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**Universiti Teknologi MARA**

**Development of Interactive Multimedia  
CD in Learning Year One Mathematics**



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Thesis submitted in fulfillment of the requirements for  
**Bachelor of Science (Hons) Information Technology**  
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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.

20<sup>th</sup> APRIL 2005

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## ABSTRACT

Multimedia technology has thus been the base of the development of courseware especially in aiding teaching and learning. Teachers act as a facilitator while the students build their knowledge from the information acquired based on what they had learned. By infusing the many elements of multimedia, such as text, graphics, audio, animation and interactivity helps the students understand the certain subject further. The approach used in the application is repetitive which helps the student to memorize and be able to master the subject better. The project aims to develop a supplement material for the National School Syllabus in learning Mathematics for Year One pupil aged seven years old. The development of the software is based on the Instructional Design Methodology, the ADDIE model which is the acronym for Analyze, Design, Develop, Implement and Evaluate. The research framework is based on Robert M. Gagne's learning theory which is the Conditions of Learning. There are basically three main modules, which are Numbers, Addition and Subtraction. With the development of this software, children will be able to have fun while learning and enhancing their mathematical skills with the games provided. The games itself have their own purpose and objective, among them are to boost the students knowledge and to encourage quick thinking in solving mathematical equation.



# CHAPTER 1

## INTRODUCTION

### 1.0 Project Background

Information technology (IT) especially multimedia is rapidly expanding; it is used either for research or for implementation. IT is becoming famous because of the massive potential it could become as a medium in conveying information. Education-wise, multimedia is a more powerful tool compared to the existing teaching aid tools, this is because multimedia integrates various media such as text, graphic, sound, animation, video and interactivity all into one digital environment (Norkhairani, 2004).

In conjunction with the existence of the new curriculums by the Ministry of Education, that is to teach how to use computers at all schools and the use of English in teaching Mathematics and Science for primary school students (Soon, 2003). This research aims to develop an interactive multimedia CD that caters for all three elements of the Ministry's new curriculum, English and Computer Literacy, by using Mathematics as the subject. This proves that the government is focused on making an IT-savvy generation in line with the suggestion by the previous Prime Minister, Tun Dr. Mahathir Mohamad (Ministry of Education, 2001).

Also with the new development, The Ministry of Education's acknowledge home schooling as an accepted alternative education approach. Education is now in the hands of the parents and the child, when, where or how to engage in learning its all up to them (Soon, 2003). This means that with the development of this CD, both child and parents can share the fun in learning and teaching mathematics.

## **1.1 Problem Description**

Along with the rise in economy, the quality of living for Malaysians have increased and thus more children are able to attend school compared to ten years ago. This results in a situation where a teacher has to handle 50 students. This ratio is intense and a teacher cannot be expected to deliver as efficient as a teacher do in the past. Also with the high quality of living, the family usually can afford or have a personal computer at home. Put two and two together, the big ratio and the available technology, this CD is beneficial in order to further help the student who may be left behind by the throng of 49 other students. The student therefore can learn and enhance his understanding of the subject at his own comfortable pace with or without the help from his family members.

Different child requires something different from another child. This project CD which aims to be a supplement to the students learning activity focuses on the activity rather than the teachings. This would help the students, who may be slow at catching up, to understand and practice mathematics, or become a fun additional practice activity for others.

## 1.2 Project Scope

According to the Mathematics Year One Textbook, there are four main modules, which are numbers zero to ten, addition within ten, subtraction within ten and numbers 11 to 20 (Wan Yusof et al, 2003). Most of Year One students in Malaysia are seven years old, thus making the children as the target audience for the project. In line with the new curriculum, the language used for this software is English.

## 1.3 Project Objectives

The objectives of the project are as follow:

- To develop an interactive Mathematics for Year One student CD by integrating all techniques of multimedia, such as the use of audio, animations, graphics, text and interactivity.
- To provide for additional activity that is fun for seven year old children in understanding and learning mathematics at their own comfortable pace.
- To provide a supplement material for the National School curriculum in Mathematics for Year One students.
- To enhance the children's grasp of mathematics and to provide for quick thinking.

## 1.4 Project Significance

- Each pupil can study at their own pace.
- The child can have fun at the same time as they are practicing mathematics.
- The children would develop quick thinking in solving mathematical problems from the game-like activities provided in the CD.
- Since the software is in a CD medium, it has many advantages, such as the pupil can use it on any IBM compatible computer with a CD-ROM, even without Internet connection.

## 1.5 Summary

As time pass by requirements would change. Today is the information age, where technology is blooming and creativity is beauty, by integrating the two elements and applying it to the development of a child would result in an outgoing person with a critical and creative mind that would run the world in the future.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.0 MULTIMEDIA

Multimedia is defined as the purposeful designed digital integration of text, graphics, audio, animation and video in a managed presentation throughout a delivery system with the aid of a computer in order to convey information interactively (Mohd Yunus, 2003).

According to Bass (2000), interactive multimedia can be defined using three criteria:

- i) Any package of material which contains some mixture of texts, graphics, animation, video and audio
- ii) The materials are packaged, integrated and linked together in a way that allows the user to navigate, browse and analyze the materials through various searches and indexes as well as the capacity to annotate or personalize the material
- iii) It is always user-centered, where the user takes charge of his own experience with the material by being able to select among multiple choices, choosing unique paths and sequences through the materials.

In a study done to measure the effects on multimedia on the progress of children in non-English speaking countries, it was found that the children using multimedia scored significantly higher than those who did not (Macaulay, 2003)

## **2.1 E-LEARNING (INTERACTIVE LEARNING)**

Definition of e-learning according to Morley (2001) is “the idea, according to its advocates, is that a person can learn almost anything, sitting at home in front of a computer, given the right kind of learning package”. And according to Rawat (2005) “e-learning is self-paced, technology-based instruction”.

The benefit of e-learning is the ability for the learner’s to learn anywhere and anytime at the individual’s own pace due to the power forces of computer and communications technology (Igonor, 2002). Another of its advantages is that it is interactive, and not a passive activity where the teachers spoon-feed the student and the student takes it all in, thus a successful e-learning includes the learner in the learning process (Morley, 2001).

## **2.2 CHILDREN AND MATHEMATICS**

Developing a basic and solid mathematical foundation is essential to a child. During their kindergarten through to primary school, children build beliefs about what mathematics is, what it means to know and do mathematics and about themselves as learners of mathematics. These beliefs influence their performance and attitude towards mathematics and perception of mathematics in later years (National Council of Teachers of Mathematics, 2004).

In the aspect of target audiences, Zanzali (1996) stated in his writing that teaching students at the primary level would need to emphasize on their concrete experiences, meaning giving numerous examples that they can relate to.

Based on Jean Piaget's "Genetic Epistemology", Kearsley (2004) summed up several principles, among them is that all learning materials and activities should imply the appropriate level of motor or mental operations for an adolescent of given age and implements the use of teaching methods that dynamically involve students and offer certain challenges for them.

According to the National Council of Teachers of Mathematics, instructional programs should allow all students to build new mathematical knowledge through problem solving; apply and adapt a variety of appropriate strategies to solve problems; monitor and reflect on the process of mathematical problem solving.

### **2.3 CHILDREN AND COMPUTERS**

The Ministry of Education had released a new curriculum which is to add a subject teach school children how to use computers. This goes to show that the government is focused on making an IT-savvy generation in order to achieve Vision 2020, in line with the suggestion by the previous Prime Minister, Tun Dr. Mahathir Mohamad (Ministry of Human Resource, 2001)

A study in the United Kingdom done to investigate how new technologies can improve teaching and learning across the national curriculum in different educational settings. One interesting finding from the study is that the students' grasp of IT, and their dexterity, is often superior to that of their teachers because the students have been able to develop IT skills at home (Nightingale, 2004)

## 2.4 CD AS STORAGE MEDIUM

Nowadays, the PC has thus become a powerful multimedia PC equipped with CD-ROM and even DVD-ROM. The advancement of high video compression techniques and the availability of large storage medium, many of the media elements can now be processed on the desktop and multimedia applications can be created. Because of their low cost and large storage capacity, CD-ROM is becoming widely used. CD-ROM is certainly not the only delivery platform for multimedia titles; however, its high-storage capacity and low-cost are making it the most attractive delivery platform in the consumer and education markets (Salemi, 2001).

## 2.5 LEARNING THEORY – COGNITIVE CONSTRUCTIVISM

Bostock (1996), writing on Robert M. Gagne's Instructional Design – Conditions of Learning, has summarized that in "*developing instruction involves analyzing requirements, selecting media and designing the instructional events*". Instruction here means the way education is conveyed and taught to the students where analysis is required to determine the learner's specifications. Based on that, the media is selected and the design of the teaching method is built.

Figure 2.1 is a diagram representing the Cognitive Constructivism Theory. It is shown in the diagram that children aged seven years old, whom are the target audience for this research, are in the preoperational stage where they can relate an object or an event with symbols or icons (Fadhlinà, 2004).



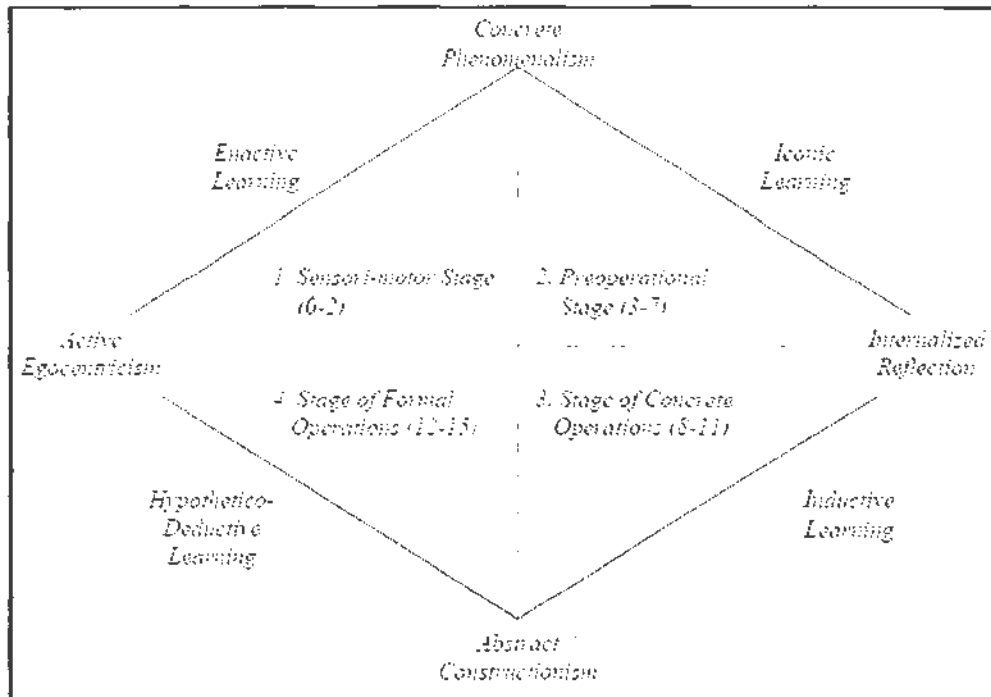


Figure 2.1: Cognitive Constructivism Theory (Fadhlina, 2004)

## 2.6 INSTRUCTIONAL DESIGN

“Learning with software: pedagogies and practice” website had outlined the software under the instructional design paradigm as *the material to be learned is broken down into smaller parts, so that the learner can concentrate on each separately and in turn; each part of the material is accompanied by a learning task; and, regular rewards and reinforcements are provided for the successful completion of learning tasks. If problems are encountered with any of the sequenced tasks, the learner is routed around a remedial loop in the software, and is thereby provided with extra support and tuition. This procedure continues until the learner successfully completes the task, and moves onto the next task.* Kemmis et al. (1977).

“Instructional Design is the systematic process of translating general principles of learning and instruction into plans for instructional materials and learning.” (“What is Instructional Design?”). “Instructional Design as reality can start at any point in the design process. Often a glimmer of an idea is developed to give the core of an instruction situation. By the time the entire process is done the designer looks back and she or he checks to see that all parts of the “science” have been taken into account. Then the entire process is written up as if it occurred in a systematic fashion.” (University of Michigan, 1996)

## CHAPTER 3

### THE INSTRUCTIONAL DESIGN METHODOLOGY

Methodologies are comprehensive, multi-step approach to system development that guide the work and influence the quality of the project. It is important for the project to follow a well-defined methodology in order to have the development process running smoothly.

#### 3.0 Introduction

Instruction is needed in the development of multimedia software in order for the process and development to run smoothly. Thus the instructional Model that is chosen is the ADDIE model. The model's acronym stands for Analysis, Design, Development, Implementation and Evaluation (Rawat, 2005). ADDIE is similar to the Traditional System Development Life Cycle, where a phase begins after a phase ends, except that the difference between the two is that ADDIE is a method especially for developing multimedia software. The model is presented as in figure 3.1.

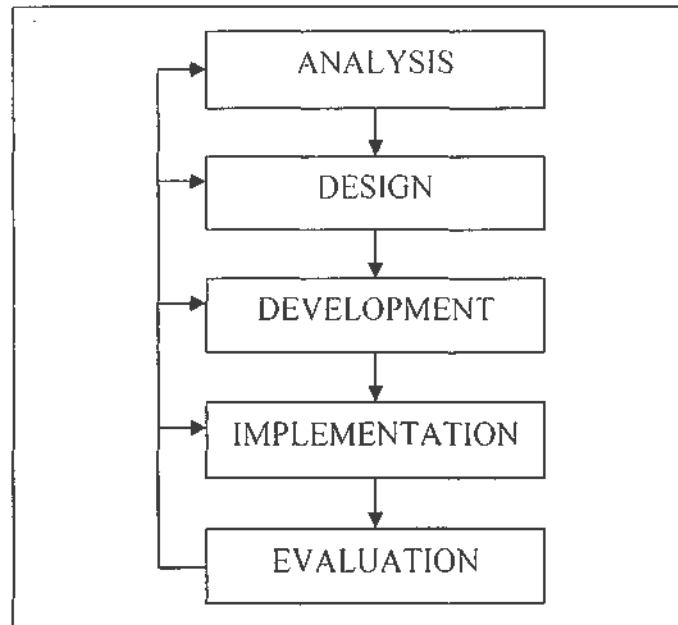


Figure 3.1: Flow Diagram of ADDIE Model  
(Source: Jamaluddin et al, 2001)

### 3.1 Analysis

In the analysis phase, which is the first and crucial phase, a developer has to consider all of the basic foundation of the project. The vital aspects of the project are analysed and reflect on the reasons, the subject, the objectives, the target audience, the scope, the contents and thus coming up with a proposal for the research. Also in this phase, the developer search for information and related literature on the subject in hand, about the target audience and the contents.

### **3.1.1 Data Collection**

The data collection methods that were used to acquire sources for this research are as follow:

#### **3.1.1[a] Searching the Internet**

In order to collect the correct and relevant information and data, searching is done for articles, journals, researches and thesis from other universities and community groups in Adobe Acrobat format as well as in html.

#### **3.1.1[b] Library**

The library is also visited for magazine articles, books regarding the software used for the development of the project, computer journals for researches related to this thesis scope and past thesis of the University's graduates.

#### **3.1.1[c] Books**

Books related to the project scope are either bought or borrowed from certain individuals as a reference for the development of this thesis. Such as, Year One Mathematics textbook and Macromedia Director book.

### 3.1.2 Research Framework

This research's framework is built based on Robert M. Gagne's theory, Conditions of Learning. The following lists the basic frame of work of this multimedia software using Gagne's theory (Kearsley, 2004) and figure 3.2 illustrates the theory using a diagram.

- Gain attention:-- by the use of animated multimedia characters, music and appealing interface with vivid colours and animated button faces.
- Identify objective:-- in the first part of the software, there will be an introduction where the main character will introduce the subject and give an overview of the software's main functions.
- Recall prior learning:-- by giving the basic examples that the user might have encountered in daily lives so they would recall back on past experiences.
- Present stimulus:-- the set of notes regarding the subject of the software would be implemented here.
- Guide learning:-- this is where the user would be given additional related examples to the previous notes and be shown how its done.
- Elicit performance:-- this is where the user will begin an activity or game and the objective is to achieve the goals of learning the subject..
- Provide feedback:-- appropriate assistance will be provided each time the user makes both right and wrong choices.
- Assess performance:-- as the activity or game ends the program will provide scores and remediation.
- Enhance retention/transfer: -- here the user will revise the topic learned for better understanding by taking the tests.

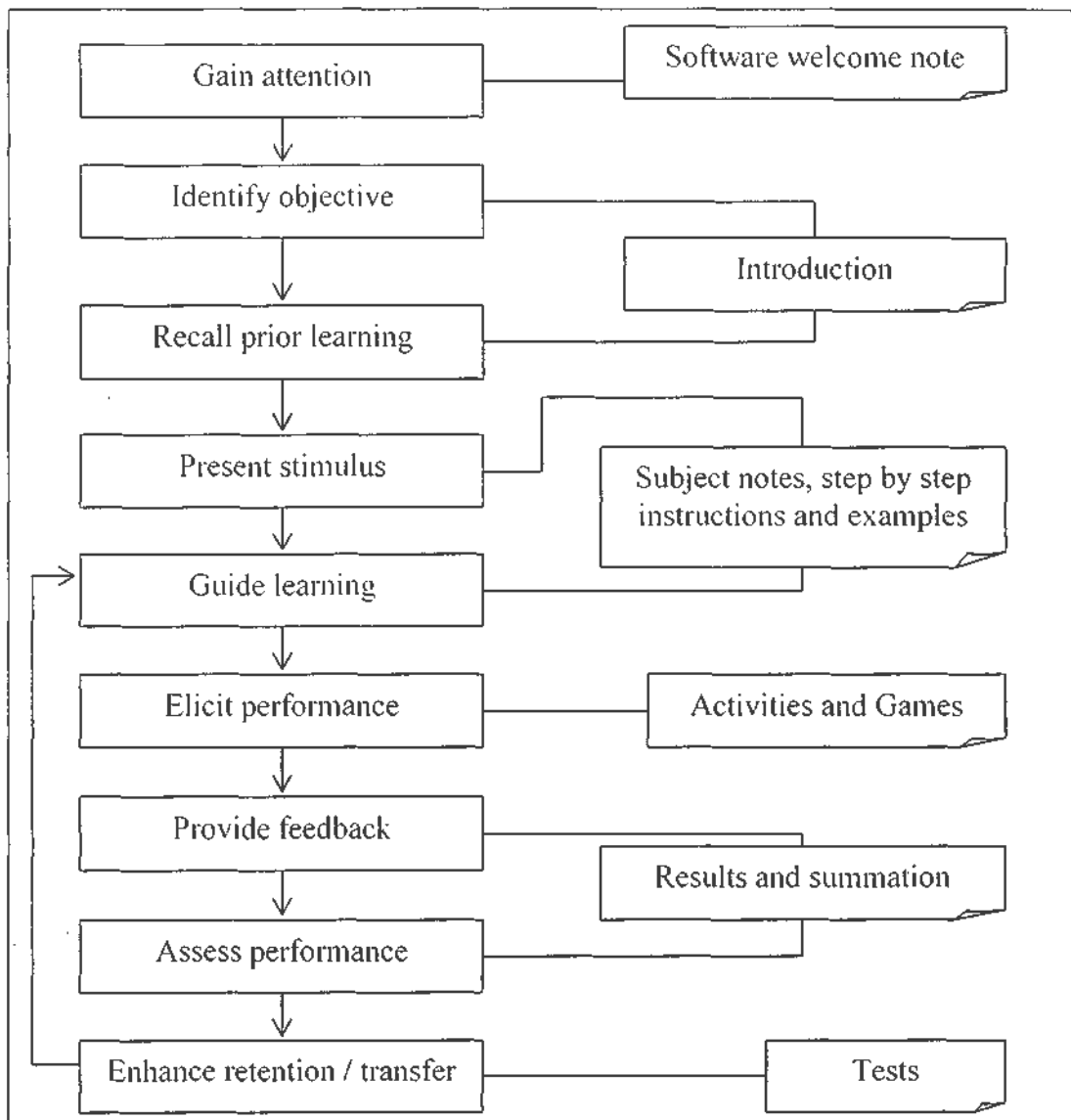


Figure 3.2: The flow diagram of the software's frame of work

## 3.2 Design

This stage is where the development of the blue print for the system. The suitable design for the target audience whom are Year One Students aged seven years old is considered. Among the design aspects are the system framework, the whole theme, the interface layout of the software, navigation, interaction and colours thus coming up with storyboards for each screen. The theme the developer came up with was using shapes as icons for the navigational buttons and uses bright and vivid colours.

### 3.2.1 Navigational Structure

Navigation system affects the whole multimedia experience. The user's key interaction with the software is navigation through the content. A good design of navigation minimizes travel, depth and redundancy. This thesis's system uses the Tree Structure, which allows the user to choose the course that interests them. Figure 3.3 shows the navigational mode the software uses.

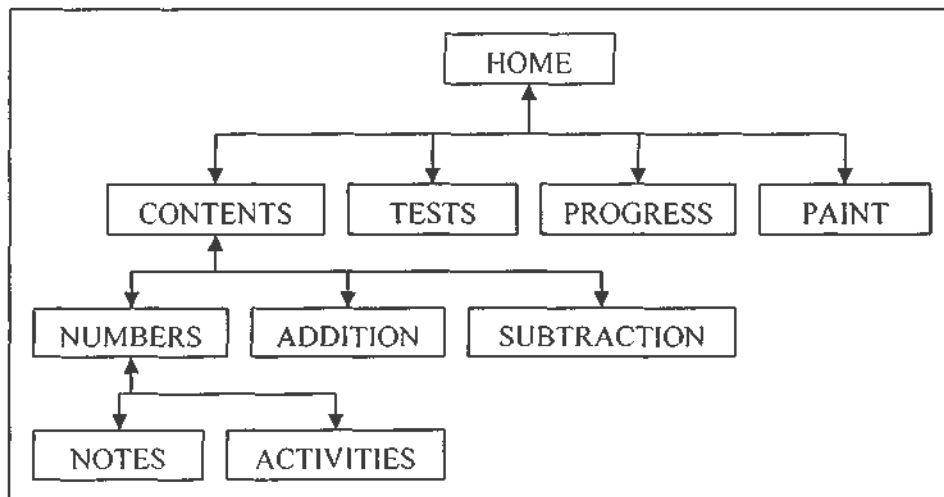


Figure 3.3: The System's Navigational Structure