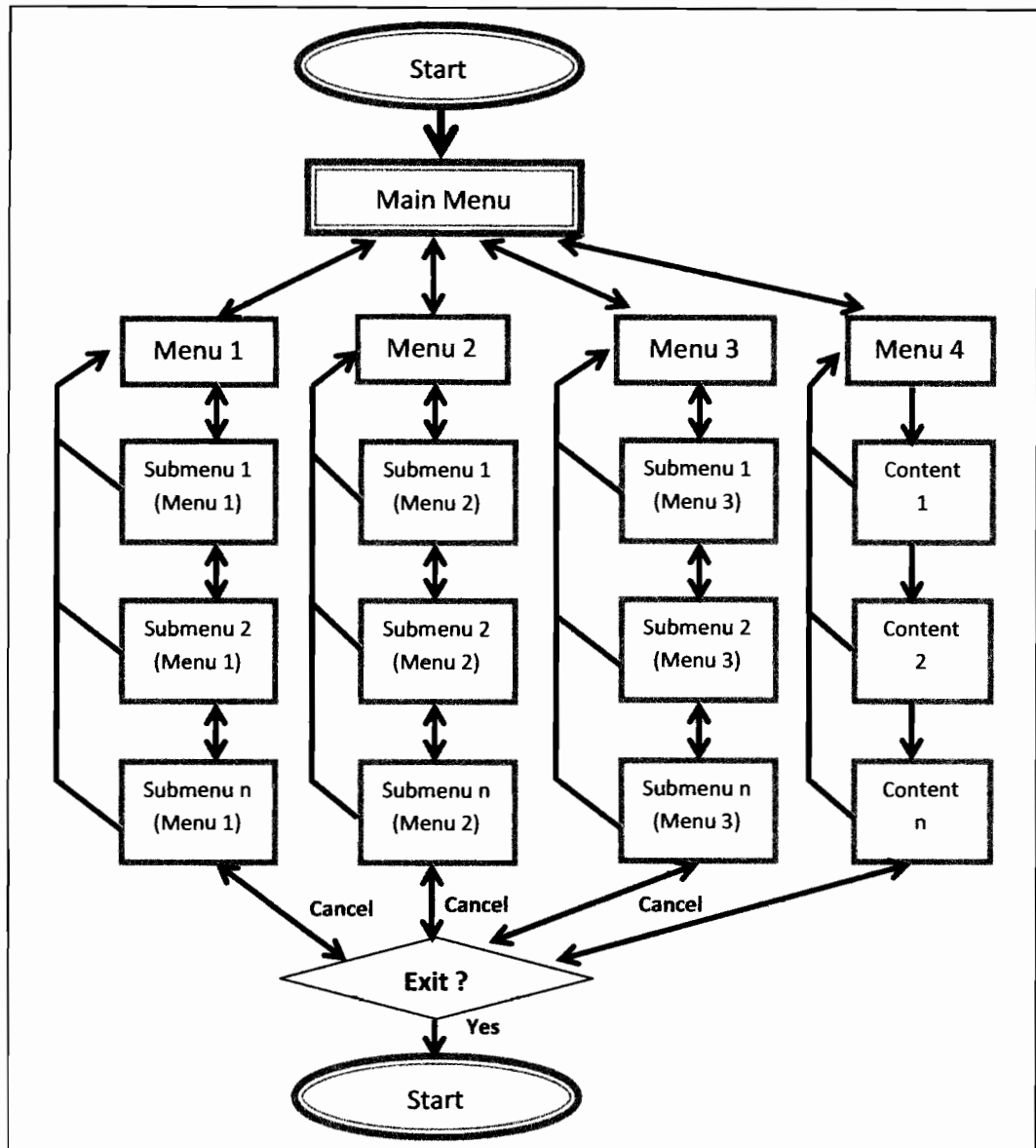


Figure 4.1: General flowchart and hierarchy

Oliver & Herrington (1995) identified three types of navigational frameworks within multimedia which include linear, hierarchical, and referential. The linking of screen is designed by researcher is combination between hierarchical and referential style of linking. Figure 4.2 shows

hierarchical structure that allows the user to easily move from pages which is added a straight-line method while Figure 4.3 shows linear structure that user can move sequence to another screen.

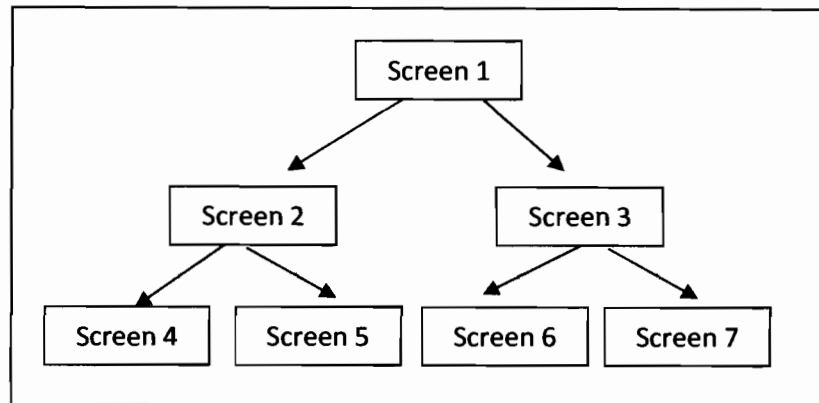


Figure 4.2: Hierarchical structure

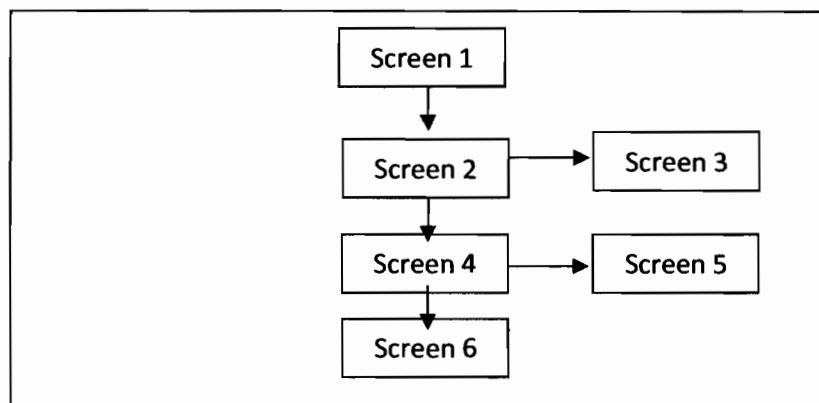


Figure 4.3: Linear structure

Thus, it is necessary to organize navigation by combining two modes of structures similar with the view of Judd (2001) stated most interactive multimedia architecture applications typically contain elements of both. So,

the Figure 4.1 had shown the combination of flowchart for the NCI Courseware.

4.1.2 Storyboard Design

A storyboard is a design of screen look like before the courseware is developed, the linking of screens exist, a information of each elements for each screen (Shuman, 2003). According to diagram of flowchart which combination between two types of structured, hierarchical and linear, the storyboard for several screen are made. It takes each section of the flowchart and show what is inside each screen. The following aspects should be addressed in the storyboard. Figure 4.4 illustrates a sample of story board that consists:

- Project name
- Designer/author name
- Page title
- Page number
- The interface screen design
- Multimedia elements description

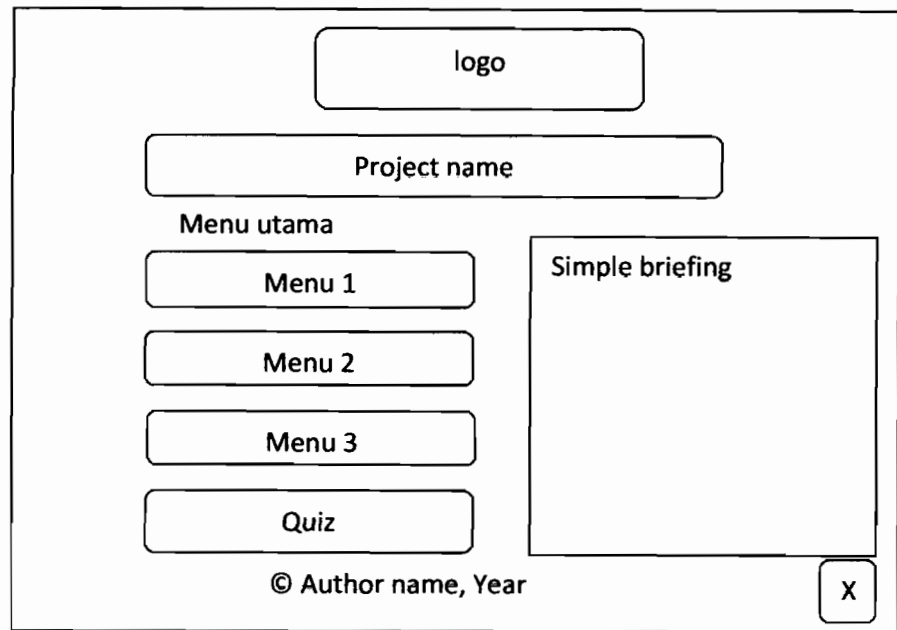


Figure 4.4: Sample of storyboard

4.2 Digitizing the Analogue Media

The media elements such as the images, videos, audios, animations, photo of background and text of contents are collected and stored it in the disc drive or CD. All these elements will be used to make the courseware more functionality, creative and interactive.

Convert the contents from notes to computerize such as Ms Power Point, Ms Word and other program. But the images or diagram in the note was difficult to convert into digital. However, some images or diagrams in the notes, could be found through search engine or website thus it was converted into the digital element and save in the PC.

Next, our voices and photo are converted and digitalized by connect it to the cable of audio component (microphone) or cable for camera. Photo and voice recording using certain software to digitalized it. Included the music from Internet or CD, it also was transferred to the PC or notebook.

4.3 Editing the Media Elements

All media elements that have been digitalized were stored in the PC or disc drive. Editing the media in digital was easy compared to documentation. Researcher made editing the elements of media depend on the format file whether it was audio, video, text, image and so on with the suitable existing tool.

The media of image was used the Paint provided by Ms Windows to make editing for icon or button in the courseware. Usually, the suitable format file for icon is .png (portable network graphic) because the ability of transparent of courseware background. However, researcher also used .jpg or .jpeg (joint photographic expert group) because of the file size.

Captured video as recording video used the camera of notebook (webcam) and made edited by software called Cyberlink YouCam version 3. This software could make our video more fun and enjoyable with the animation and interactive. It also provided the facility of setting our voice to record integrated with the video.

The voice recording were conducted using the microphone and later on were saved in a folder. This recording was set up using Windows Media Audio, provided by the Ms Windows. The message box needs the voice or audio as a reaction of our activities especially when the students answered the quizzes.

4.4 Multimedia Authoring

Authoring the courseware was the step to accomplish development of courseware. Previously, the information gathered included the main content to fill, the software of authoring, editing tools, created the structure of courseware and general flowchart, story board as a draft of multimedia authoring, element of digitalized media and this part will elaborate the authoring the interface of courseware.

There are many authoring software for examples Macromedia Flash, Authorware, Director and other. Researcher used interactive lessons and activities authoring software namely LectureMAKER version 2 based on the deployment requirement and quite easy to use because it is similarly with Ms Power Point concept. It allows saving the courseware in the global accepted Flash format additionally, the output of the courseware can be SCORM compliant. Besides that, the courseware can be saving as executing file (.exe), thus the courseware became a standalone courseware whereby students can used it as a note to make revision on self-learning method. The courseware could be seen as an inspiration to integrate

information, knowledge and communication technology in teaching and learning process especially students, everyday life (Faridah Hanim & Halimah, 2008).

Next, the discussion is the interface of courseware developed by researcher as a tool of evaluation:

4.4.1 Start Screen

When user double click on mouse, the screen will appear as a start screen (Figure 4.5). There are logos of MoHE and Community Colleges Department, title of courseware, *enter* action button, *exit* action button, date and developer's name.

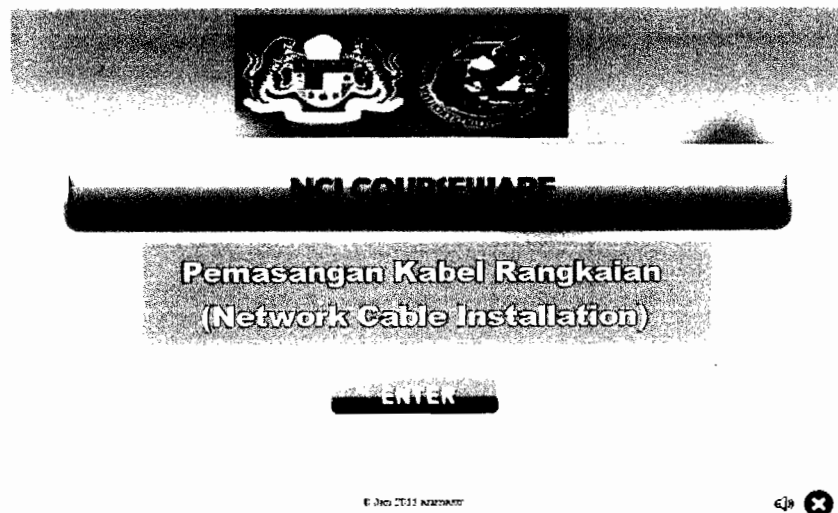


Figure 4.5: Start screen of NCI Courseware

4.4.2 Main Menu

The screen as shown in Figure 4.6 is a main menu that provided four menu which covered the syllabus of the NCI course on topic 3 that consist:

- i. Type of Cable (*Jenis Kabel*)
- ii. Equipment (*Peralatan*)
- iii. Cable Installation (*Pemasangan Kabel*)
- iv. Quiz (*Kuiz*)

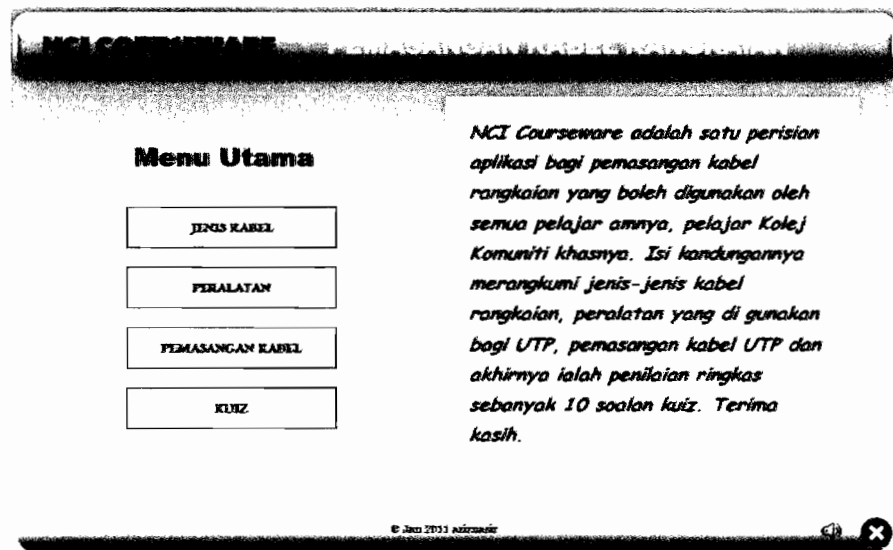


Figure 4.6: Main Menu screen

4.4.3 Menu 1 : Type of Cable

While the mouse rollover the Type of Cable (*JENIS KABEL*) button (marked circle), the button changed the color to blue and the right box changed to four sub- menu of cables as Figure 4.7 below. The four sub-menu are:

- i. Coaxial cable
- ii. UTP cable
- iii. STP cable
- iv. Fiber Optic cable

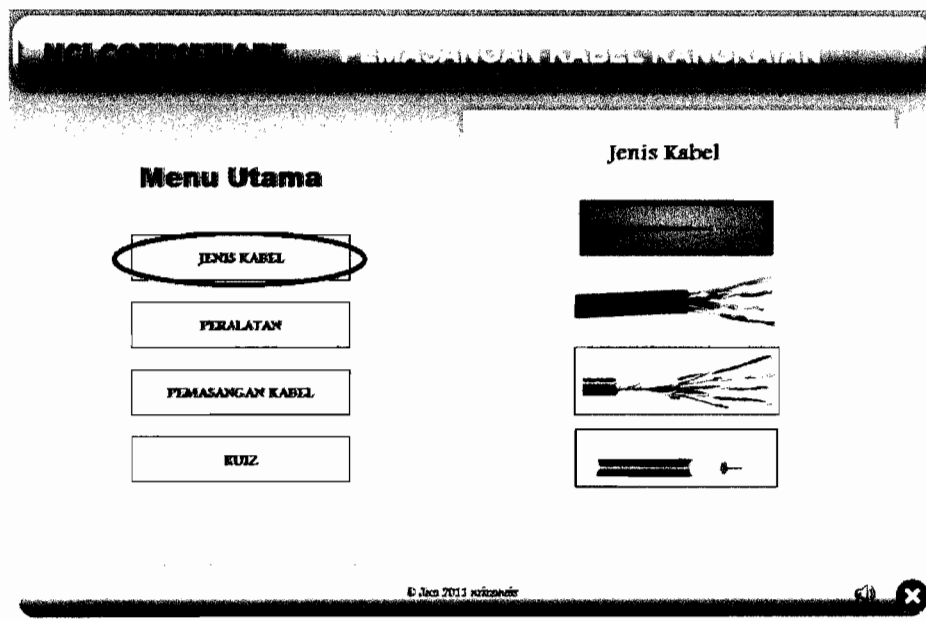


Figure 4.7: Menu1 - Types of Cable

4.4.4 Sample of Sub-Menu 1 (Menu 1)

The screen below in Figure 4.8, shown the sample of screen of sub-menu of four sub-menus provided such as Coaxial cable. In this screen, video recording of lecturer's briefing on Coaxial appeared and at the same time, the cable is presented a by arrow on the cable parts. Besides that, the courseware describe several features of network cable.

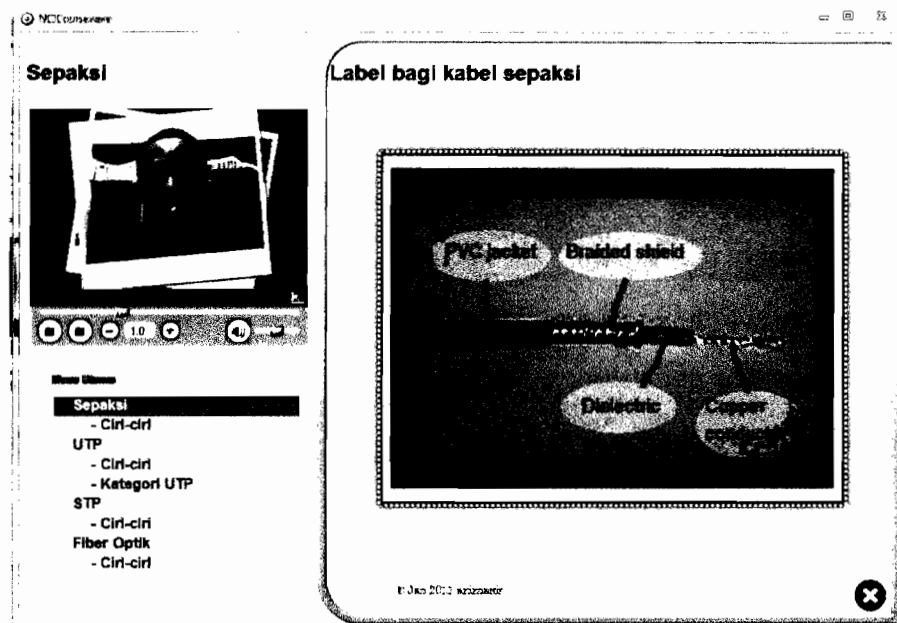


Figure 4.8: Sample of sub-menu for Menu 1

4.4.5 Menu2: Tools (Peralatan)

While the mouse rollover the Tools (*PERALATAN*) button (marked circle), the button changed the color to blue and the right box changed to six sub-menus of cable (Figure 4.9). There tools consists:

- i. Measure tape
- ii. Cutter
- iii. Stripper (including Puncher)
- iv. RJ-45 connector
- v. Crimping tool (for RJ-45)
- vi. Cable tester

Users could click one of the tool image to move another screen specifically.

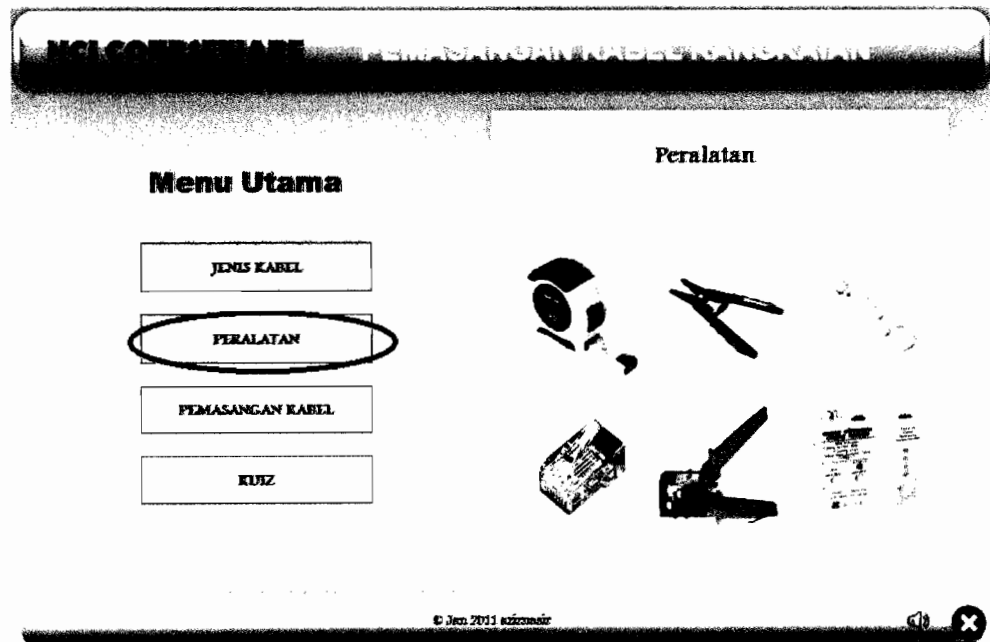


Figure 4.9: Menu 2 – Tools

4.4.6 Sample of Sub-Menu 6 (Menu2)

The screen as shown in Figure 4.10, is a sub-menu and serve as a sample screen for Menu2 that will appear after user click the image for sub-menu .

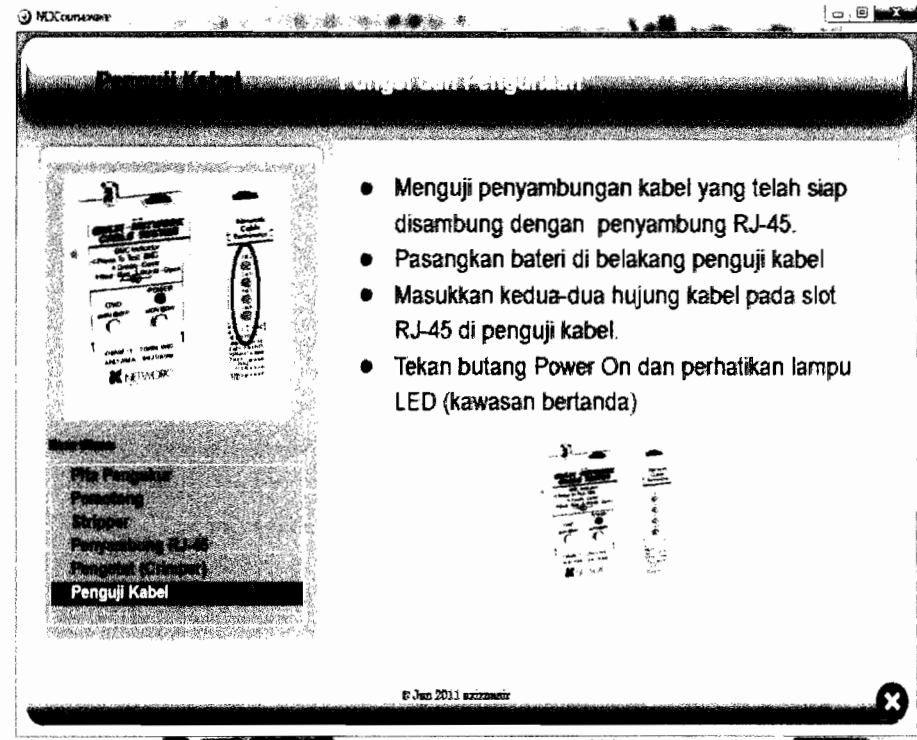


Figure 4.10: Sample of sub menu for Menu 6

4.4.7 Menu 3: Network Cable Installation (Pemasangan Kabel Rangkaian)

Figure 4.11 is shown the screen of Menu3 for network cable installation (mark circle) lesson which providing four sub-menus such as

- i. Colors of cable
- ii. Cross over cable
- iii. Straight cable
- iv. Steps of network cable installation.

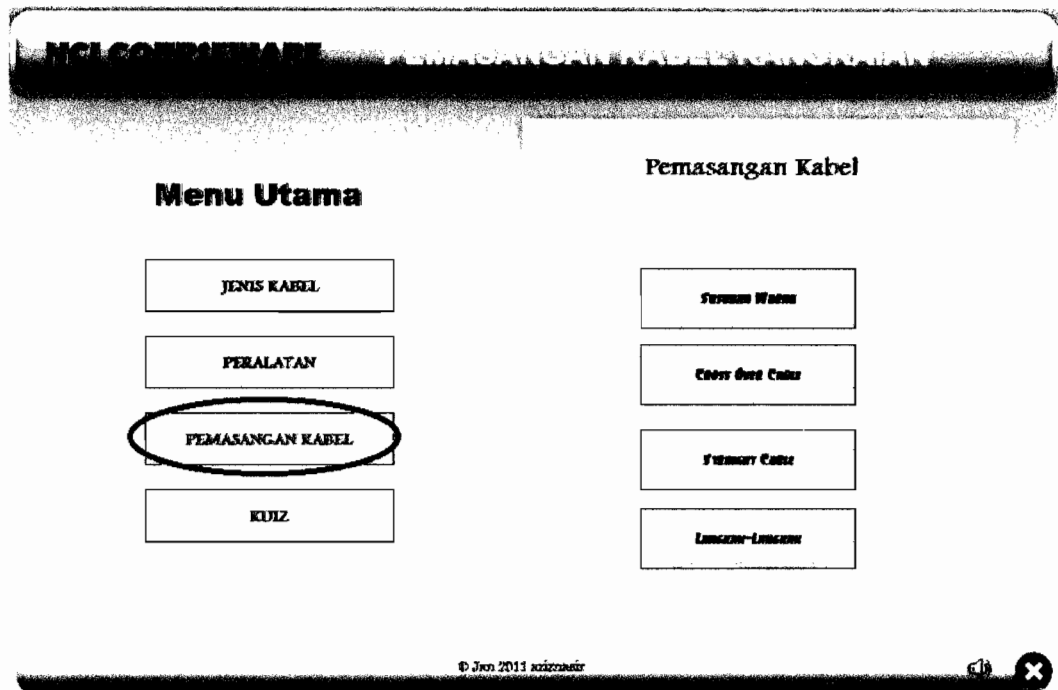


Figure 4.11: Menu 3 – Network Cable Installation

4.4.8 Sample of Sub-Menu 4 (Menu3)

This screen is a combination of video and text (referred to Figure 4.12). At the same time, courseware will underline (brown color) under the text using electronic board recording. The step of cable installation is presented until finish included the cable testing through video.

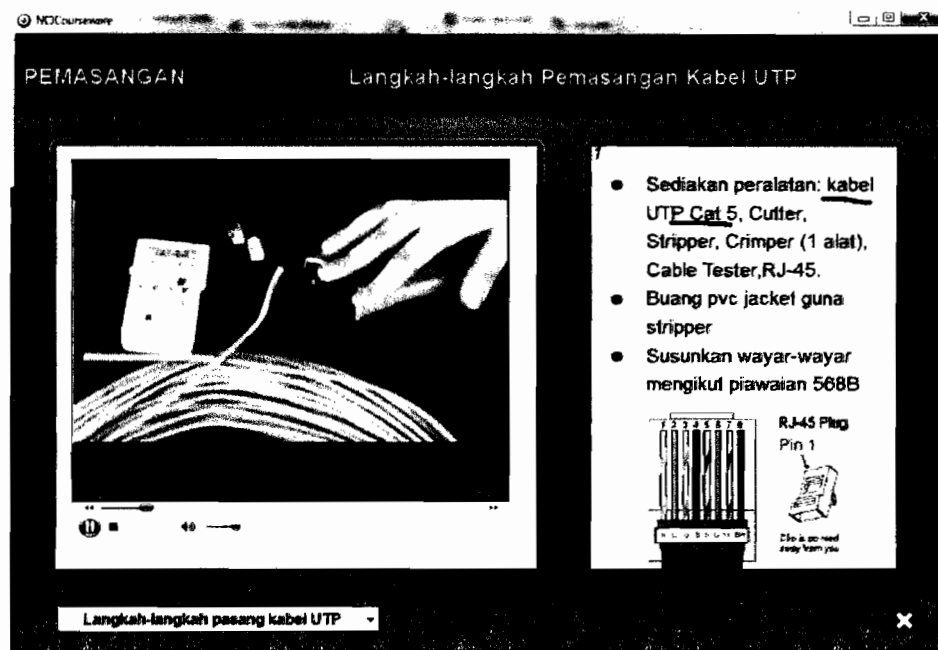


Figure 4.12: Sample of sub-menu for Menu3

4.4.9 Menu 4: Quiz (Kuiz)

From Figure 4.13 the users can repeat the activities until first round completed. The image of of Quiz will change when the mouse pass over the image. Click the image appeared to move to next screen.

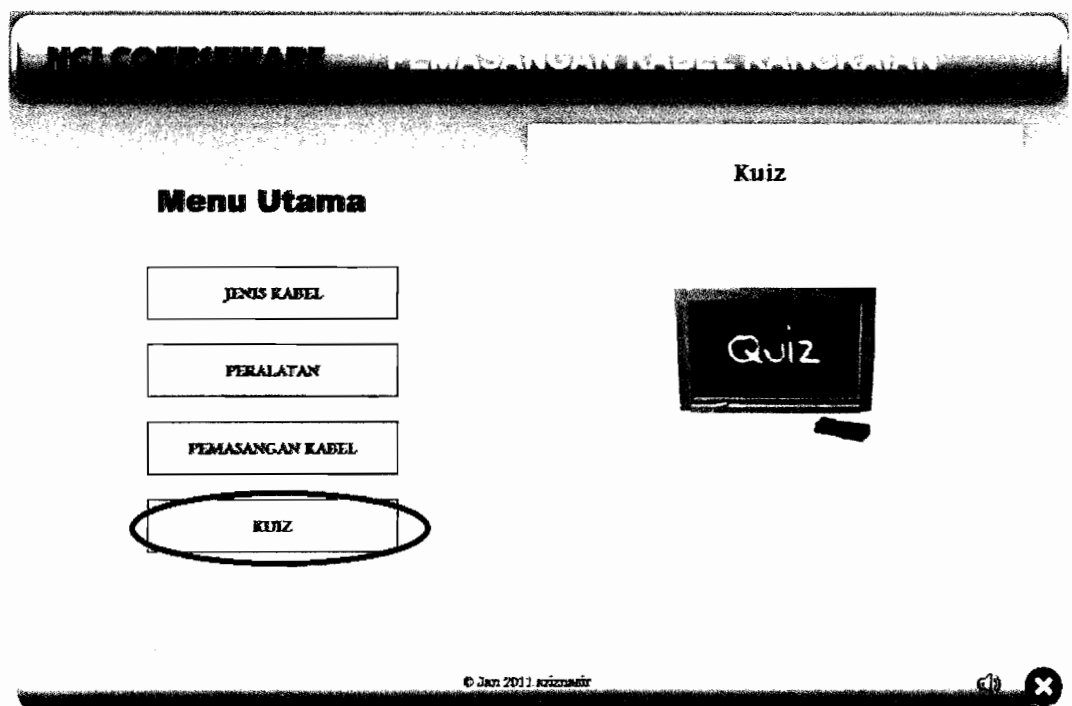


Figure 4.13: Menu 4 - Quiz

4.4.10 Sample of Quiz 1 (Menu4)

This screen (Figure 4.14) is the sample of quiz screen whereby users can do it repeatedly in condition all question must finish answered for current round. There were 10 question provided to test the user's understanding and the true answered will shown after user submit the quiz to generate the question.

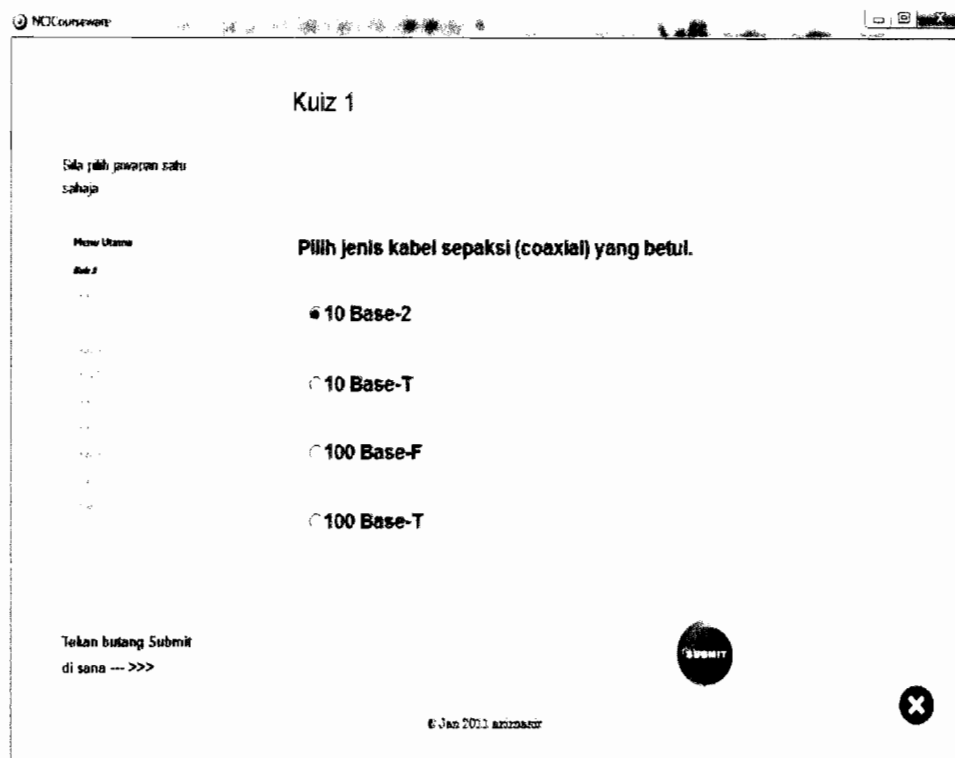


Figure 4.14: Sample of sub menu for Menu 4

4.5 Packaging for Delivery on a CD-ROM

The courseware had completed the development phase. The CD-ROM is the most ordinary way of delivering courseware that is not offered online. For teachers and trainers, courseware content may include set-up information, a course plan, teaching notes, and exercises (Whatis.com, 2008).

The courseware is saved as executable file (.exe) package. Before converted the courseware to the CD-ROM, it is better if the courseware to be tested. Researcher tests the courseware repeatedly to ensure the courseware made minimum error or failure. Next, researcher asked other lecturers to look up the courseware and suggest some suggestions for further improvement. Finally, the courseware is converted into CD-ROM and it can be copied to more than one CD-ROM for users implementation in the computer lab or home.

4.6 Summary

This chapter have already described on the development of courseware start from the create media element to packaging for delivery on a CD-ROM used MDP model adapted from Neo & Neo (2004). The discussion consist the flowchart, story board design and authoring the courseware.

CHAPTER 5

DATA ANALYSIS AND RESULT

The respondents are students and lecturers from CCBD, MoHE. There are 48 respondents and majority of them are final semester students in Certificate of Computer System and Support Programme. They must enrol for the NCI course to accomplish their certificate which was offered during last semester. However this questionnaire also distributed to lecturers who did not teach the course. The respondents have been given the CD of NCI Courseware and used it in period of time.

The usability questionnaire is divided into four main item called:

- a) perceived of usefulness,
- b) perceived of ease of use,
- c) learnability and
- d) future use.

Perceived usefulness which measure the extent to which a person believes that using the courseware that will improve his or her performances, while perceived of ease of use measure the extent to which a person believes that the courseware will be free from physical and mental effort (Chuttur, 2009).

Learnability's item is measures the capability of learning courseware and to evaluate the degree of user's ability to operate the system to some defined level of competence after some degree of training, and/or to evaluate the degree of the ability of infrequent users to relearn the system after periods of inactivity and item of future use is to measure a degree of user willingness to use this courseware in the future work (Trigui, 2009).

Data was collected from the respondents after they answered the questionnaire. They have given briefing by the researcher the objective of the study before answering the questionnaire. All data were stored in the data storage using Statistical Package for Social Sciences (SPSS) version 17.

The result was as shown below. First, the information of respondents background as Table 5.1. It shows the frequency and percentage for every part of item consisted gender, race, job of respondent and their experience on IT after analyzed the data used descriptive statistic and frequency. According to gender, there are only 43.8% male of respondent while 56.3% was female. Majority of the respondents are Malay (79.2%) compared other races in the CCBD. The students generally, majority of them were intermediate and expert in terms of experience on IT (3 years and above).

Gender	Frequency	Percent (%)
male	21	43.8
female	27	56.3
Total	48	100.0
Race	Frequency	Percent (%)
malay	38	79.2
chinese	5	10.4
indian	3	6.3
others	2	4.2
Total	48	100.0
Job	Frequency	Percent (%)
student	46	95.8
lecturer	2	4.2
Total	48	100.0
IT experience	Frequency	Percent (%)
< 1 year	1	2.1
1-3 year	8	16.7
3-6 year	20	41.7
6-10 year	10	20.8
more 10 year	9	18.8
Total	48	100.0

Table 5.1: Percentage of respondent background

5.1 Reliability of Data

Reliability in the questionnaire is important issue in usability measurement. . The reliability of the questionnaire is the ability of the questionnaire to give the same results when filled out by like-minded people in similar circumstances. It is

usually expressed on a numerical scale from zero (very unreliable) to one (extremely reliable) (Dennis, 2008).

Therefore using SPSS, in the Scale function, then selected the Reliability Analysis, Cronbach's Alpha values were calculated to determine the data inter-item reliability which assesses the degree of internal consistency between multiple measurements of a dimension. A result for reliability of data which Cronbach's Alpha value for each measure were shown. The usefulness, ease of use, learnability and future use measures have Cronbach's alpha of greater than 0.7. The internal consistency estimate of each construct ranges from 0.767 to 0.872 as shown in Table 5.2. So, these measures satisfy the internal reliability.

Item Measured	Cronbach's Alpha	N of Items
Perceived of Usefulness	.795	6
Perceived of Ease of Use	.767	4
Learnability	.849	6
Future Use	.872	4

Table 5.2: Data reliability

5.2 Mean of Measurement

The previous chapter had describes the measurement was used the 5 point Likert-scale as following:

- 1- Strongly Agree
- 2- Agree
- 3- Uncertain
- 4- Disagree
- 5- Strongly Disagree

Most of the researcher used the Likert-scale on opposite measurement, such as 1 is addressing to Strongly Disagree but in this study, researcher used 1 as a Strongly Agree.

Descriptive analysis are conducted on collected data to describe the four construct to evaluate the perception of students about this courseware. The result shows the mean of each construct, as shown in Table 5.3. From the table below, the lowest mean of all the constructs is 1.7604 that represents the construct of Learnability.

Constructs Measured	N	Mean	Std. Deviation
Perceived of Usefulness	48	1.7951	.46667
Perceived of Ease of Use	48	2.0972	.50392
Learnability	48	1.7604	.51215
FutureUse	48	1.9375	.66943

Table 5.3: Constructs measurement

Researcher also shows the items of each construct in more detail included the question statement to the respondents. Below are the tables that have produced by the descriptive analyze using SPSS 17 (Table 5.4 to 5.7).

Perceived of Usefulness Measurement	N	Mean	Std. Deviation
NCI Courseware enables me to accomplish tasks more quickly.	48	1.83	.595
Using NCI Courseware increases my productivity.	48	1.83	.559
Using NCI Courseware improves my job performance.	48	1.81	.491
Using NCI Courseware enhances my effectiveness on the job.	48	1.88	.703
Using NCI Courseware makes it easier to do my job.	48	1.83	.834
Overall, I find NCI Courseware useful in my job.	48	1.58	.739

Table 5.4: Items of Perceived of Usefulness measurement

Perceived of Ease of Use Measurement	N	Mean	Std. Deviation
Learning to operate NCI Courseware is easy for me.	48	1.79	.713
It is easy for me to remember how to perform task using NCI Courseware.	48	1.75	.729
My interaction with NCI Courseware is clear and understandable.	48	1.75	.700
I find NCI Courseware burdensome to use.	48	3.10	1.242
I find it takes a lot of effort to become skilful at using NCI Courseware.	48	2.35	1.229
Overall, I find NCI Courseware easy to use.	48	1.83	.724

Table 5.5: Items of Perceived of Ease of Use measurement

Learnability Measurement	N	Mean	Std. Deviation
It is easy to learn NCI Courseware.	48	1.83	.883
The information provided by NCI Courseware is easy to understand.	48	1.69	.689
NCI Courseware provides clarity of wording.	48	1.71	.582
The clearness and correctness of the content.	48	1.73	.610
The ordering of information is logical.	48	1.94	.727
The information provided, helped me in job process.	48	1.67	.519

Table 5.6: Items of Learnability measurement

Future Use Measurement	N	Mean	Std. Deviation
I was able to complete my job quickly using NCI Courseware.	48	1.92	.919
I could effectively complete my job using NCI Courseware.	48	2.02	.699
I was able to efficiently complete my job using NCI Courseware.	48	1.96	.798
From my current experience with using NCI Courseware, I would use it regularly	48	1.85	.714

Table 5.7: Items of Future Use measurement

5.3 Observation

Observation made on the students using the courseware in a period of about two hours. Researchers recorded the reaction of the students in the notes. The result of such observation, it was found that students pay more attention to the activities performed. Facial expression that looks fun and entertaining learning activities using the courseware is accompanied by simple musical tunes and motivated. In

addition, they not only see the text and figures alone but they are also interested in the video lectures are being briefed on the contents of the subject.

5.4 Summary

The second objective of this study were achieved, namely to evaluate the perception among users in terms of the perceived of usefulness, perceived of ease of use, learnability and future use of courseware. The data collected used quantitative method, whereby using questionnaire to get the data. Overall, users agree that the courseware is usefulness, ease of use and learnability. Similarly, the use of courseware in the future in which users give a positive perception.

The data collected by the questionnaire are reliable with Reliability Analysis supported using SPSS shown that Cronbach's Alpha is greater than 0.7. The range mean was 1.7604 to 2.0972 for all constructs of NCI Courseware evaluation.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

In this chapter, the conclusion for the study and some recommendation for the future work by researcher or the others were discussed.

6.1 Conclusion

This study used the research methodology in Information System (IS) adapted from Vaishnavi and Kuechler (2004). The model of research methodology consists:

- i Awareness of a problem – identify problems based on the experiences of researchers discovered nearly 12 years teaching in general, and specifically the NCI has been teaching almost 8 years. subsequent interviews were made against two lecturers who are teaching this course during this study.
- ii Suggestions – after a step of problem awareness, the suggestions will be implemented to solve the problem. With reference to the literature

review, and views among colleagues and supervisor, offered useful suggestions for preparing this study. The problem should have solution to overcome it.

iii Development – according to the suggestion, the step of Development should be accomplished by developing the courseware. However, researcher did not know the perception among users, thus,

iv Evaluation step had to be carried out to complete the study.

By referring to the first chapter, it is indicated by the researcher that the two objectives mentioned are achieved in this study.

First objective focused on the courseware development. Thus, researcher used various sources like journal, articles, books and academic of report via online and website. Research have chosen Multimedia Design Process (MDP) by Neo & Neo (2004), however made modification so it can be matched to the NCI Courseware. Researcher also used a LectureMaker 2.0 as an authoring software in developing the courseware.

Second objective is to evaluate perception among users in terms of perceived of usefulness, perceived of ease of use, learnability and future use of courseware.

The data collected used quantitative method, whereby using questionnaire to get the data. Overall the users are agreed with the NCI Courseware for the terms.

After conducted the research, there are some weakness of this courseware especially on courseware development such as time constraint, the first time using LectureMaker as authoring software, less adept at using the powerful authoring and animation software (such as Macromedia Flash, Macromedia Authoware, Macromedia Director Mx, Macromedia Swish) and the lack of knowledge of SPSS. However according to the result, found that the perception among users especially students who involved the course of NCI shown positively in terms of perceived of usefulness, perceived of ease of use, learnability and future use of courseware.

6.2 Recommendation

Below are the recommendations for further study by the researchers or others:

1. Use a good editing tool for edit the media element like audio, video, graphic, image, text and animation.
2. The size of screen, text, the colour usage, background and volume should suitable and do the research on user requirement.

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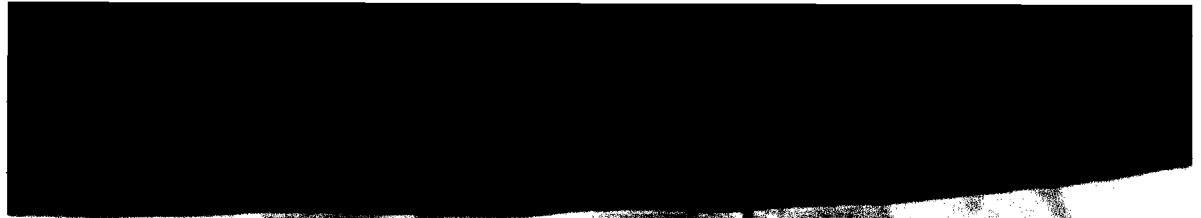
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APPENDIX A: SYLLABUS OF NETWORK CABLE INSTALLATION



TERHAD

ESS311 Pemasangan Kabel Rangkaian

3.0 PEMASANGAN PENYAMBUNG

- 3.1 Penyambungan kabel dengan penyambung
 - 3.1.1 Mengenalpasti kod-kod warna pada kabel
 - 3.1.2 Mengenalpasti jenis kabel dan penyambung yang sesuai untuk kabel tersebut, dan membuat penyambungan kabel kepada penyambung (contoh: UTP cable dengan RJ45, Coax cable dengan BNC dan lain-lain lagi)
 - 3.1.3 Membuat *patch cable*
 - 3.1.4 Menjalankan langkah-langkah pemasangan *face plate*
 - 3.1.5 Menguji sambungan



4.0 BACAAN BLUEPRINT

- 4.1 Mentakrifkan *blueprint*, mengenalpasti simbol-simbol dalam *blueprint* dan menyenaraikan kepentingan membaca *blueprint*.

The code of the course is ESS311 – Network Cable Installation or *Pemasangan Kabel Rangkaian*. There are four topics, but the courseware only focus on Topic 3.0 excluded Sub Topic 3.1.4 because of time constraint.

APPENDIX B: INTERVIEW FORM FOR LECTURER



Interview for Lecturer

Data collection by the user's verbal report using interview before developing courseware. Respondent : Lecturers who teaching /ever taught a Network Cable Installation course -NCI)

1. Is your background in networking or do you have previous experience on networking?

2. How do you prepare your teaching?

3. Please list down the way that you get the notes.

4. What method did you use to teach students? (Chalk and talk, slide show, mixed or others).

5. Based on your experienced, using the method above, what is the reaction of students during learning processed?

APPENDIX C: USABILITY QUESTIONNAIRE



Research Questionnaires The Use of Interactive Multimedia for Network Cable Installation Course

Dear Respondents,

This study attempts to discover the effectiveness of using interactive multimedia for Network Cable Installation course or Network Cable Installation Courseware (NCICourseware) in teaching and learning process. Researcher seek you kind cooperation to complete this Questionnaire by providing your honest and most accurate response regarding your experience after using the courseware. Your response is of great importance to researcher and truly appreciate your time and effort in participating in this research.

This questionnaire is divided into five sections (Section A, B, C, D and E). Section A - addressing respondent's general background. Section B - measuring the Perceived of Usefulness of NCICourseware. Section C - measuring the Perceived of Ease of Use. Section D measuring the Learnability and section E measuring the Future Use of that courseware. Respondents are required to answer all the questions in order to complete the session.

Thank you.

Yours sincerely,

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SECTION A: RESPONDENT'S GENERAL BACKGROUND

Please tick (✓) on the appropriate boxes.

1. Gender :

- Male
- Female

2. Race:

- Malay
- Chinese
- Indian
- Others

3. What is your job at the institution?

- Student
- Lecturer

4. How many years have you been using the computer?

- < 1 year
- 1 - 3 years
- 3 - 6 years
- 6 - 10 years
- More than 10 years

SECTION B: PERCEIVED OF USEFULNESS MEASUREMENT

Please tick (✓) on the appropriate boxes.

Use the following five point traditional rating Likert scale that is located below:

1 - Strongly Agree, 2 - Agree, 3 - Uncertain, 4 - Disagree and 5 - Strongly Disagree

No	Items of measurement	1	2	3	4	5
1	NCI Courseware enables me to accomplish tasks more quickly.					
2	Using NCI Courseware increases my productivity.					
3	Using NCI Courseware improves my job performance.					
4	Using NCI Courseware enhances my effectiveness on the job.					
5	Using NCI Courseware makes it easier to do my job.					
6	Overall, I find NCI Courseware useful in my job.					

SECTION C: PERCEIVED OF EASE OF USE MEASUREMENT

Please tick (✓) on the appropriate boxes.

Use the following five point traditional rating Likert-scale that is located below:

1 - Strongly Agree, 2 - Agree, 3 - Uncertain, 4 - Disagree and 5 - Strongly Disagree

No	Items of measurement	1	2	3	4	5
1	Learning to operate NCI Courseware is easy for me.					
2	It is easy for me to remember how to perform task using NCI Courseware.					
3	My interaction with NCI Courseware is clear and understandable.					
4	I find NCI Courseware burdensome to use.					
5	I find it takes a lot of effort to become skilful at using NCI Courseware.					
6	Overall, I find NCI Courseware easy to use.					

SECTION D: LEARNABILITY MEASUREMENT

Please tick (✓) on the appropriate boxes.

Use the following five point traditional rating Likert-scale that is located below:

1 - Strongly Agree, 2 - Agree, 3 - Uncertain, 4 - Disagree and 5 - Strongly Disagree

No	Items of measurement	1	2	3	4	5
1	It is easy to learn NCI Courseware.					
2	The information provided by NCI Courseware is easy to understand.					
3	NCI Courseware provides clarity of wording.					
4	The clearness and correctness of the content.					
5	The ordering of information is logical.					
6	The information provided, helped me in job process.					

SECTION E: FUTURE USE MEASUREMENT

Please tick (✓) on the appropriate boxes.

Use the following five point traditional rating Likert-scale that is located below:

1 - Strongly Agree, 2 - Agree, 3 - Uncertain, 4 - Disagree and 5 - Strongly Disagree

No	Items of measurement	1	2	3	4	5
1	I was able to complete my job quickly using NCI Courseware.					
2	I could effectively complete my job using NCI Courseware.					
3	I was able to efficiently complete my job using NCI Courseware.					
4	From my current experience with using NCI Courseware, I would use it regularly					

APPENDIX D: OBSERVATION NOTES



Observation Notes

Data collection by observing the user's behavior throughout the courseware using such as reaction on face, smiling, focusing and so on.

Date:

Time:

Location:

Number of student:

Notes: