

Universiti Teknologi MARA



**Development of Indices Tutorial
Package for Lower Secondary School
Students**

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DECLARATION

I certify that this thesis and the research to which it refers are the product of my own work and that any ideas or quotation from the work of other people, published or otherwise are fully acknowledged in accordance with the standard referring practices of the discipline

MAY 31, 2006

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ABSTRACT

Nowadays, multimedia is used in various areas such as advertisement, entertainment and education. The advancement of multimedia technology has reform current education system for its capability to enhance learning rate in the learning activity. Mathematics is a scientific discipline students experience as both a source of knowledge and a challenge for acquiring mathematical skills. Unfortunately, mathematics classes are often concerned purely with memorizing information and learning skills. Thus, this paper will discuss about the implementation of multimedia in developing a tutorial package. The tutorial package will introduced Indices to low secondary school students within age of 13 to 15 years old. The objective of this project is to develop multimedia learning package for teaching and learning Indices that could be used as Computer-Based Training (CBT) tools. In the package, the concept of Indices is applied and elaborated. The package will include learning modules with quizzes. This project had been developed using authoring tools which is Macromedia Director MX. Product of combination multimedia elements such as graphics, sound, text, animation and video in one digital environment could create an interesting and interactive learning environment.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
CBT	Computer-Based Training
ISD	Instructional System Design
ADDIE	Analysis-Design-Development-Implementation-Evaluation

CHAPTER 1

INTRODUCTION

This chapter gives a brief description about the project. In this chapter will present a background issues that related to the project, and a problem statement about the project. Objective, scope and significance of the project will also be explained.

1.0 Background

Learning process requires a lot of understanding. Understanding can be achieved easily by doing a lot of exercises that gathered with interest in the matters. Mathematics is one of the fields that require a lot of understanding. Mathematics is an important subject for science and technology careers but many students have difficulties and failure in mathematics learning (Nor Azan Mat Zin, et.al.,2002). Sometimes, the numbers and the problems that involve in mathematics are difficult to understand. The explanations that related with mathematics also might be confusing. These give problems to the students to understand and solve problems in mathematics. It is also triggers assumption among students that mathematics is very difficult.

Learning about new ideas and concepts could not be achieved through reading textbook alone (Shanti Divaharan,2002). A lot of efforts towards solving mathematics learning problems are identified. Most observed failures and substandard performance in mathematics are due to insufficient teaching-learning environment. Thus, a right kind approach is needed as a tool to support students' learning.

Indices is one of the mathematics' topics that involve repeated multiplication of the same number. This topic is quite confusing and involves a lot of numbers. Thus, students' concentration is important in understanding and furthermore to solve problems that involves Indices.

This project is developed to overcome the difficulties that arise towards learning Indices. This project hopefully will provide an enjoyable and more interesting environment in learning Indices.

1.1 Problem Statement

One of the greatest challenges in teaching is that of capturing the interest of the students and of cultivating a fascination for learning. Therefore, educational design for effective learning and teaching environment is important in the prevention and solving of mathematical learning difficulties (Nor Azan Mat Zin, et.al.,2002). Indices for lower secondary school students is difficult topic. A little misunderstanding can lead to the wrong answer. Indices's questions have been asked in both mathematics papers in PMR examination (Dr Pumadevi.S,2005).

Another problem that needs to ponder is the different level of understanding between students. The alternative solution to this problem is transferring the subjects that involve in this topic to a platform that can subdivide a single topic into different level of subtopic. Students should be able to learn level by level with their own pace and understanding. This platform provides an enjoyable and more interesting environment consist some animation, sound and interactive feature that hopefully can help to enhance the level of understanding.

This project is developed because:

- Mathematic can not be memorized but needs to be understood.

- Students who fail to master basic indices continue to have problems later on related subjects such as algebraic that require the use of basic literacy in their problem-solving activities.
- Multimedia approach can be used to improve students' understanding in learning mathematics.

1.2 Project Objective

The objectives of this project are:

- To design an interactive tutorial package.
- To develop an interactive tutorial package of Indices for lower secondary students.

1.3 Project Scope

Mathematics is a wide that has many topics in it. This project is focuses on Indices topic. This topic is one of the syllabuses for form three students. Thus, the target audiences are form three students. This is because the students will take PMR examination. Nowadays, English is used in teaching session at secondary schools. Almost all the revisions book also in English. Thus, this project will be in English Language. The subtopics in Indices are multiplication of numbers expressed in index notation, division of numbers expressed in index notation, raising numbers in index notation to a power, computations involving negative indices, computations involving fractional indices and combination of operation involving Law of Indices. However, the subtopic that will be covered in this project is multiplication of numbers expressed in index notation.

1.4 Project Significance

This project is important because it will help students to improve their level of understanding in indices topic. It is also makes the learning process become interesting. In addition, having English as the medium for the tutorial will enrich the English Language among students. Besides, the students will be familiar with the terminology that used in mathematics. This project can also be used by teachers as a teaching aid.

1.5 Summary

The brief description about the whole project has been explained. The explanation in this chapter is important because it gives information about the reasons of creation this project.

CHAPTER 2

LITERATURE REVIEW

This chapter will be explained the definition of terminologies used in this project. Besides, the topics that related to this project also will be discussed.

2.0 Definition of Terminology

There are some terminologies used in this project that need some explanations before further discussion is made. The terminologies are:

- Indices
- Tutorial package
- Secondary school

2.0.1 Indices

Index is also called exponent. Index notation consists of base and the index. Index is a number or variable that determines the number of times the base is repeatedly multiplied. In other words, in index notation, a repeated multiplication of a number a is written in the form a^n where n is the number of times of the multiplication. The number n is called the index (Dr Pumadevi.S,2005)

2.0.2 Tutorial package

Tutorial package can be defined as a computer programs, graphics and sounds that integrated into one system as a tool to support learning purpose.

2.0.3 Lower Secondary school

Secondary school can be defined as a place for teaching students at a higher level than primary. Secondary school can be divided into two categories. There are lower secondary school and upper secondary school. Students in lower secondary school are within age of 13 to 15 years old while students in upper secondary school are within age of 16 to 18 years old.

The combination of the terminology above, this project can be defined as a computer programs, graphics and sounds that integrated into one system as a tool to learn about number or variable that determines the number of times the base is repeatedly multiplied for students at a higher level than primary. In other word, this project is a multimedia learning about Indices for lower secondary school students. The approach used in this project as a revolution from the traditional approach in studying mathematics to the interesting learning environment.

2.1 Computers as a Learning Tool

Nowadays, the increasing resources of computers resulted of widely usage of computer. Moreover, almost all the managements such as in business, training and manufacturing are using computer application. This includes education systems. Many schools use computers as a learning tool. Using computers can give better understanding to students.

There are many factors which can influence students to use computers as learning support tool. Among the factors that had been identified, are the enjoyable and comfortable to use computers. Students will enjoy when doing things on a computer and comfort in working with a computer (Pratt. K, et.al.,2002). By using computers, both hands and eyes are utilized compared when reading from books. Moreover, there are many applications that can be used in computers such as word processing or spreadsheet program. Thus, students will not get bored during learning session. In addition, students can effectively use the computer tool to solve problems.

The other factor is students like to use computers. Students were generally positive about the use of computers (Pratt. K, et.al., 2002). If students will be given some choices that involve read a book, write, watch television, and use a computer, students will prefer to use computer to learning compared to the traditional lecture approach (Bagnall, D, 2000). Computers usage is important and beneficial to learning. It is also more efficient way of learning (Brian L.F. Daku, et.al.,2000).

Using computers, students can retrieve data easily most of the time. Computers as a part of classroom because of used for data acquisition (Kocijancic. S,2000). Thus, students are observed to develop more initiative to learn by using computers compared to traditional approach. Students will have higher concentration during the learning session.

Computers usage is also beneficial to teachers. It helps teachers that have limited time to explain more detail about topics and at the same time facing problems with students that were not interested to learn. Teaching with the computer tool can lead to considerable trouble with bored and disinterested students if lecture time is spent on low-level definitions, syntax, and point-and-click operations (David Wenhao Huang, et. al.,2004).

2.2 Computer-Based Training (CBT)

People have different learning styles. As a result, Computer-Based Training (CBT) is more suitable to individuals that learn best by watching, hearing, visualizing, thinking and studying on their own. Computer Based Training (CBT) utilizes a personal computer and software to enhance the students' knowledge or skills.

Traditional classroom training typically costs less to produce. The existing of CBT in classroom training requires more costs early in the initial production or development phase of the training process as compared to the delivery phase.

However, CBT can reduce the time of learning for students. CBT is also used to maintain an employee's existing skill level. According to Whitehouse, D, et.al. (1996), Computer Based Training has reduced learning time by up to 70% and increased retention as much as 50%.

The improvement of telecommunication infrastructure provides wide variety of technologies which is fitting users' needs both in service and costs point of view. This improvement has its root in training and education. New educational needs are covered by introducing computer supported methods (CBT). According to Issam R. Qasem(1996), one of the main objective of any CBT is to educate via one-to-one interaction with computers. Thus, CBT will be more interesting if it includes multimedia elements.

2.3 Multimedia

Nowadays, multimedia is used as an important element that is usually used for education. Education environment will be more interesting and easy to understand than the traditional education environment by using multimedia. Besides, multimedia also can be used in business, entertainment and training.

Multimedia had already entered the education arena as a term from the 1960s and 1970s when it applied mainly to tape-slide technology (Wise. R, 2000). *This means that multimedia was beginning about long time ago.* Thus, multimedia is not the new issue in technology environment especially in education.

The word *multimedia* shows that there are various kinds of media were involved to build multimedia. Multimedia is a presentation of a computer application, incorporation media elements such as text, graphics, video, animation, and sound, on a computer (McGloughlin. S, 2001). This means that there are multiple forms of media work together in an event.

There are many advantages of applying multimedia. The advantage of multimedia is it easy to use (McGloughlin. S, 2001). This is a purpose of applying multimedia to computer-based application; to make the application easier to use. The users can access information as they wanted (Reynolds. A & Iwinski. T., 1996). In addition, the users possible have directly support on the multimedia performance because it easy-to-follow. For example, the buttons in multimedia interface make users can gain information step by step. This will increase the user's effectiveness considerably.

The other advantage is multimedia has intuitive interface (McGloughlin. S, 2001). This means that, the users have their own assumption and understand

to determine and use the functions and application in multimedia interface. This is because usually the button in multimedia interface looks like what it is intended to do. In the other word, multimedia is a user-friendly presentation. For example, the button for user to go back to main menu will be displayed by the icon 'home'.

Besides, the explanation using multimedia encourages better understanding of the content (McGloughlin. S, 2001). Based on the statement above, there are five main elements or media in a complete multimedia. The media are texts, graphics, sound, video, and animation. Each of media has their own role to develop an interesting multimedia presentation (Jamalludin Harun & Zaidatun Tasir, 2005). The combination of the media gives new explanation environment to users. The information can be presented in summary but users will gain better understand about that information.

Only texts were used to accomplish and share information before. Thus, multimedia is a development from the traditional approach of information technology. The development of multimedia technology is parallel with the development of communication and information technology. As a result, multimedia become a popular element in this era and also suitable for education.

2.4 Development of Multimedia Technology

Multimedia is a technology that becomes famous. The presence of multimedia in information technology development makes the usage of computers become more interesting. Moreover, it also provides various kinds of services that never expected before.

Multimedia can be referred as a combination of hardware and software technology that can combines the elements such as text, graphics, audio, video, and animations as a medium to present information efficiently. In multimedia, a variety of information sources such as text, voice, image, audio, animation, and video are delivered synchronously or asynchronously via more than one device Chen and Kashyap. R.L. (2001).

There are many factors that make the widely usage of multimedia technology in this era. One of the factors is the increasing of computers usage. Computers are the evolution of the typewriter (John M. Gleason and James T. Ault, III,1999). However, the interest in multimedia area that is rapidly growing with the continuous evolution of telecommunication and computing technologies make computers as electronic equipment that necessary in all houses (Al-Khatib, et.al.,1999).

The other factor is the development of telecommunication technology and Internet. This technology not only allows the information to be accessed by other users easily and faster but also include other media such as graphic, animations, audio and video. To run multimedia over Internet, several issues must be addressed. According to Benslimane. A (2000), the first issue that must be addresses is transmission must be real-time and maintaining a good quality of service and the second issue is storage, compression and decompression must be efficient. The development of software technology also influences the development of multimedia technology. As a result, multimedia becomes a searching element that interesting and effective.

2.5 Multimedia as a Tool of Learning

Multimedia can makes the biggest changes in various areas. Using multimedia, the static information can be transformed into an interesting,

dynamic and interactive presentation. This new approach is built with text such as audio, video, animation and graphics which be combined with additional media. Without realizes it, multimedia was changed the way of thinking and behaviors in life. There are many multimedia applications that were created such as source of references, education, training, entertainment and games and business.

One of the applications that will be discussed is education. According to Allert. J (2004), students consistently ranked the visualization software as more important to the learning than any other element to learning. This approach will give the new environment to students where students can learn independently based on the time and interest.

In the progress to develop learning systems, a new style is not a simple replacement of the old ones (Zixue Cheng, et.al.,2004). Usually, the new style will contain the old one. Designing learning systems requires consideration of cognitive, sociocultural, organizational and environmental conditions of use (Roderick A. F, et.al.,2004).

Certain of multimedia application provided in websites. The purpose is to increase the enjoyment of students' learning. It is also to provide a platform so that the new information can be accessed. A lot of researches and developments are focusing on the E-learning. Beside E-learning, there is also exists M-learning (Mobile-learning). Both of the learning is using same approach which it is called Internet.

Currently, software product that related with e-learning has been developed. For example, Hye Sun Kim and Seong Baeg Kim (2004) found that TeachingMate which developed by DAUL soft Co. has functions to help the instructors who want to make e-learning teaching materials and

multiple-choice questions. However, educational games are not included in that current research. Thus, Hye Sun Kim and Seong Baeg Kim (2004) were proposed to integrate heterogeneous two subjects (English and computer science) into one course with the help of both web technology and animation-based educational games in their project. E-learning is often promoted as an evolutionary step forward in the delivery of educational programmes (Kuljis, J & Lines, L., 2004).

The educational application using mobile devices and many interesting scenarios have been proposed. Chih-Ming Chen, et. al (2004) have proposed the personalized e-learning system (PELS) for adaptive courseware recommendation. The project is implemented on the PDA device. It was proposed mobile teaching agent which can support teachers to monitor web-based learning activities as well as help learners to efficiently promote learning interests and performance.

A new learning concept is combines the education and entertainment called edutainment. According to Jamalludin Harun and Zaidatun Tasir (2005), edutainment was created by the combination of terminology (education and entertainment). This is causes many multimedia applications are created.

2.6 Learning Behaviors

Human progressed through developmental periods of prenatal, infancy, early childhood, middle childhood and adolescence (Owens, K. B., 2002). The chronological periods develop human from prenatal period to adulthood. This development effects the changes of human behavior and abilities.

The ages of 13 to 19 years old are defined as adolescence (Owens, K. B., 2002). Adolescence is a time of transaction. The transaction not just in terms

of physical and sexual transformations but also involves changes in cognitive and socioemotional areas as well. Thus, the transaction also influences adolescence learning behaviors.

Mind, behavior and the environment play an important role in the learning process (Huitt, W., 2004). Students have different abilities in learning. There are students who find learning particularly difficult (Sheffield. L.J., Cruikshank. D. E., 1996). The difficulties include they take more time, they have less interest and they seem unable to grasp concepts and skills. However, some students are fast learners, enjoy intellectual challenges and they are ready to move ahead. As a result, there are students may learn slowly and may be dependent on an adult whereas another students may learn quickly and, barely assisted by the teacher.

Learning environment can influences learning behaviors among students. Instructivist or prescriptive environment is one of the teaching methods. This environment is the “guided tour” mode (Elin. L., 2001). This environment focuses on the instructor and the lesson that the instructor intends (Elin. L., 2001). Using this teaching method, each tidbit of knowledge builds on the preceding until the student’s level of knowledge reaches that of the planned target. Tutorials and drill and kill are two features very common in multimedia products designed in the instructivist or prescriptive environment.

The democratic environment or free access browsing is a teaching method that the students a more active role in structuring the learning process. In this teaching method, the burden of learning is shifting to the students (Elin. L., 2001). Using this teaching method, the students must search for the lesson. There have no information services. This forces students to develop thinking and investigative skills.

The constructivist method is teaching method that need students construct their own knowledge of the world through observation and experience. This places them as active participants in their learning (Elin. L., 2001). Students are encouraged to try things and make mistakes heuristically, learning from both the mistakes and the successes. It makes the constructivist method a learning method, rather than a teaching method.

Learning involves much more than receiving information and storing it into memory (Rogers. P.L., 2002). It also involves thinking, analyzing situations, drawing logical conclusions, developing strategies, producing products and reacting to interpersonal situations. In the traditional school setting, learning is viewed as knowledge instruction (Owens. K. B., 2002). This means that knowledge is transferred from one who is knowledgeable to one who is not. The development of technology makes the learning process easier. This creates the interesting learning environments that enhance the learning process as well as students understanding.

2.7 Learning through Tutorial

Educational software packages often fall in the tutorial. These packages are designed to give some of the benefits from weather textbooks or from tutor. Most tutorials for software learners contain exercises intended to stimulate learners to apply the newly learned procedures on their own (Glasbeek. H,2004).

Tutorials take the role of the instructor by presenting information and guiding the learner in initial acquisition. Some tutorials do not have guide for students or the information. The tutorials only present for learning. However, the good tutorials should include both presentation and guidance (Stephen M. Alessi and Stanley R. Trollip, 1999).