



ENHANCE LEARNING USING INSTRUCTIONAL VIDEO IN  
INDICES AND LOGARITHMS

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MASTER OF COMPUTER SCIENCE  
(MULTIMEDIA COMPUTING)

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**Faculty Information and Communication Technology**

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**A thesis submitted  
in fulfillment of the requirements for the degree of Master of Computer Science  
(Multimedia Computing)**

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**2016**

## **DECLARATION**

I declare that this thesis entitled “Enhanced Learning Using Instructional Video in Indices and Logarithms” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : .....

Date : .....

## **APPROVAL**

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in term of scope and quality for the award of Master of Computer Science (Multimedia Computing).

Signature : .....

Supervisor Name : .....

Date : .....

## **ABSTRACT**

With the development of technology and also the recommendations of the Ministry of Education in a variety of learning methods in line with 21st century learning, it is expected to help students in mathematics to understand this topic. The use of diversity in the learning process is hoped to arouse the interest of students to gain knowledge and also establish the student centered approach, no longer fully depended on the teacher. Teachers who used to be a speaker, which uses one way communication, now turned into a facilitator who guides the students through a two-way learning indirectly. In addition, the approach in also allows students to learn at their own pace and also they can learn at any time and without limitation in the classroom only.

## ABSTRAK

*Dengan perkembangan teknologi dan juga saranan Kementerian Pendidikan Malaysia dalam mempelbagaikan kaedah pembelajaran selaras dengan pembelajaran abad ke-21, maka video ini diharapkan dat sedikit sebanyak membantu pelajar dalam memahami topik matematik tambahan ini. Penggunaan kepelbagaian bahan dalam proses pembelajaran ini diharap dapat menimbulkan minat pelajar untuk menimba ilmu dan juga membentuk kaedah pembelajaran berpusatkan kepada pelajar, tidak lagi berpusatkan kepada guru. Guru yang dulunya sebagai penceramah yang mana banyak menggunakan komunikasi satu hala, kini bertukar menjadi fasilitator yang membimbing pelajar melalui pembelajaran secara dua hala secara tidak langsung. Selain itu, pendekatan in juga membenarkan pelajar untuk belajar mengikut rentak mereka dan juga dapat belajar pada bila-bila masa dan tidak terhad di dalam kelas sahaja.*

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## **CHAPTER I**

### **INTRODUCTION**

#### **1.0 Introduction**

Multimedia is a new ICT technology in Malaysia learning institutions and an option to convey information. Generally , multimedia means of various media that usually refers to a combination of elements such as text, pictures or images, color , sound , animation and movie . Its impact can be seen through the use of a substance and delivery of information -centric computing

Since the Multimedia Super Corridor project was introduced in August 1996, the government has chosen 88 schools to serve as a pilot project called Smart School in 1999. The school is defined as a smart practice of educational institutions teaching and learning and school management that prepares students for the information age and among the measures to include a provision of school computer lab, TV education and the provision of SchoolNet in rural areas.

Table 1.1: Smart School Programs

<b>Programs</b>	<b>Facilities</b>
Smart School	<ul style="list-style-type: none"> <li>• 88 selected schools</li> <li>• 5809 PCs</li> <li>• 261 servers</li> </ul>
Computer Lab	<ul style="list-style-type: none"> <li>• 4495 labs</li> <li>• 93 372 PCs</li> <li>• 4495 servers</li> </ul>
PPSMI	<ul style="list-style-type: none"> <li>• 97104 laptops</li> <li>• 69009 projectors</li> <li>• 2286 TVs</li> <li>• 9662 printers</li> </ul>
EduTV	<ul style="list-style-type: none"> <li>• 11709 TVs</li> </ul>
SchoolNet	Provide internet access to rural areas

The government's agenda to build and develop human capital in the future depends very much on the quality of the national education system. Hence, the Education Development Master Plan (PIPP) 2006-2010 has been designed and implemented to realize a holistic education system, progressive, moral and world-class was launched by former Prime Minister Tun Abdullah Ahmad Badawi on 16 January 2007. It outlines the PIPP The six core and one of its main core, human capital development, focusing to create a competent workforce in science and technology. Accordingly, the emphasis in this regard can be seen from a program designed in Report Card Education Development Master Plan. It states that the Smart School is an ongoing process towards civilizing the use of ICT in education to improve the quality of teaching and learning. The program involves equipping all schools with infrastructure, hardware, software and applications, teacher training and change management appropriate and sufficient.

As a replacement to the Education Development Master Plan (PIPP) 2006-2010, Tan Sri Muhyiddin Yassin said the implementation of the National Development Plan (2013 – 2035) or PPP that he drafted cruising through dialogue across the country where the recommendation is accepted 7,039 and 12,000 participants took part. It is also leveraging ICT to improve the quality of learning in schools. The ministry will improve internet access and virtual learning environment through the implementation of 1BestariNet for all 10,000 schools are expected to be completed by the end of 2013. In the near future, all students will have access to 4G networks in schools that will provide a foundation for the implementation of interactive learning. Therefore, it is necessary for teachers to take up the challenge and equip themselves with

information technology skills to the Ministry of Education's initiatives will be implemented successfully.

The step to use multimedia in education is a recent strategic in teaching and learning process. The use of multimedia in education is very broad and is not limited. Continuing with it then, educators should look at the positive aspects of the need to interact with the latest technology to familiarize future generations with a sophisticated lifestyle in the 21st century. The use of multimedia can indirectly provide an opportunity for teachers and students to use and improve themselves with the latest technologies and ready to face the challenges of new technologies coming.

The use of multimedia can be used in a number of aspects in the classroom such as:

- Computer aided learning
- As a source of information / database (hypermedia system)
- Teaching and learning materials as teaching aids.

Apart from its use in the current circumstances, a multimedia computer also can be an effective tutor. Therefore, the computer is often used in the form of a tutorial. In the tutorial, the following applies:

- Students are exposed to the content
- Information stored logically in memory
- Reproduce the information or skills effectively a later time

## 1.1 Background of Study

This project is basically a video aided learning for students' form 4 in Malaysia who are taking an Additional Mathematic subject in their *Sijil Pelajaran Malaysia* (SPM). It has eleven (11) topics in the syllabus of this subject. The topics are as below;

- |                           |                           |
|---------------------------|---------------------------|
| 1. Functions              | 7. Statistics             |
| 2. Quadratic Equations    | 8. Circular Measure       |
| 3. Quadratic Functions    | 9. Differentiation        |
| 4. Simultaneous Equation  | 10. Solution of Triangles |
| 5. Indices and Logarithms | 11. Index Numbe           |
| 6. Coordinate Geometry    |                           |

From the interviews amongst the students, most of them agreed that the Indices and Logarithms is the hard part for them to score, because it is hard for them to master the topics. According to Puan Saripah Binti Ahmad, a Great Teacher of Additional Mathematics in SM Sains Muzaffar Syah, this topic actually an easy topic but many students can not get a full mark on this topic. Sometimes the questions are quite direct to the point, but students still do the mistake.

Currently, these students and teachers are using hardcopy and books as their references. The teachers sometimes use the PowerPoint presentation in 2D to explain to the students. This project is developed to help the teachers to teach their students to gain a better understanding in indices which consists of three major parts as fundamental (consists of 3 aspects), 5 laws and lastly solving the index questions.

Table 1.2: Simple explanation on indices

### **Positive Integral Indices**

When a real number  $a$  is multiplied by itself  $n$  times, the result is the  $n$ th power of  $a$ .

$$\text{Example: } 5 \times 5 \times 5 \times 5 = 5^4 \text{ (5 to the power of 4)}$$

In general, if  $a$  is any real number and  $n$  is a positive integer, then

$$a^n = \underbrace{a \times a \times a \times \dots \times a}_{n \text{ factors}}$$

The integer  $n$  is called the index or exponent and  $a$  is the base.

Table 1.3: Indices and Law of Indices

Indices	Law of indices
<p><b>(A) Zero Indices</b></p> <p>The zero index of any number is equal to zero.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <math>a^0 = 1, \text{ where } a \neq 0</math> </div>	<div style="border: 1px solid black; padding: 10px;"> <math>a^m \times a^n = a^{m+n}</math> <p>Example:</p> <math>3^3 \times 3^2</math>  <math>= 3^{3+2} = 3^5 = 243</math> </div>
<p><b>(B) Negative Integral Indices</b></p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> <math>a^{-n}</math> is a reciprocal of <math>a^n</math>.  <math>a^{-n} = \frac{1}{a^n}</math> </div>	<div style="border: 1px solid black; padding: 10px;"> <math>a^m \div a^n = a^{m-n}</math> or <math>\frac{a^m}{a^n} = a^{m-n}, a \neq 0</math> <p>Example:</p> <math>3^3 \div 3^2</math>  <math>= 3^{3-2} = 3^1 = 3</math> <p>or</p> <math>\frac{3^3}{3^2} = 3^{3-2} = 3^1 = 3</math> </div>
<p><b>(C) Fractional Indices</b></p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> <math>a^{\frac{1}{n}}</math> is a <math>n</math>th root of <math>a</math>.  <math>a^{\frac{1}{n}} = \sqrt[n]{a}</math>  <math>a^{\frac{m}{n}}</math> is a <math>n</math>th root of <math>a^m</math>.  <math>a^{\frac{m}{n}} = \sqrt[n]{a^m}</math> </div>	<div style="border: 1px solid black; padding: 10px;"> <math>(a^m)^n = a^{mn}</math> <p>Example:</p> <math>(7^3)^4 = 7^{3 \times 4} = 7^{12}</math> </div>
	<div style="border: 1px solid black; padding: 10px; margin-bottom: 10px;"> <math>(ab)^n = a^n b^n</math> <p>Example:</p> <math>(15)^3 = (5 \times 3)^3 = 2^3 \times 3^3</math> </div> <div style="border: 1px solid black; padding: 10px;"> <math>\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0</math> <p>Example:</p> <math>\left(\frac{3}{5}\right)^4 = \frac{3^4}{5^4} = \frac{81}{625}</math> </div>



## 1.2 Problem Statement

Teaching is the transmission of knowledge or specific skills. Where the teaching covers matters - such as planning, management, delivery, supervision and evaluation, with the aim of spreading the knowledge or skills to students with effective ways (Mok, Soon Sang, 2003). Meanwhile, according to Thomas F. Green, the purpose of teaching is to change behavior - behavior and conduct of students through the acquisition of new knowledge or belief. While learning means the process of acquiring knowledge or skill. Knowledge and skills can be acquired through experience and knowledge which is in the neighborhood. Kamus Dewan also assess that learning as a process of learning to acquire knowledge and training. In the context of education, the teacher as the responsible teaching students to master one - one lessons to achieve specific objectives. This objective should be to bring change to their students. The development and the needs of information technology and communication (ICT) now indirectly lead to changes in teaching and learning approach nowadays.

Integrating ICT in teaching and learning is a good effort, but not something that is easy to implement. To examine the effectiveness of ICT in shaping the teaching and learning process, apart from the teachers themselves need to be creative and innovative in applying theory - ICT learning into the program. Therefore, knowledge of the ICT program should be updated or 'up to date'.

Multimedia elements in the teaching-learning actually supports the use of multiple sensors (multi-sensory) as well as to stimulate the use of multiple human senses. In addition, the multimedia features also include interactivity and allow the user to control the mass media used (Vaughan, 1998). According to the study by Vaughan, he stated that multimedia communication medium can be a positive and effective as through text, sound, video and animation of various colors and patterns can be displayed at the same time. Interactive multimedia is more effective than traditional teaching-learning in the students' attention using interactive multimedia in teaching and learning as well as interest of students so that they do not feel tired and unable to concentrate fully on the learning process (Thomas, 1996)

From the interviews that have been conducted with the form 4 students from the chosen classes, they are having difficulty in understanding the Indices and Logarithms. With the current traditional method of teaching and learning in Malaysia, and the lack of variety in the way current indices and logarithms topic was taught that make students having difficulty in

finding the attractive way of learning to enhance their own learning experience. If we search in the youtube or internet, mostly provide the basic knowledge of the topic. Students only understand the surface, but if the question requires deep thinking, they will having a problem.

### **1.3 Research Questions**

Based on research background above, the research questions are:

- i. How can an instructional video support teaching and learning in mathematics?
- ii. What common mistakes made by students in answering the questions on the topic of indices and logarithms?
- iii. What is creative teaching guidelines to be used by teachers in teaching students to solve problems in indices and logarithms?

### **1.4 Research Objectives**

- i. To investigate an educational video on learning in Malaysia.
- ii. To develop the learning of additional mathematics by using the video.
- iii. To evaluate the students' performance and understanding of the students for this topic.
- iv. To generate attractive learning environment to the students.

### **1.5 Scopes**

The scopes involved in this research project are:

- i. Target audience

Two classes of form 4 students of SM Sains Muzaffar Syah who are taking additional mathematics subject; 4 Omega and 4 Sigma. 4 Omega consist of 29 students, 4 Sigma 20 students which make the total of 49 students.

- ii. Contents scope

The content of the project is to enhance the learning of the topic “Indices and Logarithms” using instructional video.

- iii. Deliverable scope

The content will be delivered in video form. The teacher can get the video by copy to their pen drive or the video file will be shared on the school server.

## **1.6 Project Significance**

The project will bring benefit to the form 4 students of SM Sains Muzaffar Syah directly, and indirectly will ease the commitments of teacher on this topic. With this, teachers will have an aid that they can use and enhance the learning just not by “chalk-and-talk” session.

In this near future, some improvement can be done and to be potentially be implied to another topic and also can be widespread to another school in the nation.

## **1.7 Conclusion**

The aim of this research is to design and develop a simulation that could produce a better solution of teaching this mathematical topic for students’ form 4 and also enhance the process of learning in a fun and effective ways.

## CHAPTER II

### LITERATURE REVIEW

#### 2.0 Background of Study

Nowadays, a paradigm shift has taken the place in education. Technology started been implemented in the education and slowly has taken the role of teacher instead of teaching, but they can spend more time on guiding and interacting with the students. With advances in the internet and communications technology, it is becoming easier for teachers to offer dynamic multi-media educational resources and the capability to support both content and assessment between instructors and learners. Cloud computing and services such as YouTube, Teacher Tube, and Screencast.com make the sharing of video resources increasing accessible for all teachers and students. Technology educators predict that within a few years, tablet PCs, laptop computers or smartphones with wireless Internet will be carried by nearly all students (Levy, 2010).

A research was recently conducted by Truebano, M., & Munn, C. (2014) on a focus group of 14 students where the participants divided into three groups of a) a training only (control), a training and video group and c) video only. The result of the research suggest that a blended approach (training and video) yielded the big success. In terms of confidence, using the video has increase the student's confident level and also their abilities.

In mathematics, in order to get a better understanding of something, students need to visualize and relate something with their experiences or something that might be easy for them to relate to. Visualization can be defined as a method of accepting and processing information, events or objects, to fully understand something unknown through images, shapes and patterns. Kostic-Kovacevic, I., & Gavrilovic, J. (2013). By using the video, student might visualize the

concept and get the better understanding for what they have learnt. Technology can be used to enhance visualization and support student understanding of mathematical concepts. It can assist in the collection, recording, organization and analysis of data. Technology can increase the scope of the problem situations that are accessible to students. The use of technology increases the feasibility of students working with interesting problem contexts where students reflect, reason, solve problems and make decisions. Drijvers, P., Monaghan, J., Thomas, M., & Trouche, L. (2014).

Nowadays, the terms “flipped classroom” is started to be established in Malaysia. The ability to engage the students with the learning contents and develop the critical-thinking among the students especially in Science, Technology, English and Mathematics subjects (STEM) have given them positive impact in learning. Schiller, N. (2014). With active student’s engagement and better storyline to tell the students, the better a student is prepared, more learning that can be achieved. With the new technologies involved, students can learn anywhere and anytime without or guidance of a teacher. With this, the role of a teacher as a center of learning circle has been transformed to a facilitator or as a guidance. Lecture and homework can be on the move. The conversation of a topic can be extend outside of the class and student can use opened up time for practices and application.

A simple comparison also is done by comparing the flipped design classroom to the traditional classroom. Since the usage of video as a tools of teaching, this will made student use the student center approached.

Table 2.1: Comparison of Learning Approaches

<b>Student Center Approaches</b>	<b>Traditional Approaches</b>
Person centered	Curriculum centered
Self-directed	Teacher directed
Child-centered	Teacher centered
Construction understanding	Covering subject matter
Thinking	Memorizing
Experiential method	Lecture
Active	Passive
Showing	Telling

Inquiry based	Knowledge based
Portability	In class
Self-paced	Teacher paced
Anytime	In class

Therefore, this research aims is to enhance the learning by identify the factors that burdens the students' mind and also produce a video on this research. This investigation will be done to the 49 students from two classes of form 4 in SM Sains Muzaffar Syah, form 4 Omega and form 4 Sigma. These classes were chosen because the the students' academic achievement are not impressive. Hence, there is a room of improvement if the study is conducted on them. From the preliminary investigation, a list of factors is expected to be identified. At the moment, there has not been study being conducted to investigate the issue. It is important to find out what kind of tools that can be used to help these students in order to get better understanding. Indices and the Logarithm concepts very important since it will have continuity in higher education later. With proficiency concept and logarithmic index, students can not only increase self-confidence to learn mathematics but they also will apply the concept in the field of employment later.

The video can be implemented in the flipped classroom as SM Sains Muzaffar Syah also has encourage the students to bring the device such as laptops, ipads and tablets to the school through the *Bring Your Own Device Programme* or known as *BYOG*. The purpose of this programme is to encourage students to get an extra knowledge and indirectly will enhance the learning. Students can gain knowledge at any time they can watch the video as many times their like.

## 2.1 Preliminary Investigation

A preliminary investigation is being conducted to identify which topic to choose and the reason for choosing this topic. Below are the trial questions from the topic Indices and Logarithms.

Question 7

If  $2^m = n$ , express  $8^m - 4^m$  in terms of  $n$ . (3 marks)

Question 8

Given  $\log_2(y + 1) - 3\log_2 x$ , express  $y$  in terms of  $x$ . (3 marks)

Question 9

Mr Anuar has bought a double storey house from a housing developer SA Setia Sdn Bhd. The price of the house is RM 300 000. Each year the price of the house was increased by 5% from the actual price. The price of the house after  $n$  years is given by  $300\,000(1.05)^n$ . Mr. Anuar decided to sell the house, when the price exceed RM 390 000 for the first time. After how many years can he sell the house? (4 marks)

Table 2.2: Trial Questions

Table 2.3: Itemized Analysis – SPM Trial 2015 of 5 Theta

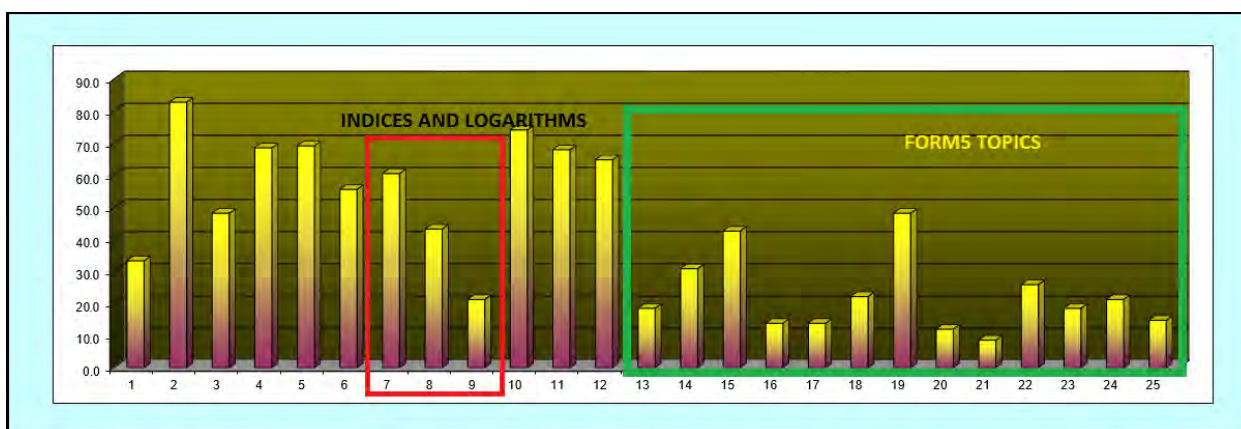


Table 2.3 shows the analysis of Additional Mathematics questions according to forms and topics. The first twelve questions consists of question from form 4 topics, and three of the questions are from indices and logarithms topic.

Figure 4 will show the frequent errors that always happened to the students. It shows what the four common error in the indices are and logarithms topic based on the students answers. Researchers has group the errors in this 4 groups of errors.

Table 2.4: Common Mistakes

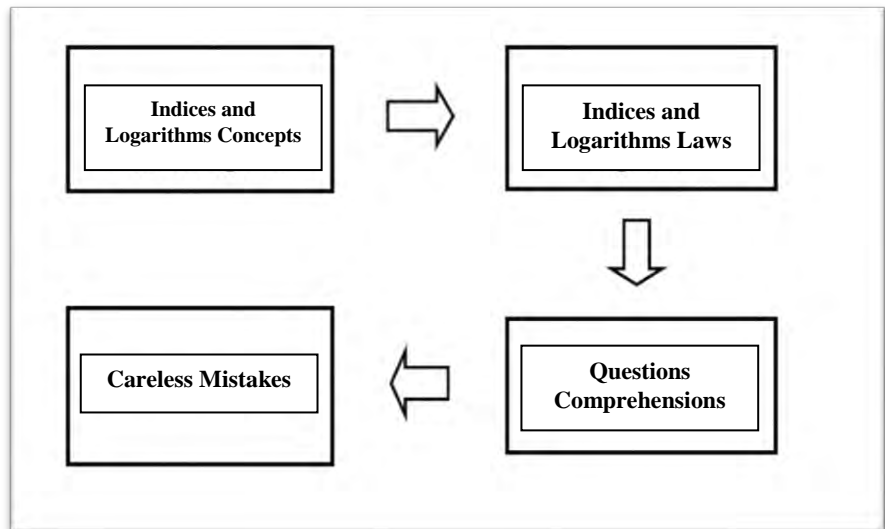


Table 2.5: Questions and Mistakes for Itemized Analysis

Question	Mistake(s)
7	Concepts and laws of Indices and Logarithms
8	Concepts and laws of Indices and Logarithms
9	Question comprehension