UNIVERSITI PUTRA MALAYSIA

DESIGN AND DEVELOPMENT OF MULTIMEDIA LEARNING MODULE ON CIRCULAR MOTION

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

DESIGN AND DEVELOPMENT OF MULTIMEDIA LEARNING MODULE ON CIRCULAR MOTION

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February 2016

Chair : Associate Professor Zaidan bin Abdul Wahab, PhD
Faculty : Science

Science and technology has improved a great impact in all aspects of life particularly in education. Various latest multimedia technology was introduced to the world. Multimedia technology is a perfect platform used in teaching and learning (T&L). The study was focused on developing a multimedia learning module of Circular Motion to assist student's understandings of correct physics concepts. This module was developed based on the ADDIE model by using I-Spring Presenter as a delivery platform. The evaluation process is to get the students' feedback on their understanding of the subject matter and their perception towards the multimedia learning module that has been developed. A total of sixty students in the Bachelor of Science program at the University Putra Malaysia who took Physics I and General Physics courses were selected as respondents. A set of questionnaire was used as the instrument for this study. The data findings were analyzed using mean scores for quantitative data and for the qualitative data, which are comments and suggestions were evaluated using thematic analysis approach. The study indicates that the respondents are satisfied with the multimedia learning module, where the overall average mean score is 3.41. Post test results have shown an improvement in the students' understanding and have reduced the misconceptions of circular motion. This module was expected to be used as a reference material for the students to promote the effective learning and to provide a guideline for educators in enhancing teaching effect. Some improvements still need to be done, especially in terms of audio settings to ensure learning through multimedia module can be effectively implemented.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PEMBANGUNAN MODUL PEMBELAJARAN MULTIMEDIA BAGI TOPIK GERAKAN MEMBULAT

Oleh

FARHA BINTI MOHAMED YASIN

Februari 2016

Pengerusi : Profesor Madya Zaidan bin Abdul Wahab, PhD
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Sains dan teknologi telah memberi impak yang besar dalam semua aspek kehidupan terutama dalam bidang pendidikan. Pelbagai teknologi multimedia terkini telah diperkenalkan kepada dunia. Teknologi multimedia adalah platform yang sangat sesuai digunakan dalam pengajaran dan pembelajaran (P&P). Kajian ini memberi tumpuan kepada pembangunan modul pembelajaran multimedia bagi topik Gerakan Membulat untuk membantu pemahaman pelajar terhadap konsep fizik yang tepat. Modul ini dibangunkan berdasarkan model ADDIE dengan menggunakan I-Spring Presenter sebagai platform penghantaran. Proses penilaian di akhir kajian adalah untuk mendapatkan maklum balas pelajar terhadap pemahaman terhadap Gerakan Membulat dan persepsi mereka terhadap modul pembelajaran multimedia yang telah dibangunkan. Seramai enam puluh pelajar program Bacelor Sains di Universiti Putra Malaysia yang mengambil kursus Fizik I dan Fizik Am telah dipilih sebagai responden. Satu set soal selidik telah digunakan sebagai instrumen untuk kajian ini. Data kuantitatif yang diperolehi telah dianalisis dengan menggunakan pengiraan skor min. Manakala pada bahagian komen dan cadangan dinilai secara kualitatif iaitu kaedah pembentukan tema. Kajian ini menunjukkan bahawa responden berpuas hati dengan modul pembelajaran multimedia yang telah dibangunkan, di mana skor min purata keseluruhan yang diperolehi ialah 3.41. Hasil dapatan ujian pos telah menunjukkan peningkatan terhadap pemahaman serta mengurangkan miskonsepsi pelajar terhadap topik gerakan membulat ini. Dengan terhasilnya modul ini, diharapkan ia dapat memberi rujukan dan seterusnya dapat menggalakkan pembelajaran yang berkesan kepada pelajar. Selain itu, pembangunan modul pembelajaran multimedia ini juga mampu menyediakan garis panduan untuk para pendidik di dalam mempelbagaikan kaedah pembelajaran mereka. Beberapa penambahbaikan masih perlu dilakukan terutamanya dari segi penetapan audio untuk memastikan pembelajaran melalui modul multimedia dapat dilaksanakan dengan berkesan.

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I certify that a Thesis Examination Committee has met on 3 February 2016 to conduct the final examination of Farha binti Mohamed Yasin on her thesis entitled "Design and Development of Multimedia Learning Module on Circular Motion" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Science is an important field in our life. The modern world cannot exist without the understanding and technology enabled by science. Science contributes so much in our daily life. Scientific knowledge can improve the quality of life at many different levels from daily routine works to global issues. Science informs public policy and personal decisions on energy, conservation, agriculture, health, transportation, communication, defense, economics, leisure, and exploration. It is almost impossible to overstate how many aspects of modern life are impacted by scientific knowledge.

In assessing students understanding of the basic concepts of science, educators should know what students know and how they learn. Students experience the world around and bring them to develop many of their concepts about how the world functions. These concepts often look trivial to people who do not know physics, but different for those who are taught about physics. When the actual physics concept is explained, we can feel how beautiful the world is because in every situation there must be an answer through understanding in science, particularly physics.

Majority of physics students would agree that physics is one of the most difficult subjects studied in school. Indeed, many students find that it is difficult to even define physics and to relate all the formulas made up of strange looking symbols. Physics is a branch of science that attempts to describe how nature works using the language of mathematics. Perhaps, it is the general lack of understanding of what physics is, combined with the subject's inherent difficulty and reliance on mathematics, which tends to discourage a student from studying physics. If students hardly understand what physics is, they are unlikely to grasp the relevance of physics to society, and more importantly the relevance of physics to them.

It is clearly important that students need to know the importance of physics and what are the benefits that can be learned from studying physics. Physics improves our quality of life by providing the basic understanding that is necessary for developing new instrumentation and techniques for medical applications, such as computer tomography, magnetic resonance imaging, positron emission tomography, ultrasonic imaging and laser surgery. Physics also generates fundamental knowledge needed for the future technological advances that will continue to drive the economic engines of the world.

Nowadays, the widespread use of multimedia technology in education changes traditional teaching method, improves teaching effect and makes the teaching procedure vivid. Technology is essential in teaching and learning of science in which it affects the teaching of science and enhances students learning.

Science and technology have a great impact in all aspects of life particularly in education. In this era of technology, we can see the development of multimedia technology is very encouraging. Various latest multimedia technology was introduced to the world. Multimedia technology is a perfect platform used in teaching and learning (T&L). Among the key elements of multimedia are text, graphics, audio, video and animation in a software capable of inducing the effectiveness of teaching and learning.

Zin, Latif, Bhari, Salaiman, Rahman, Mahdi, and Jamain (2012) reported a combination of many different types of media communications including text, graphics, audio, video, music, and animation. Interactive media is an incorporating multimedia with computing technologies (Eastman, Iyer, and Eastman, 2011). This kind of technologies is relevant to be applied in the education field because it can help students to understand about the related topics.

Towards 2020, students have more initiatives to study the art of sciences. Students should be able to use cognitive abilities for a meaningful learning. However, many students have hindrance in using these cognitive abilities in learning effectively (Tambychik and Meerah, 2010). Therefore, their potential need to be optimized in order to create a first class mentality.

Today, the computers which are the first term that comes to mind when mentioning technology, have influenced almost every aspect of life and changed human behaviors (Usta, 2011). Technology is used in education for two main reasons: as a tool for increasing the effectiveness of instruction and to integrate technology into the curriculum (Gülbahar, Madran, and Kalelioglu, 2010). The use of computer and application of new technology-based teaching strategies in educational activities contributes to the development of organization of training which is not possible using the traditional methods. Possibilities of computer processing, recording and retrieval of information trigger the situations in which the students acquire knowledge and skills independently, in accordance with the interests and aspirations (Chandra and Watters, 2012).

Students in the twenty-first century have an infinite world at their fingertips. Computers, cell phones, and tablets are accessed by the touch of a finger. The electronic devices provide immediate access to a wide range of information including social opportunities, contact information pertinent to a teenager, news, weather, textbooks, high school grades and class attendance. High school and young adult students are the generation of information at their fingertips, the e-generation. “Let your fingers do the walking through the Yellow Pages” was used by the telephone company to advertise their services in the twentieth century. Rather than finding phone numbers and text social conversations, different types of information from all over the world can be accessed using a cell phone. Technology is the linchpin to students to access the world around them. Today, high school online courses are available for student’s use which are the most up-to-date Internet technology (Kilgore, 2013).

1.2 Statement of the Problem

Most of the current higher-education teaching and learning approaches are quite conventional, in which they are content-based models that require educators to focus solely on the course syllabus, thus allowing students to learn the course material only superficially. Limitation of class time is another reason why teachers must employ conventional teaching and learning processes. The lack of in-depth learning in today's higher education system has caused misconceptions on students' low achievement levels. They often fail to apply the concepts that they have learned via traditional methods. As a result, they are unable to grasp higher-level course material and eventually have difficulty adapting to new topics.

In school learning process, the science subjects, especially physics give major challenges to the students. Most of the students were reported facing difficulties in acquiring the knowledge and skills needed in physics. Physics is a field that requires a higher-order thinking skills in problem solving. Problem posed or constructed consists of creating new problems or questions to be explored or examined about a given situation (Cildir and Sezen, 2011). Thus, physics knowledge and skills are important.

In this large-scale study by Chandra et al. (2012), the interactive models can be used efficiently in learning that may be proposed by students to conduct interactive research model and to establish certain conclusions. In this way, students acquire knowledge through independent creative activity, and this knowledge is useful for obtaining a concrete result, observed on the computer monitor. Moreover, learning styles in physics education is also a chance to improve the educational process of this subject and to increase the motivation of pupils to learn physics (Zajacova, 2013).

This study was conducted using the developed interactive courseware as a tutoring tool to enhance students learning to the application of circular motion. The special aim of applying this interactive multimedia is to enable students to think more critically and creatively, to state arguments for difficult concepts in physics particularly and to crack the problem in science successfully. This module was also designed to enable students to access information related to the topic easily.

Circular motion is one of the topic in Newtonian Mechanics. Some students realize that this topic is very hard to understand and should be well connected to prior concepts and ideas. The goal of designing this multimedia learning module can be realized through careful exploration of the two aspects of circular motion: force and acceleration - cause and effect.

Common difficulties facing by students with topic on circular motion can be attributed to two primary conceptual difficulties. The first difficulty is that students cannot relate the application of physics with their daily life experience. Meanwhile, the second conceptual difficulty is that students cannot use their common sense to solve problem related to the velocity. The conceptual difficulties faced by students are evident when teachers avoid

superficial multiple-choice, short answer or recall questions in favor of assessment practices that truly get inside students' heads.

With the rise of technology, students can explore teaching and learning process more effectively. The development of multimedia learning module will help students in understanding the basic concept more conveniently. Thus, students with low achievement level can learn well because they can use more time on the module. Learning modules allow students to carry out their learning without being interrupted by other factors such as not able to record the notes during the formal class. Scientists also have used the concept of visualization of this advanced technology to unravel complex problems.

Content, format and presentation mode in this module were different from other multimedia modules because in this module is combined with a variety of media from various sources for easy user access. Learning will be more effective without wasting time searching for web pages that are relevant to the topic of this circular motion. When students use a deep approach to their learning, they can get a higher education outcomes, such as critical thinking, problem solving and synthesize, compared to the surface approach to learning which will lead lower level results, such as using memorization techniques to simply pass an evaluation.

1.3 Purpose of the Study

The primary purpose of this study is to design and develop a multimedia learning module for physics students in the university. The multimedia module would help to improve students' understanding on the concepts and ideas on circular motion. Using learning module also gives the students the opportunity to control the learning process by allowing the students to access the module both during class time and outside the class.

This module was not intended to replace the traditional learning, but it was designed as an ingredient to enhance the mastery of the circular motion topic. Besides that, this study also observed the overall perception of the module that has been developed. In order to improve, students were also asked to express their opinion towards a positive learning environment and thus can provide continuous motivation to the students.

1.4 Research Questions

Two questions were tested in this study; viewing the multimedia learning module was an effective method of instruction to teach physics students in the topic of circular motion as compared to lecture and text-based instruction.

Question one: What are the weaknesses among the students in understanding circular motion?

Question two: Is there a significant impact on student perception and satisfaction with circular motion module?

1.5 Objectives of the Study

The main goal of this study is to design and develop a multimedia learning module for university students. This study intends to promote the learning of physics in the topic of circular motion.

The objectives of this study are:

1. To identify the main weaknesses among students in solving problems involving circular motion.
2. To design and develop multimedia learning modules on circular motion.
3. To assess the students satisfaction on the use of developed learning module.

1.6 Significance of the Study

The importance of this study can be divided into several sections such as the importance to individuals, institutions, universities and research fields in Malaysia. This studies are very important to those who are directly involved in the teaching and learning of physics, especially trainers in schools, matriculation colleges and also higher institutions.

This multimedia learning module was developed to attract and assist students understanding on circular motion topic. Computer Assisted Instruction (CAI) strategy has been proved by Ab Rahman and Baharuddin (2004) that the development of interactive multimedia applications can facilitate students understanding of learning the content through the set of learning tools and provide numerous examples and exercises.

This assertion is supported by Kamarul and Ab. Halim (2007) in which the use of interactive multimedia teaching aids as support materials may be practiced to improve the effectiveness of teaching and learning process and to enhance student interest in the topic learned. Other than that, this statement is supported by Zaidatun (2012) who stated that interactive multimedia (video) can be implemented as teaching aids when outside of class time.

Multimedia learning is able to attract and motivate students so that they will have interest in learning physics. Through a multimedia-based learning as well, it can help students who are having problems in the classroom to assist the students in order to understand the lesson. Shaharuddin and Ahmad Khairi (2011) proved that users will be interested to learn using interactive multimedia as it can reduce boredom when learning. In addition, it also can make students more active due to the element of interactivity in the software.

The findings by Pol, Harskamp and Suhre (2005) showed that the improvement of the students with respect to solving problems regarding the forces after being exposed to the NatHint program. This program was explored by the students without any knowledge about forces, although they did make improvements in making a plan in which they must apply this knowledge.

This study is expected to have a positive impact on teachers in identifying students' weaknesses, especially on the topic of circular motion. The multimedia learning module generated in this study can be used by the students as self-study materials and also as an alternative to reference books, and other learning materials to improve their skills on creative and critical thinking. Findings of this study may also help trainers to produce their own e-learning materials that are appropriate to the needs and to the level of their students understanding.

On the other hands, these findings may provide information and awareness to provide more opportunities for certain parties to expand their study through the related issues. This study is also expected to increase the number of existing studies related to the teaching and learning of physics in Malaysia and become one of the references to other researchers to produce the interactive multimedia learning materials.

1.7 Assumptions and Limitations

1.7.1 Assumptions

For the purposes of this study, it is assumed that:

1. Respondents will be truthful in answering and completing the survey questionnaire.
2. Participants in the study will respond voluntarily and will not be placed under any undue influence during the survey process.
3. Respondents are homogenous in terms of their background as a college student and have the basic knowledge in this topic.
4. Respondents have the skills and basic knowledge of computers and Internet.

1.7.2 Limitations

To ensure that the objectives of the study can be achieved and further facilitating the understanding and control of the study, some scopes have been identified. This study is limited by the following characteristics:

1. The population consisted of physics students from Faculty of Science, University Putra Malaysia. Therefore, the findings of the study cannot be generalized to all levels of university students.
2. A multimedia learning module developed was limited to the topic of circular motion. Not all of the syllabus in this topic will be covered in this module.

3. This study only focuses on the main purpose which is designing and developing the multimedia learning module.

1.8 Definition of Terms

1.8.1 Multimedia

Multimedia word comes from 'multi' and 'media' which describes that media is a tool that is used as a channel for communication such as text, graphic, video, sound and moving object. Multimedia can also be defined as a computer-based interactive communication process that includes the use of audio and visual media such as text, graphics, audio, video and animation (Jamalludin and Zaidatun, 2000).

1.8.2 Learning Module

Learning module is a method for delivering the course materials on the screen at one time. It includes ideas, information and can contain text, graphics, multimedia and quizzes. Learning modules contain important information that allows users to access learning more easily and effectively.

Learning contents in a multimedia learning module can be viewed in sequence or out of sequence. If sequential viewing is enforced, the users can only view the learning module in the order in which items are listed. Users cannot progress to the page in the unit without seeing the previous page. In sequential viewing made, items in the Learning Module can be viewed in any order from the content page.

1.8.3 Misconception

Misconception is defined as a wrong belief or opinion as a result of not understanding something. It is an erroneous conception or a mistaken notion (Online Dictionary [OD], 2015).

1.8.4 Interactive

Interactivity allows students to navigate and explore the multimedia learning module in different ways. Through interactivity as well, students will be actively involved in the learning process and thus increase the level of motivation and interest in the subjects studied. According to the study by Rosnaini, Mohd Arif, Arba'at and Isham Shah (2007), an interactive computer presentation combined multiple media elements, such as text, graphics, animation, sound and video to be used as a systematic and effective courseware to manipulate aspects of audio and visual interests of consumers and provide a deep impression.

1.8.5 Microsoft Power Point

Power Point is one of the software used for the presentation tool in Microsoft Windows. Power Point is the most popular presentation software that can be used to create slide presentations and it also can be uploaded with attractive graphics.

The user can create and present visual aids such as chart and graphs, and it is easy to drag and drop the slides to re-order presentation. Besides that, the animation effect can be created easily and attractively in each slides.

1.8.6 Circular Motion

Circular motion is one of the subtopic in Newtonian Mechanics. The topics are contained in the syllabus of Physics I and General Physics at University Putra Malaysia.

1.8.7 I-Spring Presenter

I-Spring Presenter is the software that works as a PowerPoint add-in, to make a PowerPoint presentation more attractive and interactive Flash-based and can be opened in almost every computer or platform. I-Spring Presenter supports e-learning and is very flexible where different forms of multimedia elements could be inserted, so that the e-learning modules produced will be more interactive and appealing. This software is also used to design different types of quizzes.

1.9 Summary

There are five chapters in this thesis. The first chapter discusses the introduction, problem statement, purpose of the research, objectives, significance of the research, assumption, limitations and some definitions of terms.

Based on the discussion in this chapter, the use of interactive multimedia in education has become a popular method of teaching and learning. Multimedia instructional tool has been incorporated into today's educational environment to provide students with multimedia content combined with student-centered, hands-on, active learning activities with the goal of increasing student knowledge and motivation (Wang, 2010).

The previous studies that have been carried out associated with the use of multimedia in teaching and learning showed that the use of interactive multimedia was very appropriate and effective in helping students through the learning process. Interactive learning environment allows students to view, listen, respond and act. Hence, this first chapter concludes that the development of multimedia learning module on circular motion topic is a necessity for utilizing higher order thinking skills in the field of physics. In addition, students can enhance motivation through exposure to the multimedia learning using computer-aided learning (CAL).

Chapter 2 includes a review of the previous study that have been identified which related to the research study. The literature review focuses on instructional technology and multimedia instructional tools, specifically about the problems encountered in the process of teaching and learning physics. This chapter also discusses about the relevant literature on the effectiveness of interactive multimedia in education, learning theory and the development of interactive multimedia design.

While, the third chapter discusses the research procedure used in this study, including sampling, instrumentation, pilot studies and data analysis. The design and development phases of the multimedia learning module are also included in this chapter.

Chapter 4 presents the results of the data analysis. Findings related to each research question will be presented. Finally, the fifth chapter provides the conclusions, interpretation of the findings, implications, and recommendations for action and for further studies.

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