



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Development of Computer-based Training of Hydraulics and Pneumatics Learning Equipments

Thesis submitted in accordance with the requirements of the Universiti Teknikal
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(Robotic and Automation)

By

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This thesis submitted to the senate of KUTKM and has been accepted as fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering (Robotic and Automation). The member of the supervisory committee is as follows:

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DECLARATION

I hereby, declare this thesis entitled “Development of Computer-based Training of Hydraulics and Pneumatics Learning Equipments” is the results of my own research except as cited in the reference.

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ABSTRACT

Computer-based Training (CBT) is the utilization of the computer and allied technologies to provide training or education. In this project, an application is going to be developed using Macromedia Authorware. Macromedia's Authorware is a software development tools for creating interactive multimedia applications. The fluid power field has difficulty in achieving the professionalism and formal educational system found in many other engineering and technical fields. A selection of fluid power computerized design and simulation software is now available. As a result, students, technicians and even organization can use the application to search for information about hydraulics and pneumatics if as an example, for student, to use in their studies or laboratory report especially those taking Fluid Power subject that offered by Universiti Teknikal Malaysia Melaka (UTeM).

ABSTRAK

Computer-based Training (CBT) ialah penggunaan komputer disertakan dengan gabungan teknologi untuk menyediakan latihan atau pembelajaran. Dalam projek ini, satu aplikasi akan dibangunkan dengan menggunakan perisian Macromedia Authorware. Macromedia Authorware adalah alat pembangunan perisian untuk membentuk satu interaksi multimedia aplikasi. Bidang Kuasa Bendalir adalah satu bidang yang sukar dicapai ke tahap professional dan pembelajaran secara formal telah disediakan dalam bidang kejuruteraan dan teknikal. Pada masa kini, Kuasa Bendalir boleh didapati dengan meerekabentuk secara berkomputer dan perisian simulasi. Akhirnya, pelajar, juruteknik dan organisasi boleh menggunakan aplikasi ini untuk mencari maklumat tentang hydraulic dan Pneumatic. Sebagai contoh, pelajar yang mengambil matapelajaran kuasa Bendalir akan menggunakan infomasi-infomasi ini untuk pembelajaran mereka di Universiti Teknikal Malaysia Melaka.

DEDICATION

For my beloved family.

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CHAPTER 1

INTRODUCTION

The primary purpose of this study is to develop a Computer-based Training (CBT) courseware. Software development is a dynamic as there are many interacting factors throughout the lifecycle. Besides that, the purpose is to present concepts of a computer-based training module for student's education in manufacturing/mechanical fields. This study compared computer simulated laboratory instruction to traditional hands-on laboratory instruction, in terms of effectiveness. Here, you can see the objectives, scopes and the challenges in doing this project as address in this chapter.

1.1 Objective of the project

The main purpose of this project is to create a manual document for a fluid power laboratory by using the interactive multimedia called Authorware. Other objective shall be highlight as below:

- 1) To enhance knowledge regarding the use of computer in teaching and training especially Computer-based Training in manufacturing and mechanical field.
- 2) To develop a framework for computerized training for hydraulics and pneumatics teaching kits.
- 3) To develop a Computer-based Training courseware of hydraulics and pneumatics learning equipments at Faculty of Manufacturing Engineering.

1.2 Scope of the Project

Computer technology has made a significant impact in many areas of teaching and learning. Most educators have not had suitable training to prepare them to use technology in their teaching. Most educators report feeling inadequately trained to use technology resources, particularly computer-based technologies.

The scope of this project will be involved in learning and training of the Computer-based Training (CBT). Focus will be given to provide a CBT application to suit Fluid Power subject offered by Faculty of Manufacturing Engineering. In Universiti Teknikal Malaysia Melaka (UTeM), CBT is a new program for the students. The Computer-based Training will be developing based on the syllabus requirement for UTeM's Bachelor Degree of Manufacturing Engineering.

The computer-based training is use for the fluid power subject especially for hydraulics and pneumatics learning equipments in UTeM's laboratory. With the program, the students will have better understanding of the hydraulics and pneumatics learning equipments. After developing the computer-based training, students can also do the manual task as always. Therefore, both tasks manual and computerize can be used in the fluid power subject.

The computer-based training will be developing by using Authorware 7.0. Authorware is one of the software that eases the student to use the CBT. The CBT will be covered as follow:

- Hydraulic Systems
- Pneumatic Systems
- Laboratory sessions
- Tutorial

1.3 Challenges of the project

The challenge for developing the computer-based training is to assure that latest ICT technologies are used to support the principles of learning and are adequate to ensure an effective learning experience for students. Computer-based training is a powerful tool that can be used to address this challenge. Some of the challenges are:

- In order to direct training of the appropriate tasks at the appropriate level, multiple training materials need to be developed and classroom education time allocated. Traditional classroom computer- training classes are often presented in a very linear, task completion, instructor-oriented fashion.
- The students' willingness to learn computer technologies and their related tasks is slowed down by low self-efficacy levels. A less threatening learning environment promotes increased willingness to learn.
- Providing an interactive learning environment for students offers an alternative representation of the theory and practical knowledge needed to incorporate the computer into their daily work routine.

CHAPTER 2

LITERATURE REVIEW

2.1 Computer-Based Training

“There is very strong evidence that computer-based training requires less time for training compared to instructor-led training. The amount of reduction ranges from 20-80 percent, with 40-60 percent being the most common. Time reduction for multimedia training is usually attributed to a tighter instructional design, the option for participants to bypass content not needed, and the opportunity for participants to focus on those sections of the course not yet mastered.” (Brandon Hall, 1998).

2.1.1 Introduction

Computer-based training (CBT) services are where a student learns by executing special training programs on a computer relating to their occupation. CBT is especially effective for training people to use computer applications because the CBT program can be integrated with the applications so that students can practice using the application as they learn. CBT's growth has been hampered by the enormous resources required: human resources to create a CBT program, and hardware resources needed to run it. However, the increase in personal computer computing power, and especially the growing prevalence of computers equipped with CD-ROMs, is making CBT a more viable option for corporations and individuals' alike.

A Computer-based training was introduced to satisfy training of skills but initially created a greater workload for academics due to inflexibility of the product and unanticipated technical problems (Lang et al, 2002). Newman and Lamming (1995) indicated that the usability is the key for an interactive system design Computer-Based Training is beginning to gain wider acceptance due to the added advantages of the multimedia components. Computer-based training is frequently developed for all kinds of business training, including skills training for software applications, and soft skills. Computer-based training is also used widely for industrial, manufacturing, and safety skills training. With computer-based training, training is provided through the use of a computer and software, which guides a learner through an instructional program (www.wikipedia.org/computerbasedtraining).

Due to the rapid growth of Internet, web-based CBT, distance education, distance learning and e-learning are becoming synonymous. Harris (1999) pointed out that the United States has a tremendous growth for technology-mediated distance learning because the need was high and the technology was here. These technologies make use of various forms of interactivity to engage the student in effective, and often novel, learning experiences, (Leidner, 1996); Alavi, 1997). Among the fields that had utilized CBT for their training purposes are aircraft maintenance (Kraus and Gramopadhye, 2001), finite element analysis (Whitehouse, 2001), automotive industry (Dencker, 1999), pharmaceutical training and education (Moss, 1998), failure analysis (Henderson, 1997), simulation analysis (Tao, 2005), business training (Vergaro, 2002), Process Safety Management (Zaloom and Ramachandran, 1996) and inspection training (Gramopadhye et al, 1998).

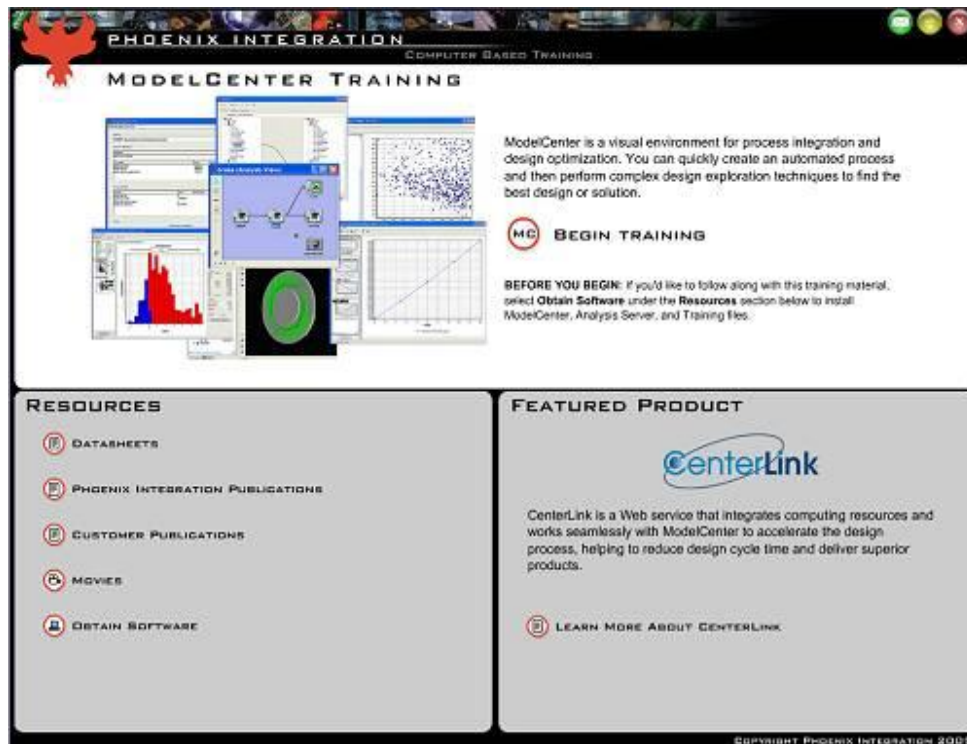


Figure 2.1: Screenshot of Computer-Based Training Website (www.phoenix.com)

There are other related and sometime interchangeable terms in computer-based training, such as (www.wikipedia.org):

- Computer-Assisted Instruction (CAI) - Delivering instruction through the medium of a computer. These are alternative terms for computer-based training.
- Computer-Assisted Learning (CAL) - Using a computer as an extra tool to aid in a traditional learning situation, like classroom training. The computer is a device to assist the instructor during the training process, like a blackboard or handouts.
- Computer-Assisted Testing (CAT) - Assessing an individual through the medium of a computer. Individuals take the test at the computer, and the computer records and score the test.
- Multimedia Courseware – media that uses multiple forms of information content and information processing (e.g. text, audio, graphics, animation, video, interactivity) to inform or entertain the user.

- Web-based Training (WBT) – It is delivered over the Internet using a web browser. WBT frequently includes interactive methods, such as bulletin boards, chat rooms, instant messaging, etc. WBT is usually a self-paced learning medium, however some systems allow for online testing and evaluation at specific times.

Computer-based training replaces the classroom hands-on computer training classrooms used today. Through computer-based training, participants learn through a simulation of the real applications, thereby eliminating issues related to instructor access, program materials, class scheduling, and time required attending training. Compared with traditional campus-based teaching, planning, content preparation, and class scheduling, computer-based training delivers just-in-time learning opportunities and training tools for implementation teams.

2.1.2 Tool and Technique for Development of CBT

There are many tools and techniques were use in developing the CBT. The tools and techniques should be selected properly according to the suitability of the project objectives and scopes. This project selected instructional design model as the main tool in developing the CBT due to its understanding easiness. One of the tools is the instructional (Fazli and Syukor, 2006).

Instructional Design Model

The purpose of the instructional design process is to guide the development of a learning tool like paper course, online course, instructor guide, so that the tool best meets the learning objectives. As shown in Figure 2.2, Lee and Owen (2000) break the analysis phase into two parts.

The first is need assessment which is a systematic way of exploring and establishing the type of solution needed. The second is front-end analysis which is a collection of technique that can be used in various combinations to help you narrow the type and level of solution that will be required. In completing the activities in this phase, the author will find the student learning and instructor teaching issue and decide how to satisfy the issue. Beside that the author has to decide the delivery mechanism for the solution before writing the objectives. Cost analysis also should be completed in this phase.

During needs assessment it is critical to focus on gathering the information are required to be able to make informed decision. The information from needs assessment provides input into front end analysis in that, once the need for an invention is established in need assessment, front end analysis explores deeper levels of information needed for the design of the solution.

In order to perform needs assessment and front end analysis the author has to make a judgment about how much assessment and analysis is required to make an informed decision based on your time frame, project size and project constraints. The developer also has to determine the appropriate sources for collecting information before establish a technique for collecting and assembling information.

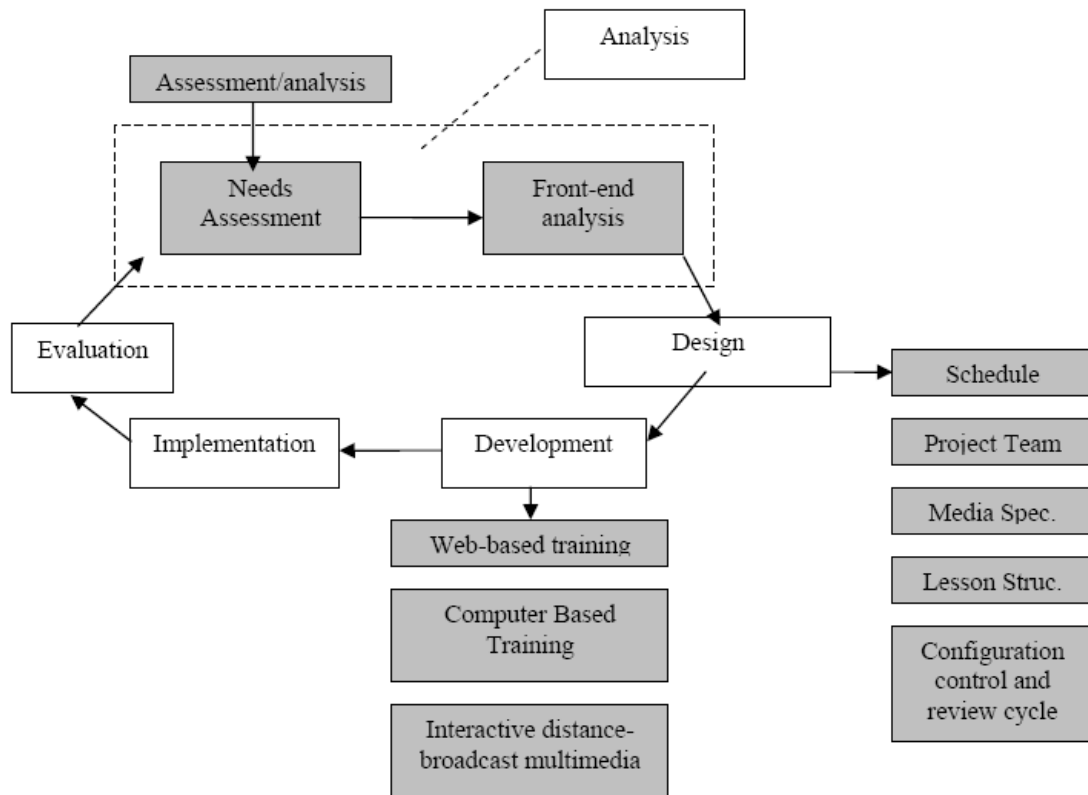


Figure 2.2: Multimedia instructional design model (Lee and Owen, 2000)

2.1.3 Concept of Computer Based Training (CBT)

The main sources used to develop computer based training may be referred to Figure 2.3, document, information from trainer and observation to simulator is. The data is collected and computer based training is created to become a courseware or loaded in website. The student can be accessed the training web from anywhere and anytime, plus they also can be assessed by using web quiz. Existing training method is still used in class period, even in the laboratory session.

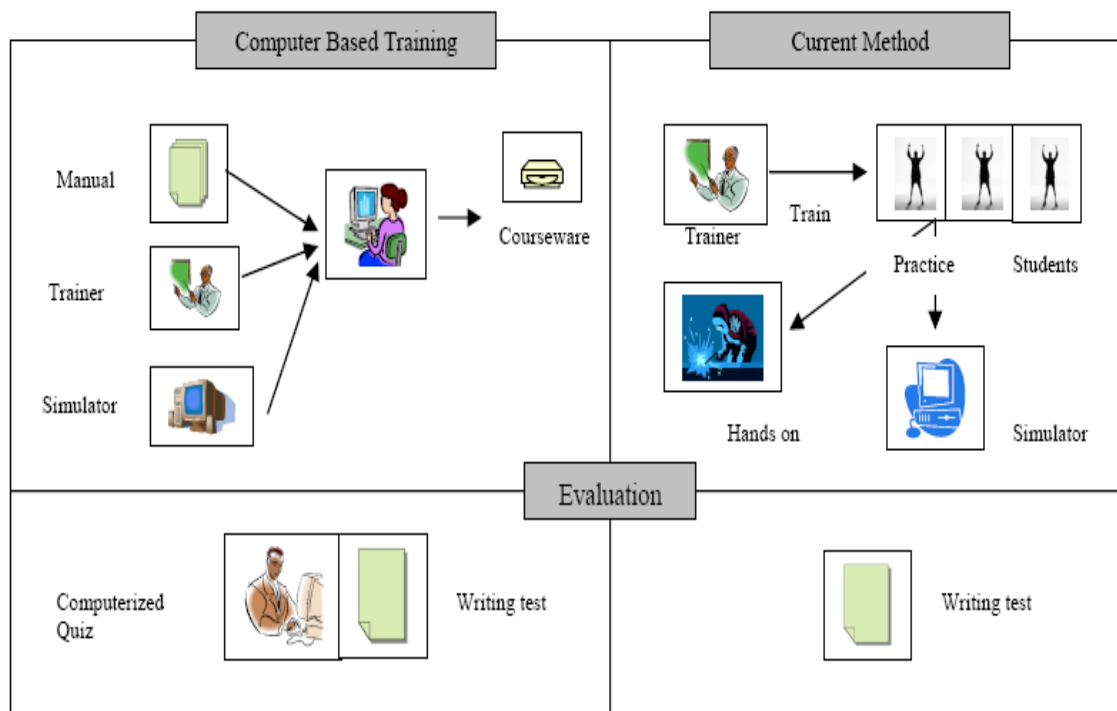


Figure 2.3: Conceptual Model of CBT compare with current training method (Fazli and Syukor, 2006)

2.1.4 Pedagogical Considerations in CBT

It is clearly possible to apply any specific pedagogical approach to e-Learning, however some approaches are more common than others. There are also many types of teaching strategies are used in computer based training in order to maximize the effectiveness of teaching and learning process like exercises, tutorial, games, simulation and problem solving. These will increase the interactivity of the CBT package where student's participation will be maximized. Most computer-based training uses one or a combination of the following: