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# INTERACTIVE MATHEMATICS LEARNING SYSTEM

# ( EMATH )

**ABSTRACT**

Interactive Mathematics Learning system is a web based multimedia learning system for lower primary school level. The target users are lower primary school students, teachers and parents. It can be used either as a teaching tool or a self learning program.

This system provides lessons to educate students of 7 and 8 years of age. It can also be used by preschool children. At the end of every lesson, short test and quiz will be given to test the understanding of the students. Games based on the basic mathemahics operations are also created to test the students skills in mathematics.

The aim of the system is to create an effective and interesting learning and teaching tool and environment to enable students learn mathematics and at the same time enjoy the lessons. This web based system can also promote and encourage the use of computers at an early age. This would enhance the computer literacy of students and also teachers.

The development model used to develop this system is the waterfall model combined with the prototype model. The main advantage of this system is that the process can be tailored to meet the specific requirement yet possibly changing the needs of the application

The tools that will be used for this interactive multimedia system comprises of Macromedia Dreamweaver, Macromedia Flash and Microsoft Agent Scripting Helper. The programming languages that will be used are HTML, Javascript and also ASP to develop the system.

The main features of this system is that it's user friendly with an attractive interface, easy to navigate, interactive, and interesting with a talking wizard which serves as a guide and also tutor.

## ACKNOWLEDGEMENTS

This thesis would not have possibly be completed without the help and contributions of many people in many ways. I would like to take this opportunity to thank the following parties who have helped me in one way or another :

Firstly, I would like to thank my supervisor Pn. Sri Devi Ravana and moderator Pn. Fariza Hanum for their guidance and advice. Their contribution and comments allowed me to be more creative in designing the system. Their help also allowed me to design an effective and interesting system by overcoming the weaknesses pointed out by them.

Secondly, I would like to thank my course mates who helped me by sharing their knowledge and experiences. They're helped allowed me to realize the weakness of the system and come up with a solution to solve the problems encountered.

Lastly, I would like to thank my family and friends who have always been giving me the support and the encouragement needed in order to develop the system. Their motivation has helped the completion of this proposal in a way.

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# CHAPTER 1 - INTRODUCTION

## 1.1 Project Definition

Traditionally, mathematics like any other subjects is being taught using books in schools. The advancement of technology and use of computers has made learning and teaching online possible. Online learning can be carried out anywhere as long as there's a computer which is connected to the Internet. The students don't have to be at a classroom at a particular place or at a particular time.

This interactive mathematics learning system is a web – based multimedia learning and teaching tool for the lower primary school students and teachers. It can be used as a self – learning tool by students or as a teaching tool to be used by teachers in the classrooms. Parents can also use the system to guide their children at home.

This interactive mathematics learning system has a main talking wizard to help guide users to use the system, tutor and also interact with the users by responding to the users input along the way. It is quite interesting and attractive which the children will find enjoyable using the system. The wizard appears at every page to give brief explanations.

Besides that, this system is a bilingual system. Users can choose to either use English or Bahasa Melayu. It also offers lessons, quizzes and tests to test the student's capability at every chapter.

Lessons of this system teach the basic mathematics operations and is divided to two parts which is for Standard 1 ( for students aged 7) and Standard 2 ( for students aged 8 ). There are fifteen topics for each level. At the end of every topic, there'll be a test and

also a quiz to test the students. There are also games for students to test their skills and understanding which are based on mathematics operations and numbers in a fun way.

This system's site will also contain hyperlinks to other educational sites. Users can even tell their friends about the site by e – mail of the URL of the site. This way more people would know about this site.

**1.2 Aims and Objectives**

The aim of this project is to make teaching and learning mathematics in an effective and interesting way for lower primary level. It is also a tool that can be used to encourage the use of computers at an early age itself and to enhance the computer literacy level of students and teachers.

The objectives of this project are as follows :

a) To develop an effective, interesting and stimulating teaching and learning tool

b) To create, design and develop a web based teaching and learning mathematics system for the lower primary school students

c) To create a better learning and teaching approach with a stimulating environment.

d) To expose and encourage the use of computers to students at an early age.

e) To improve the computer literacy level among students.

**1.3 Project Scope**

During the development of the project, several considerations will be made. The main users taken into considerations will be the lower primary school students and

teachers. It will also be based on the KBSR mathematics subject syllabus of Malaysian primary schools.

The scope of the project are as follows :

a) The lower primary school mathematics subject syllabus.

The system will be based on the mathematics subject syllabus for standard 1 & 2 students ( aged 7 – 8 ).

b) The language that will be used will be bilingual that is it will be in English and also in Malay

c) The target users are :

i ) Standard 1 & 2 primary school students

ii ) Teachers of the lower primary school level. This system can be used by teachers to as a teaching tool that can be conducted in the classroom.

iii ) Parents of primary school students. Parents can use this system as a guide to teach their children at home.

**1.4 Assumptions**

In the development of the system, several assumptions have been made that is as follows :

a ) Access to the Internet is available by the target users because this system is a web based application and can only be accesed online from the Internet.

b ) Target uses have basic in the handling of computers.

## 1.5 Limitations

There are several limitations in this system. It is as follows :

a) This system is mainly for students of lower primary schools and also can be used by preschool students.

b) Access to the Internet is a must as this system is a web – based application.

c) Guidance by parents and teachers are important and will be needed as there is a possibility of students misusing the Internet by surfing unrelated or unnecessary sites instead.

## 1.6 Project Schedule

**Table 1.1 : The project schedule of the development of this project.**

| Month | Mar | | | | Apr | | | | May | | | | June | | | | July | | | | Aug | | | | Sept | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Week | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Feasibility study | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System definition | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System analysis | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System design | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Report | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Coding | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System documentation | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Testing and review | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Presentation | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

# CHAPTER 2 – LITERATURE REVIEW

## 2.1 Web – based Learning

### 2.1.1 What is Web - based Learning?

Web-based training (sometimes called e-learning) is anywhere, any-time instruction delivered over the Internet or a corporate intranet to browser-equipped learners. There are two primary models of Web-based instruction: synchronous (instructor-facilitated) and asynchronous (self-directed, self-paced). Instruction can be delivered by a combination of static methods (learning portals, hyperlinked pages, screen cam tutorials, streaming audio/video, and live Web broadcasts) and interactive methods (threaded discussions, chats, and desk-top video conferencing).

We can say that web based learning is generally defined as :

a) content available anytime, 24 hours by 7 days

b) content accessible by a learner located anywhere in the world

c) an environment that is learner-centered, one that is personalized to the individual and customized to the organization

d) involving some form of technology for delivery

e) network (Internet, LAN Local Area Network, or WAN Wide Area Network) assisted

f) the whole learning experience, from assessment through testing and sometimes certification

g) including online administration - called a Learner Management System ( LMS) for managing registration, payments, and learner progress

Enthusiasts feel that Web-based instruction is the perfect solution to meeting the needs of life-long learners because it is available on demand, does not require travel, and is cost-efficient. Critics point out that Web-based training is a good alternative for independent, self-motivated students but that technical issues and the need for human contact limit its usefulness for students with other learning styles.

Although, all of the experts has his or her own definition, there is a common factor, which is that Web-based learning takes full advantages of the Internet or World Wide Web to deliver information.

### 2.1.2 Types of Web – based Learning

#### 2.1.2.a Synchronous eLearning

Synchronous is defined as " occuring at the same time ". Synchronous eLearning infers that the instructor and the learner interact with each other and the course content simultaneously even if both are at geographically dispersed locations.

#### 2.1.2.b Asynchronous eLearning

Asynchronous is defined as " not occuring at the same time ". in asynchronous learning, learners have to complete the learning tasks by a specified course - end - date.

Learners do not follow a schedule of learning sessions, but have the flexibility of learning when and where they want.

### 2.1.3 The importance of Web-based learning

Web-based learning is an emerging field in education due to the rapid growth of the Internet. Reasons for the growth of Web-based learning include :

a) promotes growth of distance education economically ( inexpensive source and reliable ) as compared to computer based training, live broadcasts, video tapes, and so on, ( Relan and Gillani, 1997; Santi, 1997 ),

b) enables learners who prefer or are required to learn outside traditional classrooms to attend classes at their homes or offices, ( Bannan and Milheim, 1997 ), and

c) provides delivery medium, content provider, and subject matter in one package, unlike other mediums, such as computer based training that require a separate delivery mechanism ( McManus, 1996 ).

### 2.1.4 Overview of the Web-based learning

The primitive form of Web-based learning started in the last decade. As the information age evolves, massive changes that have impact on educational systems are observed in our society. Especially, advances in information technologies have played an

important role in creating needs for a paradigm shift in education. As Peters (1997) pointed out, new paradigm asked educators to think education anew and to organize teaching and learning in different ways. A new approach in redesigning teaching and learning in the digital environment has become necessary.

In the Web-based learning environment, the students are asked to develop skills for managing their learning and collaborating with others in a network-based knowledge constructing community. The idea of Web-based learning has been realized to bring wider opportunities to the students in the form of a flexible, open and distance learning system. The Web-based learning environment allows access to education by anyone, from anywhere, at any time and in any mode of their choices.

To create a Web-based learning environment and thus to provide flexible and open learning, well designed digital resources and the mechanism for networking people are required. Web-based learning is viewed as an innovative approach for adapting to a new educational paradigm, using the Web as the delivery medium.

In recent times, the Web has become a very powerful interactive tool for sharing information and ideas among people all over the world. The Web, which was released onto the Internet in 1991, can provide students with new learning experiences and opportunities to have equal access to learning resources through the Internet. Several characteristics of Web-based learning have been noted (Relan and Gillani, 1997; Crossman, 1997).

a ) Web-based learning can extend the boundaries of learning environment. That is, learning can occur in classrooms, at home, and in the workplace. Time constraint can be overcome. Teaching-learning activities can occur any time in virtual space.

b ) Web-based learning may promote experiential knowledge building activities through social interaction. Since the Web supports the use of cooperative learning strategy, the students have the potential to discuss various issues with peers and to query experts on a particular issue. Web-based learning can be designed for active collaboration and interaction in both synchronous and asynchronous form.

c ) Access to various type of information has become possible in Web-based learning. In Web-based learning environment, information in multimedia mode can be obtained and the presentation of content is in a hypermedia format that allows students to navigate the Internet database in a non-sequential way. The attributes of the Web in hypermedia format allow the students choices of content, resources and media for promoting their understanding and learning.

As implied above, the traditional approach to learning and Web-based approach to learning show differences in many aspects. The following table summarizes several important features between the two approaches of learning.

**Table 2.1 : Summary of Traditional Learning Approach versus Web-based Learning.**

| | Traditional learning | Web-based learning |
|---|---|---|
| **Main source of information** | Teacher and textbook | Various resources on internet |
| **Format of information** | Text | Multimedia |
| **Presentation format** | Linear | Hypermedia |
| **Interaction type** | Synchronous | Asynchronous / Synchronous |
| **Interaction space** | Time / Space bound Classroom | Time / Space free Networked world |
| **Instructional emphasis** | Acquiring knowledge | Building knowledge |
| **Objectives** | Specific, pre-defined | General, negotiable |

### 2.1.5 Advantages of online or computer-based learning

a) Class work can be scheduled around work and family

b) Reduces travel time and travel costs for off-campus students

c) Students may have the option to select learning materials that meets their level of knowledge and interest

d) Students can study anywhere they have access to a computer and Internet connection

e) Self-paced learning modules allow students to work at their own pace

f) Flexibility to join discussions in the bulletin board threaded discussion areas at any hour, or visit with classmates and instructors remotely in chat rooms

g) Instructors and students both report eLearning fosters more interaction among students and instructors than in large lecture courses

h) eLearning can accommodate different learning styles and facilitate learning through a variety of activities

i) Develops knowledge of the Internet and computers skills that will help learners throughout their lives and careers

j) Successfully completing online or computer-based courses builds self-knowledge and self-confidence and encourages students to take responsibility for their learning

k) Learners can test out of or skim over materials already mastered and concentrate efforts in mastering areas containing new information and/or skills

### 2.1.6 Disadvantages of online or computer-based learning

a) Learners with low motivation or bad study habits may fall behind

b) Without the routine structures of a traditional class, students may get lost or confused about course activities and deadlines

c) Students may feel isolated from the instructor and classmates

d) Instructor may not always be available when students are studying or need help

e) Slow Internet connections or older computers may make accessing course materials frustrating

f) Managing computer files and online learning software can sometimes seem complex for students with beginner-level computer skills

g) Hands-on or lab work is difficult to simulate in a virtual classroom

## 2.2 CD – ROM based Learning

### 2.2.1 What is CD – ROM based Learning

Unlike the completely web-based programs, these distance learning programs provide you with software which is CD-rom based, so that you can work even without web access. Many of the materials are on the computer rather than using books for everything.

### 2.2.2 Advantages of CD-ROM based Learning

When compared to instructor-led programs, the features and benefits of CD-ROM training include all those shared by other types of technology-based training:

a) self-paced

b) highly interactive

c) increased retention rates

d) reduced costs.

When compared to Web-based training, the benefits largely come from the fact that CD-ROMs usually provide a more engaging learning experience, with text, audio, video, and animations all used to convey information. Typically, a graphic will be displayed along with bulleted text as an audio narration provides the primary content. Video clips can be used to show human behaviors or complex operations. This use of multiple media means that learning is optimized for all three learning styles: auditory, kinesthetic, and visual.

Student engagement is also increased with the use of creative themes or metaphors. Whether the topic is sales training or understanding a new computer system, today's programs are often wrapped in a classic Hollywood genre: science fiction, mystery, adventure, or even television talk shows and game shows. Students can play the role of starship captain, a private eye, or swashbuckling archeologist as they explore their way through knowledge and conquer the learning objectives.

Finally, since people learn best from experience, the multimedia capability of CD-ROMs provides the power to create realistic job simulations. For example, a sales training program could put the student face-to-face with a tough prospect. ("Your prices are 10 percent higher than what I'm paying now!") Medical education programs put new doctors in front of simulated patients. ("Would you choose chemotherapy or surgery?") Soldiers choose tactics on a realistic battlefield. ("Enemy tank is flanking 500 yards to the right.") CEOs could hone their approach to crisis management. ("Ms. Jones, the 6 o'clock

news crew is in the lobby demanding a statement about our product recall. What should we do?")

In each case, a discovery-learning simulation can be developed using disk-based CBT, or delivered via the Web, but with bandwidth limitations the simulations would consist of only text and graphics. The learning is enhanced with multimedia CD-ROM because students are able to see the body language and hear the voices of on-screen video participants, and interact in real-time using a greater number of senses.

### 2.2.3 Disadvantages of CD – ROM based Learning

One of the disadvantages of CD-ROM based training, when compared to instructor-led delivery, is the lack of peer-to-peer learning opportunities. After all, good instructors are really supposed to be facilitators, who bring out experience-based lessons and realizations from the students themselves. Additionally, there are other benefits from the socialization that takes place in a physical classroom, including higher motivation, team building, and creation of relationships that can be supportive long after the training is over.

The biggest drawback of CD-ROM-based training when compared to Web-based training is the difficulty in updating or changing the content. Once a CD-ROM is created, the information on it can not be changed. If a widget manufacturer uses CD-ROMs to train its sales force and they create a better widget, a new training CD-ROM will have to be created, duplicated, and distributed to the sales force. Depending on the size of the

sales force, distributing new CD-ROMs could cost thousands of dollars. More important than the higher cost is the additional time required. Once the training program itself is updated, it typically takes three weeks for a duplication company to complete an order, which is likely followed by another week to package, address, and ship the CDs to the sales representatives.

Finally, CD-ROM programs present a challenge when it comes to student tracking. Because the CD is a distributed system without a direct link back to a training manager, other types of media must also be used for the reporting of student scores and completion certificates. Common methods include:

a) Printout of score report or certificate, which is then faxed or mailed to a manager or the corporate training department.

b) Final score is saved as a small data file onto a floppy diskette, which is then mailed back to the home office for processing.

c) If student has e-mail access, but no Intranet is available for automatic distribution, assessment score files can be attached to e-mail messages and sent to a training manager.

In summary, multimedia CD-ROMs -- and their future replacements, DVDs -- offer many advantages and limitations which must be compared to other delivery options on each training program.

## 2.3 What is Multimedia?

### 2.3.1 The Definition of Multimedia.

The term multimedia describes a number of diverse technologies that allow visual and audio media to be taken and combined in new ways for the purpose of communicating. Applications include entertainment, education and advertising. Multimedia often refers to computer technologies. Nearly every PC built today is capable of multimedia because they include a CD-ROM drive, and a good sound and video card. But the term multimedia also describes a number of dedicated media appliances, from digital VCRs and interactive television, to advanced wireless devices, to public television screens. The meaning of multimedia will continue to expand as technology evolves and new applications are invented.

Multimedia is more than one concurrent presentation medium (for example, on CD-ROM or a Web site). Although still images are a different medium than text, multimedia is typically used to mean the combination of text, sound, and/or motion video. Some people might say that the addition of animated images (for example, animated GIF on the Web) produces multimedia, but it has typically meant one of the following:

a) Text and sound

b) Text, sound, and still or animated graphic images

c) Text, sound, and video images

d) Video and sound

e) Multiple display areas, images, or presentations presented concurrently

f) In live situations, the use of a speaker or actors and "props" together with sound, images, and motion video

Multimedia can arguably be distinguished from traditional motion pictures or movies both by the scale of the production (multimedia is usually smaller and less expensive) and by the possibility of audience interactivity or involvement (in which case, it is usually called *interactive multimedia*). Interactive elements can include: voice command, mouse manipulation, text entry, touch screen, video capture of the user, or live participation (in live presentations).

Multimedia tends to imply sophistication (and relatively more expense) in both production and presentation than simple text-and-images. Multimedia presentations are possible in many contexts, including the Web, CD-ROMs, and live theater. A rule-of-thumb for the minimum development cost of a packaged multimedia production with video for commercial presentation (as at trade shows) is: $1,000 a minute of presentation time. Since any Web site can be viewed as a multimedia presentation, however, any tool that helps develop a site in multimedia form can be classed as multimedia software and the cost can be less than for standard video productions.

For multimedia Web sites, popular multimedia (sound or sound and motion video or animation) players include:MPEG, Quicktime, and Shockwave.

### 2.3.2 What is Multimedia Used For?

Multimedia today is primarily used for education and corporate training. "Distance Learning" enables information and instructional materials to be accessed exactly as needed, at a time and place convenient for the learner, more cost-effectively than in a traditional classroom, and in a structure best suited to individual educational needs.

As available bandwidth increases, computing costs continue to fall, and efficiencies of scale proliferate, a wider range of applications is expected to develop.

### 2.3.3 The Future of Multimedia

From the development of the first graphical user interfaces (GUIs) multimedia has always made computing easier, more transparent, and more accessible. That process will accelerate as multimedia goes beyond computers and spreads to small, cheap everyday devices in our homes, cars and offices. Physical device interaction creates the potential for hundreds of new applications, from multimedia medical diagnostic tools to multimedia- enabled workstations on assembly lines. Our organization is in the forefront of these developments. We have written Java programs that communicate with lights, small DC motors, steppers, etc., and have begun development of new gaming devices and toys that interact with the television characters on whom they're based. We believe that multimedia is only beginning to reach its full potential. Projections Company and its people have been in the vanguard of multimedia developments for two decades -- and we intend to continue demonstrating leadership in bringing the benefits of multimedia to an

ever-expanding number of businesses, educational institutions, and individuals around the globe.

## 2.4 Approaches Used in Gathering Information

The approaches used in gathering information for the development of this system is through the use of electronic media, printed media, survey and questionnaires and also guidance from the lecturer.

The electronic media used is the Internet which provided a lot of information on the most suitable requirements software and hardware, development tools, and methodologies for the system development. Besides that, other web based learning sites were reviewed for information and knowledge. All these information were mainly gained by using search engines such as Google, Lycos, Yahoo, MSN search, and Catcha seach.

As for the printed media, books were used to get more details on the programming languages, development tools, and authoring tools. Articles from newspapers and also magazines were also used to gain further details on the latest development on the list mentioned above.

A survey was also carried out to gather information from the students, teachers and also parents. The result of the survey will be analyzed and taken into consideration during the system development phase.

Besides that, lots of information were gained through the guidance of my lecturer Pn. Sri Devi Ravana and also through my moderator Pn. Fariza Hanum.

## 2.5 Findings

### 2.5.1 Printed Media

a) Software Engineering and Theory Practice

( Author : Shari Lawrence Pfleeger, Publisher : Prentice Hall )

This book was used to gain information on the various types of development models. Each models were explained in details and this helped me in choosing the right development model for this system.

b) System Analysis and Design Methods ( 5th edition )

( Author : Jeffrey L. Whitten, Lonnie D. Bentley, Kevin C. Dittman )

This book was used to gain more information on the Systems Development Life Cycle ( SDLC ).

### 2.5.2 Survey and Questionnaire

A survey was carried out on the existing systems of interactive mathematics

learning systems in the market. There are two categories of available systems which are CD rom based and also web based.

For the CD ROM based learning, two existing systems in the market was analyzed :

a) The Virtual School Mathematics

b) Gnarly Math

For the web based learning systems, two existing systems from these web sites were also analyzed :

a) http://www.c3.lanl.gov/mega-math/

b) http://www.easymaths.org/

To gather information from students, teachers and parents, questionnaires were distributed to two primary schools. The objective of the survey was to find out the popularity of web based learning and CD ROM learning among primary school students. It is also to find out the topics that should be included in this interactive mathematics learning system.

### 2.5.3 Electronic media ( Internet Search )

#### 2.5.3.1 Sites on web based learning and interactive multimedia

http://www.stemnet.nf.ca/~elmurphy/emurphy/ile.html

#### 2.5.3.2 Sites on web designing

http://www.widearea.co.uk/design.html

#### 2.5.3.3 Sites on development process

a) http://www.students.cs.uu.nl/~ahurk/scriptie/waterfall.html

b) http://searchvb.techtarget.com/sDefinition/0,,sid8_gci519580,00.html

### 2.5.4 Guidance from the lecturer

Discussion with the lecturer was conducted during the process of preparing this proposal to ensure that the content of this proposal is accurate and relevant to the system. Tips and information was given and it was very helpful. The lecturer also gave advice and also opinions regarding the design of this interactive mathematics learning system.

## 2.6 Relational Development Models

### 2.6.1 Waterfall Model

The waterfall model was derived from engineering models to put some order in the development of large software products. It consists of different stages which are processed in a linear fashion. Compared to other software development models it is more rigid and better mangable. The waterfall model is an important model which is the basis of many other models, however for many modern projects it has become a little outdated. It is still wildly used.

The waterfall model, as stated in the introduction, is an engineering model designed to be applied to the development of software. The idea is the following: there are different stages to the development and the outputs of the first stage "flow" into the second stage and these outputs "flow" into the third stage and so on.

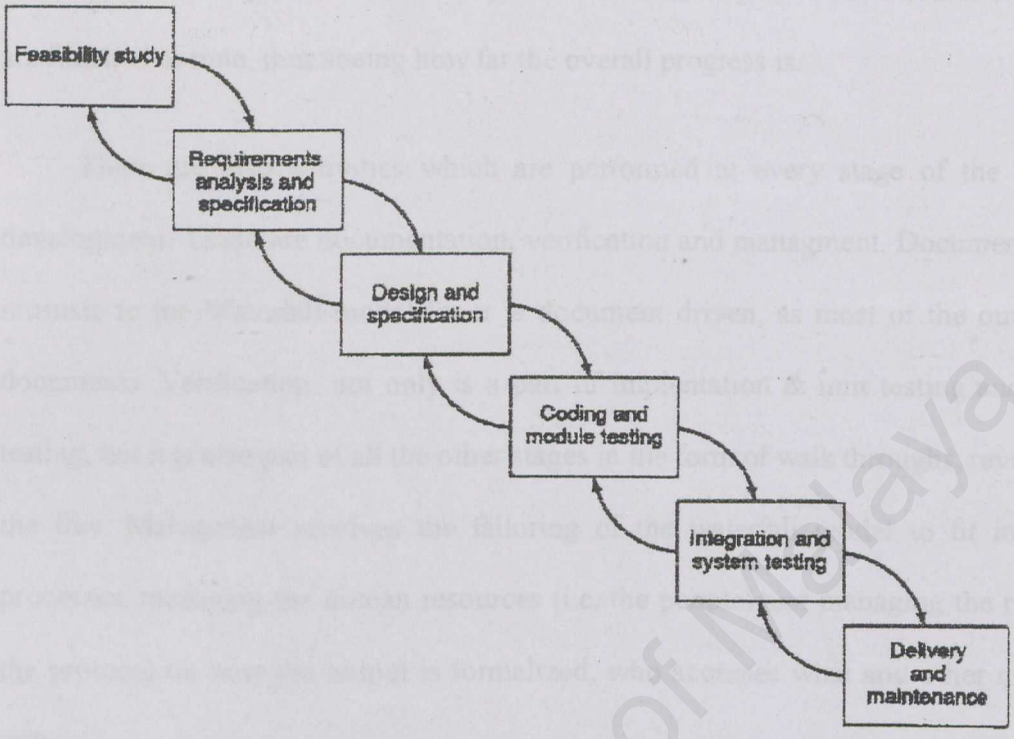
There are usually five stages in this model of software development:

1. Requirements analysis and definition. In this stage the requirements of the "to be developed software" are established. These are usually the services it will provide, its constraints and the goals of the software. Once these are established they have to be defined in such a way that they are usable in the next stage. This stage is often preluded by a feasibility study or a feasiblity study is included in this stage. The feasibility study includes questions like: should we develop the software, what are the alternatives? It could be called the conception of a

software product and might be seen as the very beginning of the life cycle.

2. System and software design. In this stage the established requirements, flowing from the first stage, are identified as software or hardware requirements. The software requirements are then translated in such a way that they can be readily transformed into computer programs.
3. Implementation and unit testing. This is the stage where the computer programs are created. Each program is called a unit, and unit testing is the verification that every unit meets its specification.
4. System testing. All the units are combined and now the whole is tested. When the combined programs are successfully tested the software product is finished.
5. Operation and maintenance. Most software products include this stage of the development. It involves correcting errors that have gone undetected before, improvement and other forms of support. This stage is part of the life cycle of a software product, and not of the strict development, although improvements and fixes can still be considered as "development"

**Figure 2.1 : The Waterfall Model**




These steps are the main stages. There are also sub-stages, within each stage, but they differ from project to project. For example for management purposes the requirements stage is divided in a feasibility study, an outline requirements definition, a design study and a requirements specification stage.

It is also possible that certain software projects require the adding of an extra stage all together, or the splitting of one in two stages. However all the different waterfall models have the same underlying idea; the idea that one stage provides outputs which can be used as the input for the next stage. There thus is a linear flow amongst the stages.

The progress of the software development, using the waterfall model, is thus easy to find out. A common way to look at the outputs of a certain stage and see whether or not they are finished in time, thus seeing how far the overall progress is.

There are also activities which are performed at every stage of the software development. These are documentation, verification and managment. Documentation is intrinsic to the Waterfall model for it is document driven, as most of the outputs are documents. Verification, not only is a part of implentation & unit testing and system testing, but it is also part of all the other stages in the form of walk throughs, reviews and the like. Managment involves the tailoring of the waterfall model to fit individual processes, managing the human resources (i.e. the people) and managing the rules and the protocol on how the output is formalized, who accesses what and other managing tasks.

Finaly it has to be noted that the software development process is not as linear as it seems. When errors in later stages are found, they are often fed back to a previous stage and the development is set back to that stage again. Since this is a managing nightmare, it often occurs that problems are ignored, left for later or programmed around. This feed back makes for a waterfall with information flowing both ways: down through the stages when something is made, and up through the stages when something goes wrong, or feedback is given. Also many processes are frozen when it is not yet the time to deal with them. This has led to the development of other, more flexible models.

The advantage of waterfall development is that it allows for departmentalization

and managerial control. A schedule can be set with deadlines for each stage of development and a product can proceed through the development process like a car in a carwash, and theoretically, be delivered on time. Development moves from concept, through design, implementation, testing, installation, troubleshooting, and ends up at operation and maintenance. Each phase of development proceeds in strict order, without any overlapping or **iterative** steps.

The disadvantage of waterfall development is that it does not allow for much reflection or revision. Once an application is in the testing stage, it is very difficult to go back and change something that was not well-thought out in the concept stage.

## 2.7 Relational Authoring Tools and Programming Languages

### 2.7.1 Macromedia Dreamweaver

Macromedia Dreamweaver is a powerful WYSIWYG site building tool, one just as respected for what it does do as what it doesn't. What it does offer is an intuitive environment for building cross-platform sites. What it doesn't do is alter existing HTML by inserting esoteric tags that add nothing but weight.

Dreamweaver is a favorite of multimedia designers, since it easily integrates with other Macromedia applications, like Flash and Shockwave. It's probably a less popular choice for small staffs or corporate sites, since it doesn't come with a library of Web-

ready graphics, like FrontPage and NetObjects does.

### 2.7.2 Macromedia Flash – Animation

Macromedia Flash allows you to create a Web experience that is more attractive, more compelling, and compatible with more browsers than with any other Web solution. Dynamic HTML (DHTML), Java, and other advanced Web design formats are not reliable alternatives, since they're either not compatible or inconsistent with different browsers. With Macromedia Flash Player's pervasive penetration, wide availability, scalable vectors, animation, sound, and more, Macromedia Flash sites provide the high production quality that attracts visitors and brings them back to your site. Since Macromedia Flash is free of the limiting design capabilities of more traditional Web display options, it lets you clearly and exactly express your brand and company identity.

Macromedia's Flash product promises to make the Web more interactive and more exciting. In fact, the product description on Macromedia's site says:

> Macromedia Flash is the key to designing and delivering low-bandwidth animations, presentations, and Web sites. It offers scripting capabilities and server-side connectivity for creating engaging applications, Web interfaces, and training courses. Once you've created your content, 96% of the online audience will be able to view it with the Macromedia Flash Player.

Macromedia describes its Flash product as a tool that can help with creating "engaging applications" and "low-bandwidth" animations, which you can use to "create the ultimate user experience". As with any tool, there are advantages and disadvantages:

It's important to design your Web site with your user's needs in mind because no matter how your site tries to create revenue -- whether through online sales or advertising -- it can't succeed without users. And since there are millions of Web sites out there, users won't come back to ones that they find hard to use.

So let's define usability. I like the definition that StudioWorks has in their Usability vs. Interactivity article:

> The ease at which a user can locate the relevant information for which they are searching.

That's important, because numerous studies have shown that people on the Web use it to seek information and rate ease of use more important than nearly any other factor.



### 2.7.3 Microsoft Agent Scripting Helper

Microsoft® Agent is a set of programmable software services that supports the presentation of interactive animated characters within the Microsoft Windows® interface. Developers can use characters as interactive assistants to introduce, guide,

entertain, or otherwise enhance their Web pages or applications in addition to the conventional use of windows, menus, and controls. Microsoft Agent enables software developers and Web authors to incorporate a new form of user interaction, known as conversational interfaces, that leverages natural aspects of human social communication. In addition to mouse and keyboard input, Microsoft Agent includes optional support for speech recognition so applications can respond to voice commands. Characters can respond using synthesized speech, recorded audio, or text in a cartoon word balloon.

MASH is an easy-to-use program that lets you to compose and playback entertaining Microsoft Agent presentations by simply dragging characters around the screen and specifying what you want them to say and do. Behind the scenes, MASH does all the hard work for you and can automatically generate your presentations into several supported scripting/programming languages.

Some uses for these inspiring technologies include talking websites, interactive presentations, self-running kiosks/demos, tutorials, tour guides, clipboard and text file readers, and just plain fun.



#### 2.7.3.1 The Features of MASH

a) Easily experiment with Character Animations, Text-to-Speech, Language, Voice, Cartoon Balloons, and Move actions

b) Save your presentations in MASH Script (.MSH) text files or MASH Executable (.EXE) files for later editing

c) Generate your presentations to many supported file formats including, VBScript for HTML, JavaScript for HTML, Email Stationery, Visual Basic, VBA for Office documents, and Windows Scripting Host.

d) With the Microsoft Speech Recognition Engine, you can use Voice Activated Menu Commands to launch Programs, Documents, Web Sites, and more...

e) For power users, the generated scripts are based on templates that can be edited and adjusted to suit your needs.

### 2.7.4 HTML

HTML (Hypertext Markup Language) is the set of **markup** symbols or codes inserted in a file intended for display on a World Wide Web **browser** page. The markup tells the Web browser how to display a Web page's words and images for the user. Each individual markup code is referred to as an element (but many people also refer to it as a tag). Some elements come in pairs that indicate when some display effect is to begin and when it is to end.

HTML is a formal Recommendation by the World Wide Web Consortium (**W3C**) and is generally adhered to by the major browsers, Microsoft's Internet Explorer and Netscape's Navigator, which also provide some additional non-standard codes. The current version of HTML is **HTML 4.0**. However, both Internet Explorer and Netscape implement some features differently and provide non-standard extensions. Web developers using the more advanced features of HTML 4 may have to design pages for

both browsers and send out the appropriate version to a user. Significant features in HTML 4 are sometimes described in general as **dynamic HTML**. What is sometimes referred to as HTML 5 is an extensible form of HTML called Extensible Hypertext Markup Language (**XHTML**).

### 2.7.5 Javascript

JavaScript is a compact, object-based scripting language for developing client and server Internet applications. JavaScript statements can be embedded directly in an HTML page. These statements can recognize and respond to user events such as mouse clicks, form input, and page navigation.

For example, you can write a JavaScript function to verify that users enter valid information into a form. Without any network transmission, an HTML page with embedded JavaScript can interpret the entered text and alert the user with a message dialog if the input is invalid. Or you can use JavaScript to perform an action (such as play an audio file, execute an applet, or communicate with a plug-in) in response to the user opening or exiting a page.

### 2.7.6 Action Server Page ( ASP )

#### 2.7.6.1 What Is ASP?

Active Server Page; a web server technology from Microsoft that allows for the creation of dynamic, interactive sessions with the user. An ASP is a web page that contains HTML and embedded programming code written in VBScript or Jscript. ASPs are Microsoft's alternative to CGI scripts and JavaServer Pages (JSPs), which allow web pages to interact with databases and other programs. ASP documents are named with the extension .asp or .ASP.

#### 2.7.6.2 Introduction to ASP

a) An Active Server Page (ASP) is a Web page that consists of HTML code, Server-side script, Client-side script.

b) Client side script can be executed by web browsers. Can be VBScript, JavaScript, etc

c) Server side script executed by web servers. It may be VBScript or COM objects

d) Must contain an ". asp" extension.

e) Microsoft solution for developing dynamic web pages

f) Uses VBScript, a variant of Visual Basic

   a. A subset of VB

   b. Internet-enabled

g) Object-oriented architecture

   a. Provides objects for various functions such as database access, file access,

etc.

h) Supported by Microsoft's IIS and Personal Web Server

### 2.7.6.5 Tools for Developing ASP Application

a) ASP applications are exclusively executed on the server side. Because ASP supports VBScript, Jscript, Perl and other scripting languages, Web developers do not need to learn an entirely new language.

b) By default ASP only supports only VBScript and JScript/JavaScript.

c) There are a variety of Web development programs that support client and server-side script.

d) User just needs a Notepad or any text editor to code the scripting language.

e) Some of the web page editors that currently support Active Server Pages include FrontPage 2000, Macromedia Dreamweaver 3.0, Drumbeat 200, Microsoft Script Editor, Microsoft InterDev and Macromedia UltraDev can also use for editing the scripting language.

## 2.7 Evaluation of Existing Systems

### 2.8.1 Web based Learning

1. http://www.c3.lanl.gov/mega-math/

The MegaMath project is intended to bring unusual and important mathematical ideas to elementary school classrooms so that young people and their teachers can think about them together. The best way for you to browse MegaMath may depend on whether you are a teacher, a student, or a mathematician.

It's easy to use this system. There is an easy to understand step by step guide to use the system. Children can use it without any problems. Besides that it is a very attractive site that will not bore the children. In fact the children would be interested to revisit the page again because of the colourful graphics and interesting features offered by this site. Teachers and parents can use this site with a guideline provided on how to conduct lessons.

The main parts of MegaMath are as follows :

a) Topics can be picked by clicking on pictures or the description. Students can pick topics according to the pictures that they like. The advantage of this is that students would be more interested to find out what their favourite picture is all about and learn more about it. The disadvantage is that maybe the students would not browse on the pictures that they do not like or do not find attractive.

b) There are interesting stories to read which are related to mathematics. This is a different approach to learn mathematics and is effective teaching and learning method because it's interesting and students can improve their reading skills at the same time.

c) Games to be played on the PC and also on the playground are offered on this site. This is a very good idea because the students can try out the mathematics related games when they are not using the system.

d) There are also a glossary of definition of mathematics terms that is described in an easy to understand way.

e) Students and teachers can e mail and also read mails from other students and teachers for feedbacks.

f) Students and teachers can send in questions and receive a feedback from the authors.

2. **http://www.easymaths.org/**

The Mathematics Web Association (Easymaths) is an emerging NPO (Non Profit Organisation) that strives to make Mathematics resources available to all, free and "easy" and fun, via the medium of the Internet. It actively encourages the involvement of parents, teachers, students and all other interested parties in the enhancement of Mathematics learning and understanding. It provides a forum for teachers to interact with one another, students to interact with teachers and an opportunity for the community as a whole, government and the private sector, to take ownership of Mathematics skills development in South Africa.

The main parts of this system include :

a) topic revisions

b) diagnostic tests

c) worksheets

d) study timetable and support materials

e) summary sheets

f) old exams and tests

g) extension material

h) links to relevant maths material

The features of this site are as fllows :

a) It is a very interesting site with full of activities. Correction of mistakes and contributions are most welcome as the site is planned to be expanded as much as possible with help from anyone who's qualified.

b) On the website students have access to Mathematics worksheets, lessons, examinations, study skills support, fun articles and activities, counselling services and a notice board and monitored forum.

c) Teachers are able to access worksheets, a database of topic related questions, lesson material and examinations. A counselling service provides assistance and support for teachers finding themselves in stressful circumstances. It provides a forum for teachers to network with other teachers / tutors in an informal way. Teachers receives recognition for their contributions to the website through incentives.

d) Parents get support and information on all mathematical issues that help them to give their children the necessary support.

e) It is an open web accessible to every member of the community to take ownership of.

f) The private sector has the opportunity to become involved in Mathematical skills

development by contributing towards the maintenance and development of this website. Government Departments can use the website as a means of communication with the community and parents

### 2.8.2 CD ROM based Learning

**1. The Virtual School Mathematics**

The Virtual School – Mathematics is an exceptional interactive program designed for children from 6 to 10 years old. It covers the full range of material taught in the first classes of primary school. The application contains almost 200 types of exercises divided into the following thematic groups:

a) introductory classification exercises and the notion of sets
b) sets and subsets
c) comparing sets
d) the notion of numbers
e) numbers in the decimal system
f) comparison of numbers with the use of signs
g) addition
h) subtraction
i) multiplication
j) division

The idea of the program is to teach children the bases of mathematics through interesting games and animated stories. Young users of the application go on a space voyage to the planet of the Counters, space creatures who wish to learn mathematics. While wandering around the planet and solving the exercises, children find various items and pieces of equipment from a space laboratory. Each of them is a pretext for introducing and explaining concepts from physics, technology and natural phenomena. All those items, gathered together, create a multimedia encyclopaedia of science and technology, including entries like: *sundial, hourglass, compass, computer, camera, camcorder*, and many others

Children are accompanied by a virtual friend, Robo, who helps them in case of any trouble. They can find a detailed description of all tasks waiting for them in each Counters' city and thanks to the score table they are able to see all their results. Having solved all the exercises included in the program, young users get a diploma of the space explorer.



**2. Gnarly Math**

This system will be enjoyed by children, teachers and also parents.

For children, working alone or with a parent, can explore the main branches of Mathematics: Numbers, Algebra, Topology, Geometry, Chance, and Trigonometry. *Gnarly Math* was born in school classrooms, where one of the authors spent ten years

getting children interested in the above subjects. For home schoolers, it can be a fascinating supplement to a math textbook. And *Gnarly Math* contains much more than Math! It's stuffed with quotes from Shakespeare, pieces of history, paintings by Rembrandt and others, and similar tidbits aimed at diverting and stimulating the mind.

For teachers, teachers can use *Gnarly Math* in the classroom, but they can also employ it simply to look for new ideas which will help children enjoy and be curious about Math. The ideas include puzzles, games, and experiments, all chosen so as to beguile the young. There are two pages for teachers which make specific suggestions designed to reverse kids' ideas about math, and show them that it is fun, exciting, interesting, easy, and useful.

For parents, there are two pages devoted specifically to parents, making many suggestions on how to use the CD to make your kids math-lovers.

For adults, who hated the subject in school, you can brush up on your math on your own, in your own time, as quickly or as slowly as you like. Adults who enjoy math can refresh their memories, and perhaps learn something new as well.

# CHAPTER 3 : METHODOLOGY

## 3.1 Modelling the Process and Life Cycle

### 3.1.1 What is a process?

A process is a series of value-added tasks that are linked together to turn inputs into a product or service output. It must have two or more activities that serves a purpose for an organization. Processes can be defined at many different levels and with various boundaries.

a) Processes must have a beginning and an end.

b) Processes are co-ordinated activities that involve people, procedures and technology.

c) Processes constitute a significant portion of organizational costs.

d) An organization is only as effective as its processes.

e) All work is part of a process that starts and ends with a customer.

A process is any work that meets these 4 criteria:

a) It is recurrent.

b) It effects some aspect of organizational capabilities.

c) It can be accomplished in different ways that make a difference to the contribution it generates in terms of cost, value, service or quality.

d) It involves co-ordination.

Processes comprise three main attributes:

a) Making processes efficient means minimizing the resources used.

b) Making processes effective means producing the desired results.

c) Making processes adaptable means being able to adapt to changing customer and business needs.

When the process involves the building of some product, it is referred as a life cycle which involves the following stages :

a) requirement analysis and definition

b) system design

c) program design

d) program implementation

e) unit testing

f) integration testing

g) system testing

h) system delivery

i) maintenance

The reasons of modeling a process are as follows :

a) it forms a common understanding of the activities, resources, and constraints involved in a system development

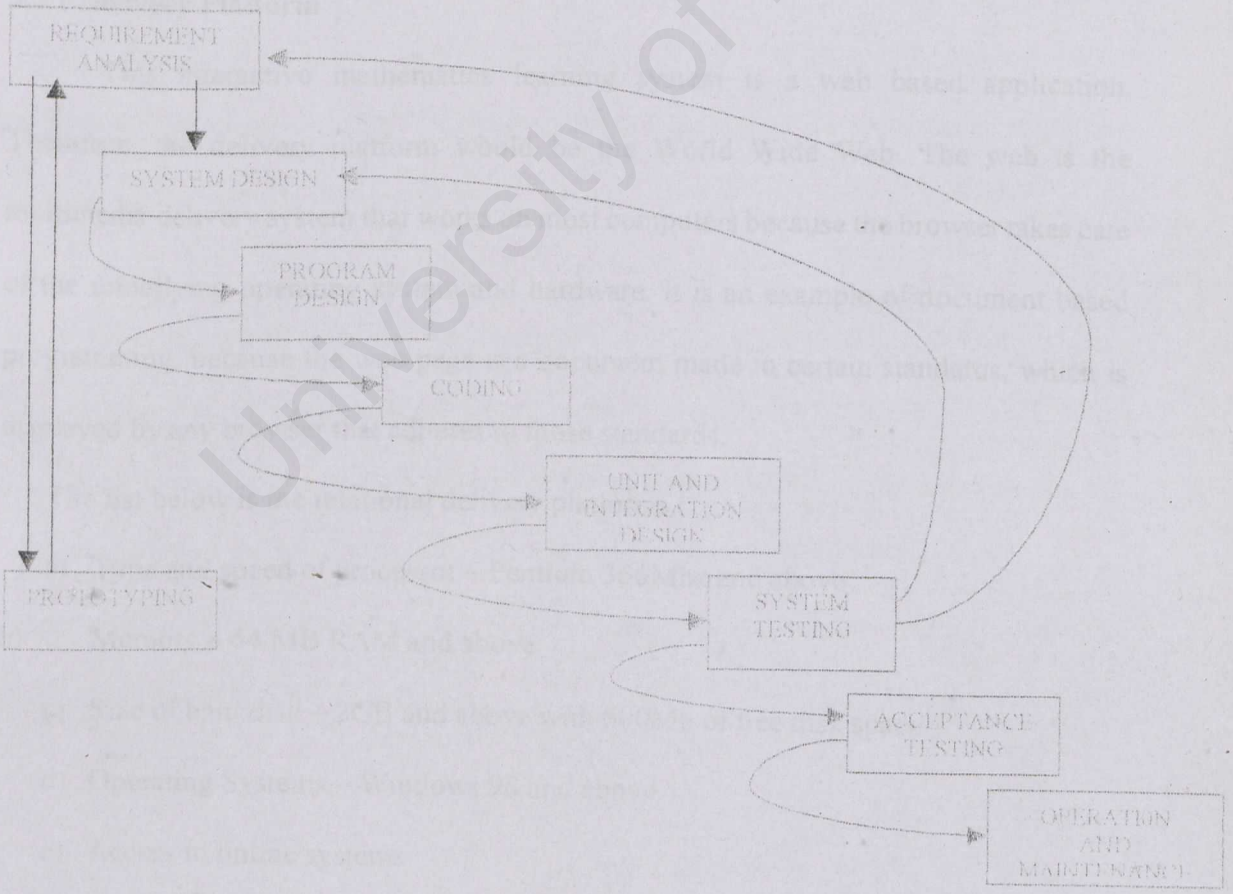
b) helps to find inconsistencies, redundancies and ommisions in he process and in its constituent parts. As these problems are noted and corrected, the process becomes more effective and focused on building the final product.

c) The model should reflect the goals of development, such as building high quality system, finding faults early in development, and meeting required budget and schedule constraints.

Early development model includes system requirements as input and a delivered product as output.

### 3.1.2 Proposed Development Model for This System

**Figure 3.1 : Waterfall Model With Prototyping**



The model chosen to develop this system is the combination of two models which is the waterfall model and the prototype model. In a waterfall model each stage should be fully completed before proceeding to the next. This model documents the process well. With the addition of the prototype model as the sub process, certain aspects of the system can be reviewed and tested to check its functionality and whether it meets the specific requirements. The means that process can be tailored to meet the specific requirement yet possibly changing needs of any application. This way, major problems can be avoided as errors can be detected at an early stage.

### 3.2 Delivery Platform and Medium

#### 3.2.1 Delivery Platform

This interactive mathematics learning system is a web based application. Therefore, the delivery platform would be the World Wide Web. The web is the multimedia delivery system that works on most computers because the browser takes care of the underlying operating system and hardware. It is an example of document based programming, because the web page is a document made to certain standards, which is displayed by any browser that adheres to those standards.

The list below is the relational delivery platforms :

a) Type and speed of processor – Pentium 366Mhz and above

b) Memory – 64 MB RAM and above

c) Size of hard disk – 2GB and above with 500Mb of free disk space

d) Operating Systems – Windows 98 and above

e) Access to online systems

f) Speed of network connection – 56K and above

g) Resolution of the screen – 800 x 600 pixels

h) Number of colours on the screeen – 256 and above

i) Sound handling – 8 bit and above

### 3.2.2 Delivery Medium

The delivery medium for this system will be online delivery. The four main issues are speed of access, distance, updating, 'unlimited' size of the data space that can be provided online.

The speed of the access of users depends on the access speed of the Internet at the moment.

This delivery medium, allows people from all over the world to access the system anywhere at anytime. All that's needed is the connection to the Internet. This method overcomes the barrier of time and space.

### 3.2.3 Why Chose a Web based Application and Not a CD ROM based Application

The reasons why this system is going to be a web based application and not a CD ROM based application are as follows. Firstly, for a learning and teaching application like this system the need of the system to be updated is important. Updates on web pages are easier to be performed compared to CD ROM where information on it remains static and cannot be changed.

Secondly, a web based application is stored on a server and can be accessed by anyone from anywhere at anytime. CD ROM applications can only be used depending on the distribution of the CD. It only can be used by the user that has gotten hold of the CD.

Lastly, with a web based learning application, it can be accessed by multiple users simultaneously. Teachers and students can experience the interactive learning and teaching environment. One CD can only be used by one user at a time.

### 3.3 Proposed Development Tools

#### 3.3.1 Authoring Tools

##### 3.3.1.1 Macromedia Dreamweaver

Macromedia Dreamweaver was chosen to develop the web pages of the system.

###### 3.3.1.1.a The Advantages of Macromedia Dreamweaver

The advantages of Dreamweaver and also the reasons of it being chosen are as follows :

a) All-around cozy user interface is the best in the field.

b) Page layouts, especially tables, are easy to manipulate and use.

c) The searchable O'Reilly code reference library is extensive and convenient.

d) The new Code View window features are numerous and useful.

e) JavaScript debugger eliminates the need for a third-party debugging app.

f) New Asset panel gathers all site media in a single library.

g) Flash buttons and text features make adding multimedia to your site totally painless.

h) Round-trip graphics editing simplifies the process of making changes after graphics are placed on the page.

i) New site management tools encourage seamless communication with development team members.

j)

### 3.3.1.1.b The Disadvantages of Macromedia Dreamweaver

Besides the advantages, there are also a few disadvantages that I believe the solutions to it will be found during the development of the system. The disadvantages are as follows :

a) New graphics features encourage a proprietary environment with limited alternatives.

b) HTML editing greatly improved, but still not robust enough to replace more feature-rich text editors.

c) Flash elements bloat file size and page-load time.

### 3.3.1.1.c. Why Chose Macromedia Dreamweaver and Not Microsoft Front Page ?

a) FrontPage has a tendency to overwrite your code with proprietary code, including some that is very Internet Explorer-specific. That never happens in Dreamweaver. It produces clean code, and it can always be edited the way a user wants to.

b) In addition, while FrontPage includes extensions that lets a user add functionality to their website, it must be installed on your web server, which, creates a security issue.Doing this creates a 'hole' through which the FrontPage extensions on the developer's computer communicate. Unfortunately, that hole is often exploited by hackers. Dreamweaver also lets users to add features to their Web site, but none of them rely on a server to work.

c) The Dreamweaver Code Reference Panel helpful for quickly looking up code examples. The panel's content is based on the Definitive DHTML Reference book published by industry leader O'Reilly Publications.

d) The Dreamweaver interface also makes designing sites easy. There's a Split Screen View, which lets users see their design and code at the same time, and the program's flexible, customizable templates. When a user edits a Dreamweaver template, it updates every site page that uses it. FrontPage doesn't have that same functionality.

e) Rollovers are much easier to create in Dreamweaver. Creating rollovers in FrontPage is not a straightforward process. Plus, they all had a similar appearance, and customizing them is difficult.



### 3.3.1.2 Macromedia Flash

Macromedia Flash was chosen to develop the animation and also graphics of the web pages. Below are the advantages and the disadvantages of Flash together with the solutions to the usability problems.

### 3.3.1.2.a The Advantages of Macromedia Flash

**a) Vector graphics are flexible**

Flash prodcues vector graphics that, unlike raster graphics formats such as GIF, JPEG or PNG, can be resized without adversely affecting picture quality.

Vector graphics are also very small in file size and are therefore quick to download.

**b) Little or no programming knowledge is necessary to use Flash**

Compared to Java Applets, it's easy for non-technical users to create Flash movies.

**c) Flash's SWF file format is fairly open standard**

It's possible to create Flash movies without even using Flash. You can use products such as Adobe's LiveMotion and even some Web-based tools to create Flash movies.

**d) Widespread acceptance and adoption of Flash Player**

Macromedia's site boasts that 96% of Web users can view Flash movies without having to download a plugin. Flash movies can be viewed in both Netscape Navigator and Internet Explorer. In addition to being somewhat browser-independent, it attempts to be platform- independent. Macromedia also produces Flash players for Windows, Mac, Linux and Sun's Solaris version of UNIX.

**e) Cross-platform development environment**

Macromedia Flash (which you need to create movies) is available for Macintosh and 32-bit Windows PCs.

**f) Allows for user interactivity**

A user can interact with a Flash movie, for example, to play games. This kind of interactivity is not possible with animated GIF or PNG images.

**g) Reusable Objects**

The Flash development environment promotes designing movies as a collection of reusable "objects." This results in smaller download sizes and reduced development times.

**3.3.1.2b The Disadvantages of Macromedia Flash**

Flash suffers from some usability problems. The usability problems are as follows :

**a) Long download times**

Despite lightweight vector animations, Flash movies can take longer to download than most users want to wait. When you begin to add the really flashy elements to your movie -- things like video and sound -- you can easily bog things down. Though broadband

Internet access has become more prevalant in the past two years, most home users (and many small business users) still access the Web over a modem.

**b) Flash can destroy normal user navigation**

Sites which are done entirely in Flash are a usability nightmare. Web users are accustomed to certain navigation controls such as the back and forward buttons. Unfortunately, in multi-page Flash sites, the back button doesn't take you to the previous page -- it takes you to the previous site.

Since Flash sites are often used as "brochureware" to present product information, this can be really annoying, since you cannot easily use back and forward to compare two similar products on the same site.

Developers will often try to overcome this problem by designing some navigation features into the Flash movie, but this often exarcebates the problem since the user is forced to learn some new, nonstandard navigation scheme.

Finally, many Flash sites "pop up" in a new window. For some reason, developers often feel compelled to remove the address bar, navigation bar and status bars of these new windows, which make it difficult for a user to know what's happening.

**c) Flash lends itself to self-serving sites and design excess**

As I stated before, Web users tend to seek specific information. They also tend to disfavorably view most things which get in the way of seeking that information. Many sites have often long and useless "Intro" sites which don't serve any need of the user.

**d) It's hard to print text rendered in Flash**

Since Web pages can change dynamically, it's often necessary to print them out and capture a "snapshot" in time.

This is particularly important in Flash sites that present product information, since the user may need to print hard copies of features and present them to someone else for approval.

When a user uses the browser's print button to print the text rendered in a Flash movie, the text will usually come out very faint, dithered or blurry.

**e) Stale Content**

While Macromedia says that one of Flash's goals is to retain visitors, countless studies have show that users use the Web to seek information and prefer sites that are updated frequently.

Since creating content with Flash is typically more abor-intensive than creating similar content with HTML, Flash content tends to be changed less frequently.

**f) It's not always possible to select, copy and paste text rendered in Flash**

To add insult to injury, you can't select and copy text from a Flash movie and paste it into a word processor to prepare a report.

**Update:** With Flash 5 you can now select a text box, then check the "selectable" checkbox in the text options panel. Users should then be able to select that text. Thanks to Olivia Kobelt, Web designer/developer at The Principia for pointing this out.

**g) Lack of User Control**

I'm probably in the minority, but before I click links on a site, I point to them with my mouse and look in the status bar to see where the link will take me.

You also cannot use the browser's "Find" feature to find specific text on a page.

**h) Lack of search engine support**

Most search engines cannot index Flash content, and users will be less likely to find a Flash-heavy Web site through a search engine.

**i) Accessibility Problems**

Flash doesn't allow (AFAIK) the user to resize fonts in order to make them larger or smaller (as one might do with the font button or preferences in IE or Netscape). Designers often make fonts too small to be read by people with smaller monitors, lower resolution or poorer eyesight.

It also appears that Flash content cannot be accessed by screen readers and therefore is unavailable to user's with poor or no eyesight.

Though Flash player software is free, you can't assume that users have it or want to install it. They might also not have the correct version. Like many software applications, content

created in a new version of Flash might not be viewable with older versions of the Flash player. Even though the Flash player is free, some users don't have the technical ability to install plugins (think about your mother or grandmother). Other users (such as corporate users) may have the know-how but lack the permission to do so. As with HTML, it's a good approach to write to the lowest common denominator unless you have a good reason not to do so.

### 3.3.1.3 Microsoft Agent Scripting Helper ( MASH )

MASH was chosen to generate the talking wizard which acts as the tutor and guide of this system. Below are the features of MASH which is the reason why it was chosen.

a) Easily experiment with Character Animations, Text-to-Speech, Language, Voice, Cartoon Balloons, and Move actions

b) Presentations in MASH Script (.MSH) text files or MASH Executable (.EXE) files for later editing can be saved.

c) Presentations can be generaed to many supported file formats including, VBScript for HTML, JavaScript for HTML, Email Stationery, Visual Basic, VBA for Office documents, and Windows Scripting Host.

d) With the Microsoft Speech Recognition Engine, Voice Activated Menu Commands to launch Programs, Documents, Web Sites, and more...

e) For power users, the generated scripts are based on templates that can be edited and adjusted to suit one's needs.

### 3.3.2 Programming Languages

#### 3.3.2.1 HTML

HTML is used as it is the programming language that is used for construction of the web pages.

#### 3.3.2.2 Javascript

**JavaScript** is a programmable API that allows cross-platform scripting of events, objects, and actions. It allows the page designer to access events such as startups, exits, and users' mouse clicks. JavaScript extends the programmatic capabilities of Netscape Navigator (and to a slightly lesser extent, Microsoft's Internet Explorer) to a wide range of authors, and is easy enough for anyone who can compose HTML. Because JavaScript is part of LiveConnect, you can use it to create interaction between HTML, plug-ins, and Java. LiveConnect enables:

- Navigator plug-ins loaded on a page to interact with JavaScripts running on the same page.
- Java applets loaded on a page to communicate with JavaScripts running on the same page, and vice versa.

Using JavaScript, even less-experienced developers will be able to direct responses from a variety of events, objects, and actions. It provides anyone who can

compose HTML with the ability to change images and play different sounds in response to specified events, such as a users' mouse click or screen exit and entry.

### 3.3.2.3 Active Server Page ( ASP )

The reason why I chose ASP is because of some of the benefits stated below :

#### 3.3.2.3.a Benefits of Using ASP

a) Asp complements client side scripting

b) ASP development is easy to learn

c) With the ASP development environment, we can easily leverage existing investments and skills.

d) ASP development is compile-free.

e) The ASP environment is extensible.

f) ASP protects proprietary business algorithms and information.

g) Both Netscape Navigator and Microsoft Internet Explorer browsers as well as other browsers can view ASP pages because the ASP is executed on the server and delivered to the client computer as simple HTML.

#### 3.3.2.3.b How ASP compares with similar Web development technologies?

Below are the comparison of ASP with other web Development technologies :

a) Common Gateway Interface (CGI)

CGI is the oldest Web application development technology in existence. It was designed to give Web application developers the opportunity to build programs executed on the server side each time a Web user requests that application through a URL. Each time the CGI application is executed; a new process has to be created on the server, which can be quite resource-intensive for the server especially when several users try to execute the same application simultaneously.

b) Internet Server Application Programming Interface (ISAPI)

ISAPI is a high-performance Web application development technology. ISAPI applications are compiled applications, so they are very efficient and ideal for high-performance Web sites. ISAPI applications are more complicated and not as easy to build deploy as Asp applications. By using Asp with the custom Asp components you build with Visual Basic, you can realize some of the benefits of ISAPI without learning a more complex application development language such as C++.

c) Internet database Connector (IDC)

IDC is Microsoft first Web database application development framework. IDC has limited capabilities when it comes to interfacing with multiple databases and processing data before it is presented to the user. Asp solves the limitations of IDC by providing a powerful and extensible Web application development framework.

d) Windows CGI (WinCGI)

WinCGI makes it easy to build and deploy Web solution using the power and flexibility of Visual Basic. However, WinCGI doesn't offer Web application developers the flexibility offered by ASP, such as the ability to use the scripting language of our choice.

e) Practical Extraction and Report Language (PERL)

Perl is a powerful scripting language widely used by Web application developers (particularly in the UNIX). ASP supports Perl, so if you're familiar with it, you can build your ASP applications using all the powerful features of Perl.

f) Cold Fusion

It is a database markup language primarily used to build database applications easily. Although Cold Fusion works well for building database applications, ASP is more integrated with IIS and gives us more flexible, robust and scalable platform for building and deploying sophisticated database applications.

## Chapter 4 : System Analysis

### 4.1 System Analysis

The definition of system analysis is a problem solving technique that decomposes a system into ints component pieces for the purpose of studying how well those components parts work and interact to accomplish their purposes ( Whitten, Bentley & Dittman, 2000 ).

Systems analysis is driven by the business concerns of systems owners and systems users. Hence it addresses the data, process and the interface building blocks from systems owners' and systems users' perspective. The documentation and deliverables produced by systems analysis tasks are typically stored in a repository.

Fundamentally systems analysis is about problem solving. There are many approaches to problem solving; therefore there are many approaches to systems analysis. Some of the most popular systems analysis approaches include structured analysis, information engineering, discovery prototyping and object oriented analysis. These approaches are often viewed as competing alternatives. In reality certain combinations can and should actually complement one another.

### 4.2 The Requirements Process

Capturing the necessary requirements before developing a system is important. A requirement is a feature of the system or a description of something the system or a description of something the system is capable of doing in order to fulfill the system's purpose ( Pfleeger 1998 ). The requirements were gathered for this system through

research on the Internet and books, analysis of the results of the survey conducted and also from the review of existing systems.

### 4.3 Requirements Elicitation

To determine the users needs, a variety of techniques must be used. Requirements are divided into three main categories :

a) Requirements that absolutely must be met

b) Requirements that are highly desirable but not necessary

c) Requirements that are possible but could be eliminated

#### 4.3.1 Requirements for this Interactive Mathematics Learning System ( Emath )

Through the information gathered, the outline of this system is prepared. Requirements are divided to functional and non functional requirements.

##### 4.3.1.1 Functional Requirements

Functional requirements describes an interaction between the system and its environment. It also describes how the system should behave to stimuli.

This system is divided to two main modules which is English and Bahasa Melayu. The language can be chosen by the user. After the selection of the language, this system is then divided into four sub modules :

a) Lessons

This is the main sub module of this system. Lessons are divided to two standards

( Standard 1 & Standard 2 ) comprising of thirteen lessons each. There's a step by step guide that will be given for users to follow on the basic of mathematics operations. .

b) Games

There would be three types of games provided in this system. Two games will be based on the basic mathematics operations and one is just a game for fun.

c) Quiz

There's a quiz for the four basic mathematics operations. Users can chose the operation and level preferred. There would be feedbacks given each time an answer is given by the user.

d) Links

There are links provided to other related and also other types of educational sites.

**4.3.1.2 Non – functional Requirements**

A non functional requirement describes a restriction on the system that limits our choices for constructing a solution to the problem. These constraints usually narrow our our selection of language, platform or implementation techniques or tools. Below are the non functional requirements that is needed for this interactive system :

a) Interactive

This web based application enables interaction between users and the system. The common form of interactivity is the clicking on hyperlinks to navigate around the system. There also input boxes for the users to input answers and there will be a feedback to the answers of the users.

b) User Satisfaction

This system is designed for users to have fun, enjoy themselves and to please them besides being educational. This is important to encourage continuous usage and revisitation to this system.

c) Learnability

The guide and instructions are very easy to follow. Therefore anyone who is new to this system can learn how to use it without any difficulties. It will also be easy to remember how to use after a long term of not being used.

d) Easy to Navigate

The navigation of this system is as easy as possible. The navigation buttons are all graphics or pictures which besides being attractive, it can be easily understood.

e) User – friendly

Users are able to browse the web site without any difficulties. This sytem is easy to use with a graphical user interface where users can point and click their way around easily. There's also a talking wizard at every page that acts as a guide and a tutor for this system.

f) Attractive Interface

The interface of this system is full of graphics, colours and also with animation in order to attract attention and interest of students.

## CHAPTER 5 – SYSTEM DESIGN AND MODULES

### 5.1 Design of this system

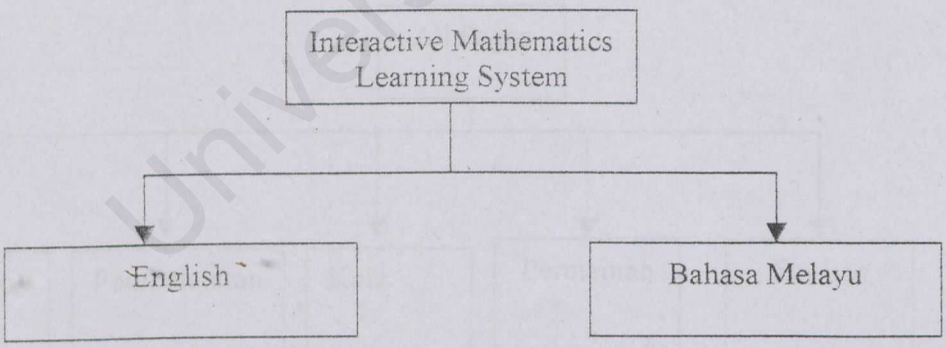
The design of this system is based on the information gathered. This system is designed based on the requirements of the end users. The advantages and the disadvantages of this system will also be taken into consideration.

This system is basically user fiendly, easy to understand, well organized with a attractive interface. It also consists of lessons, tests, quizzes and also games based on basic mathematics operations.

This system will be developed in both English and Bahasa Melayu. A talking wizard which acts as a guide and tutor will also appear at every page.

### 5.2 System Structural Design and Data Flow Diagram ( DFD ) of this System

**Figure 5.1 : Main structural Design of the System**



The system is divided into two main parts in which users can chose whether to view the site in English or in Bahasa Melayu. The talking wizard would appear as soon as the site is accessed. If the voice of the wizard cannot be heard, a step by step instruction will be given to download the necessary application in order to hear the wizard.

### 5.2.1 All web pages

**Figure 5.2 Structured Design for All Web Pages ( English )**

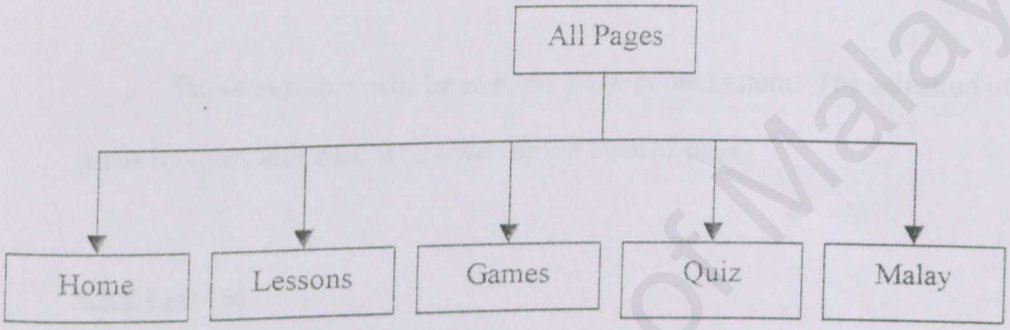
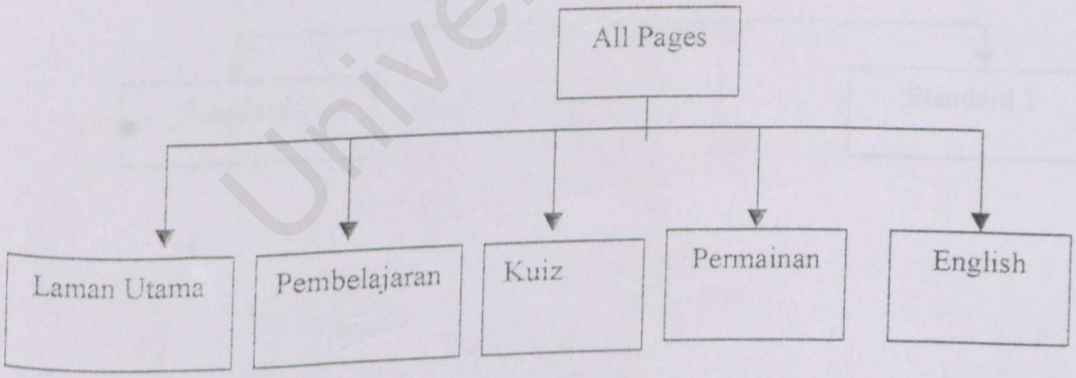



**Figure 5.3 Structured Design for All Web Pages ( Bahasa Melayu )**



There are six main modules in this system :

a) Home ( Laman Utama )

b) Lessons ( Pembelajaran )

c) Quiz ( Kuiz )

d) Games ( Permainan )

e) Links ( Laman Lain )

f) English ( Bahasa Melayu )

These modules will be in every page in the system.. The selection of page will be made by users and they'll be taken to the desired page.

### 5.2.2 Lessons

**Figure 5.4 : Structured Design for Lessons ( English )**

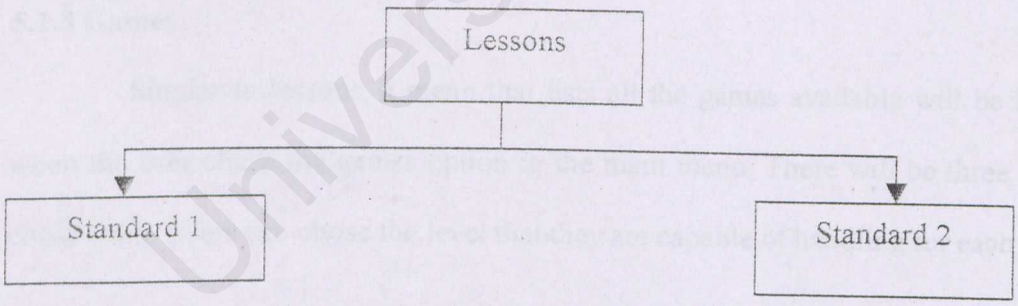
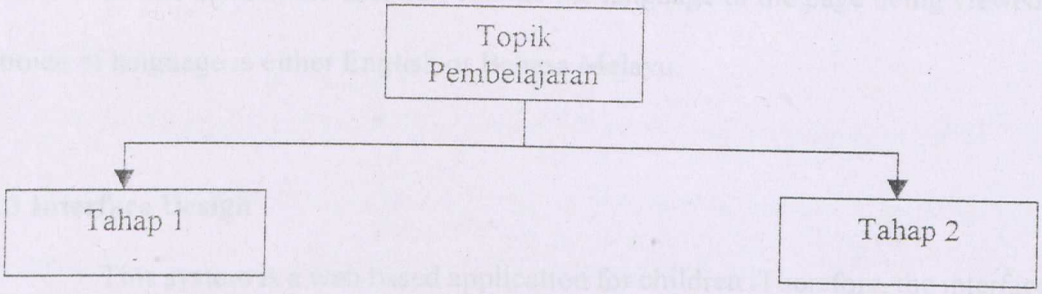


**Figure 5.5 Structured Design for Lessons ( Bahasa Melayu )**




Lessons are divided to two levels which are Standard 1 and Standard 2. When the choice of standard is selected, the the list of topics which comprises of fifteen topics each will appear. The user can click at any topic to chose the desired topic. After the lessons users can click on the quiz buton to test their capability. The questions to the are randomly generated. The wizard would appear and will remain to guide users and to give brief explanation on each topic.

### 5.2.3 Games

Similar to lessons, a menu that lists all the games available will be listed out when the user clicks the games option in the main menu. There will be three games to chose from. Users can chose the level that they are capable of handling for each game.

### 5.2.4 Links

In this option, the list of related sites and other types of educational sites will be listed out. Users have a choice to chose the desired site and when the URL of the site is clicked on, the site will appear on a pop up window.

### 5.2.5 English or Malay

In this option, the user can change the language of the page being viewed. The choice of language is either English or Bahasa Melayu.

## 5.3 Interface Design

This system is a web based application for children. Therefore, the interface will be designed to be colourful and attractive. It will be designed to be user friendly, attractive and easy to navigate. The graphics and the animation that are included in this site will be quite reasonable so that the download time of this site would not be too slow. The main attraction of this system is the talking wizard which acts as a guide and tutor. It also performs tricks and gestures to attract the attention and interest of children.

## Chapter 6 - System Implementation

### 6.1 Introduction

The implementation of this system involves the environment of the system development and also the program coding. In this phase, the system requirements and design are converted to a program code. Modifications are also done to previous designs for improvement.

Each of the web pages of this system is developed and designed separately. It is later integrated and linked to make a full system that functions well. This is done after the testing of each and every page of this system.

### 6.2 Development Environment

#### 6.2.1 Hardware used in the development of the system

- Standard personal computer input/output compliance
- Intel Pentium 4 Processor 1300 MHz
- Hard Disk 20GB space
- Memory 128 MB RAM

#### 6.2.2 Software used in the development of this system

- Windows ME – the operating system
- Internet Explorer 5.5 – the web browser to view the pages designed
- Macromedia Dreamweaver MX for the development of the HTML pages

- MGI Photosuite for the editing of images
- Adobe Photoshop for the enhancements of images and fonts
- Notepad for the editing of the coding
- Microsoft Word for the recording of the documentation

### 6.3 Implementation

The beginning stage of the system, Macromedia Flash was planned to be used to develop the animation and the interactive part of the system. But, later Javascript and Java was used due to the ability of this programming language to generate interactive questions, games and also the talking wizard.

### 6.4 The Development of The Web Pages

The programming language to develop this system was chosen very carefully based on a few criteria. First the availability of the development tool should be easy. Secondly, knowledge of the software development tools were also important. The programming language that was also chosen had to be suitable based on the nature of the system development.

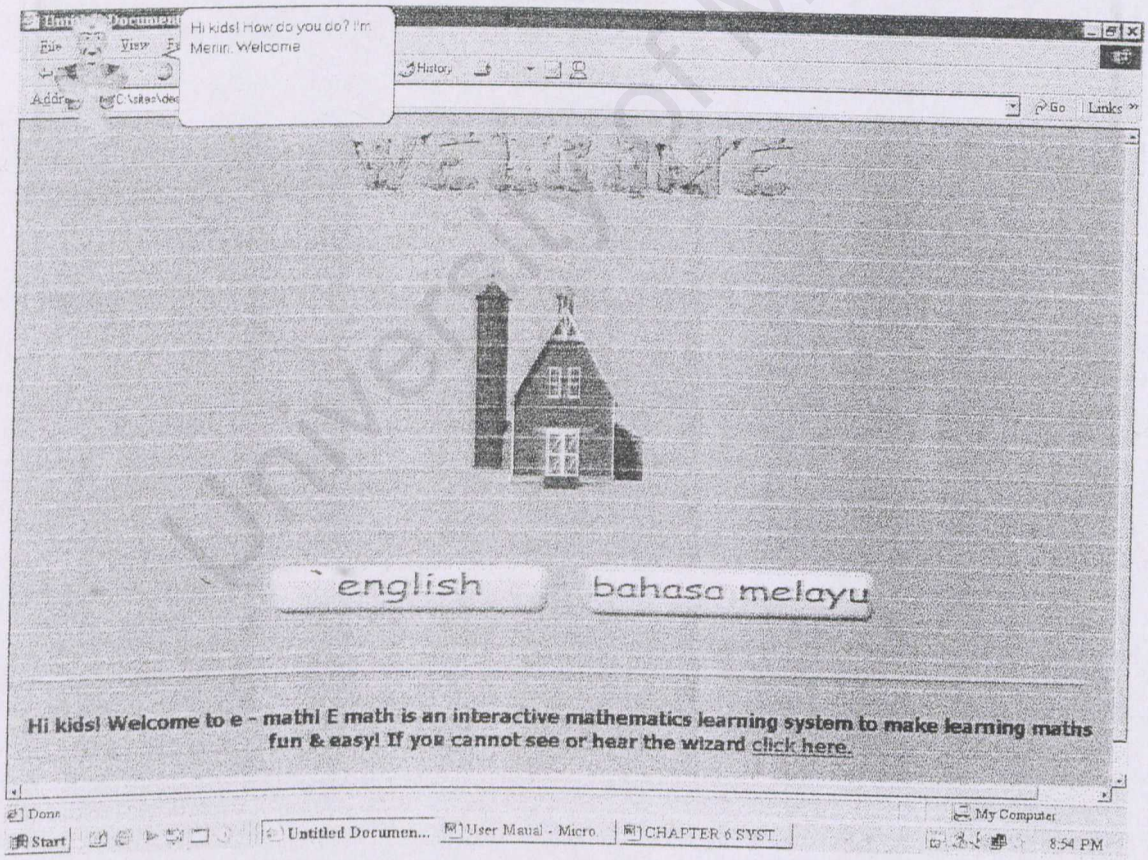
These criterias are important to develop the pages smoothly and with ease. The programming language used are HTML, Javascript and also Java. HTML is a programming language used to develop the basic web pages. Javascript and Java are used for the development of the interactive questions, games and also to generate the talking wizard.

Adobe Photoshop was used to enhance images and also for the creation of the buttons. MGI Photosuite was also used to edit some of the images used in this system. The web pages were developed using Macromedia Dreamweaver MX. The javascript and Java code are then inserted in the HTML document. All editing and modification of codes were done using notepad and also Wordpad.

### 6.5 The Flow Of Emath

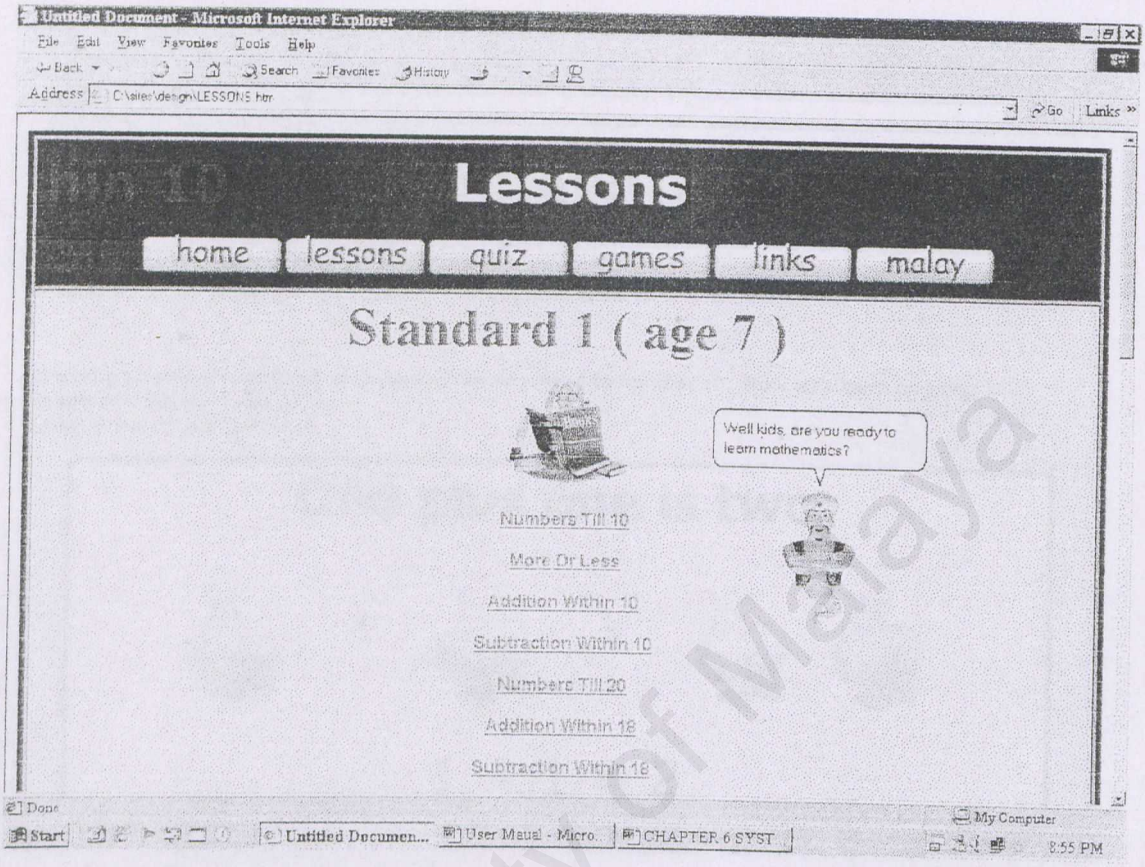
Below are the basic flow of Emath that has been developed and implemented :

**Figure 6.1 : Emath's welcome page**



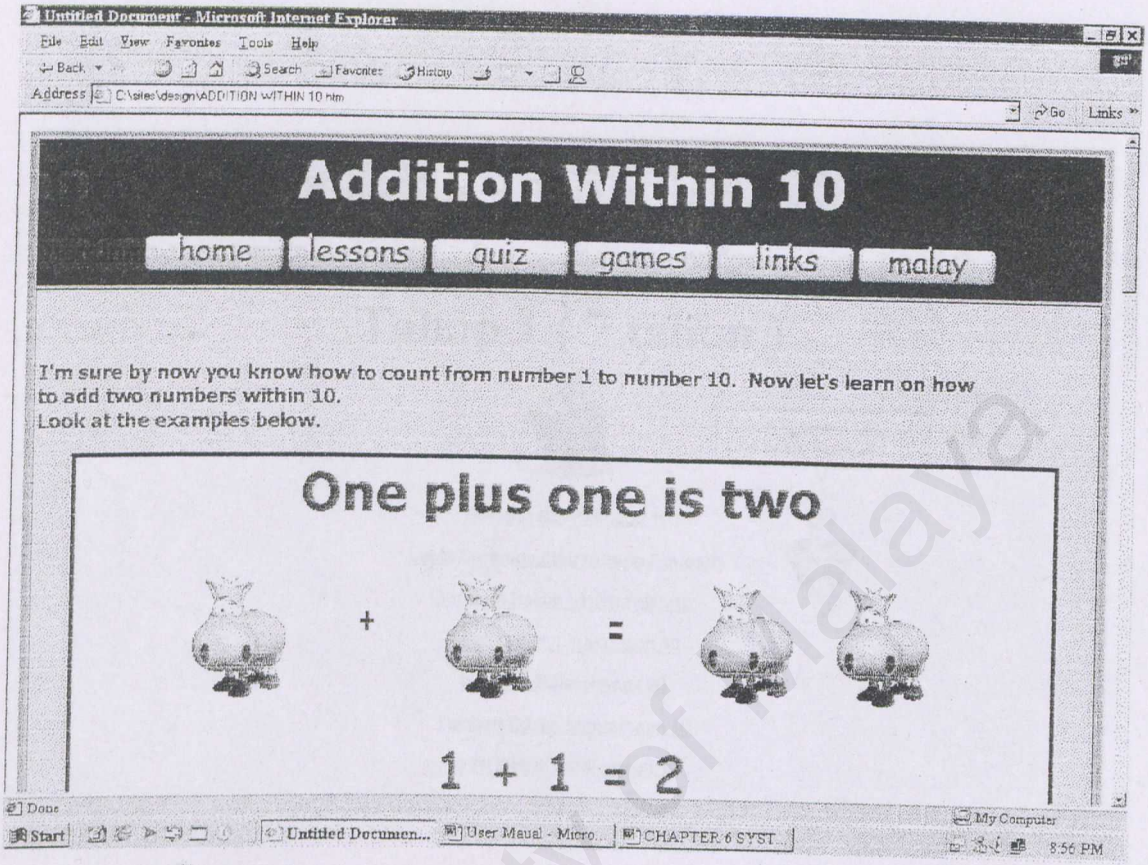

Users can choose the option of viewing the page in English or in Malay

Figure 6.2 : Lessons menu



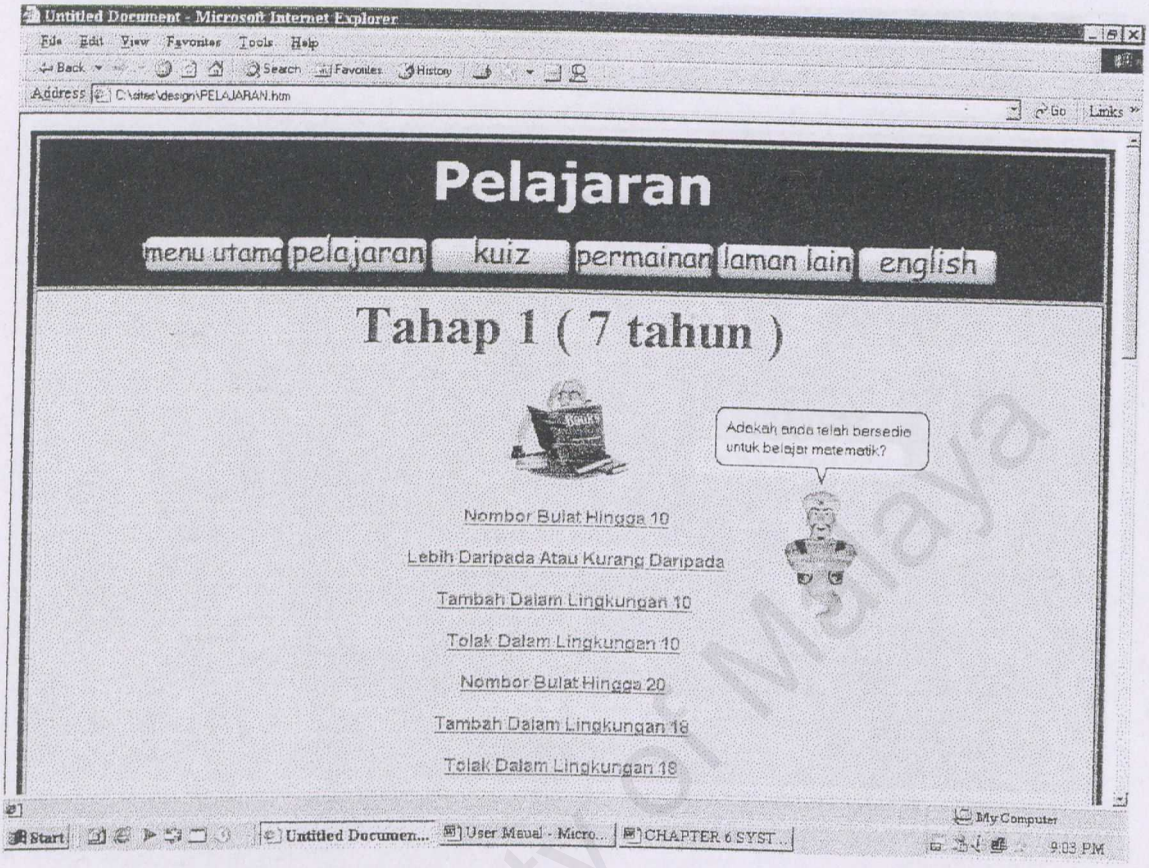

This is the lesson's menu that list all the topics of lesson.

**Figure 6.3 : Example of a lesson**



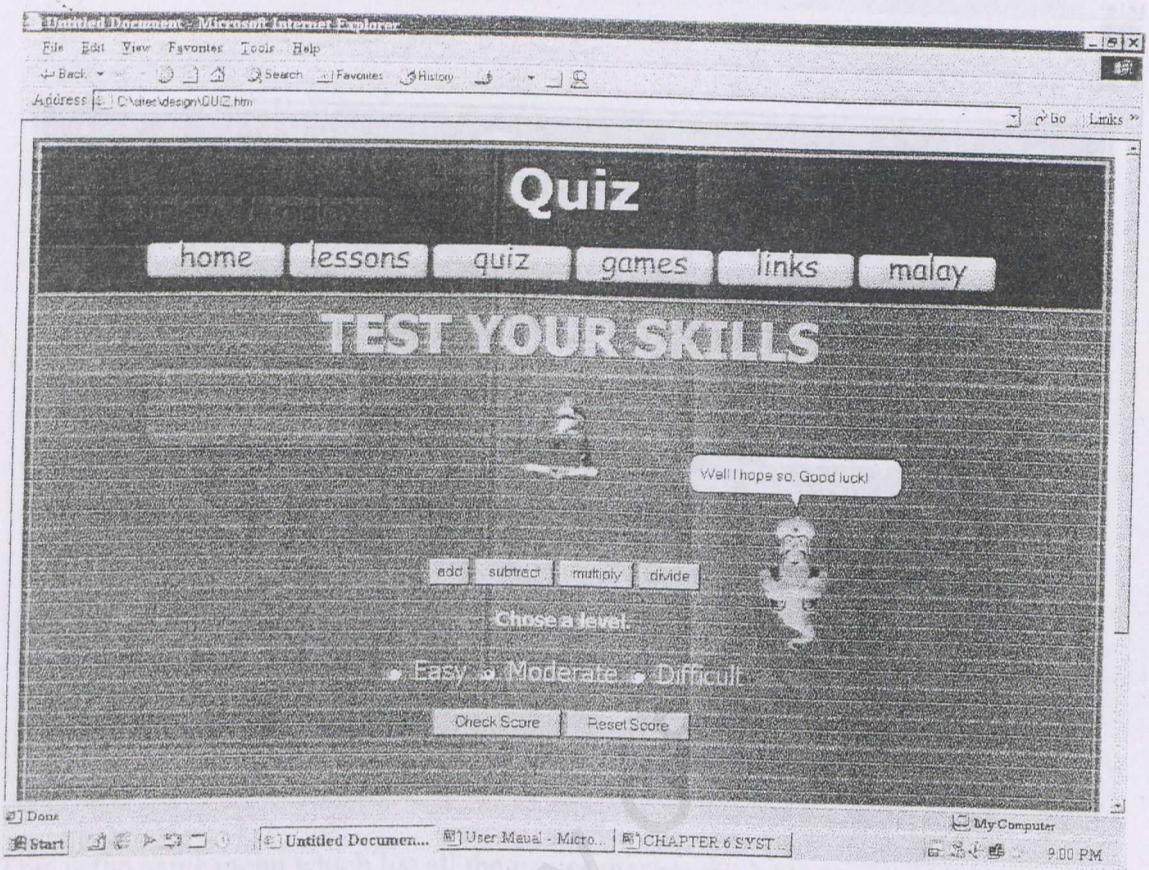

The figure above is an example of a lesson

**Figure 6.4 : Lessons ( Malay version )**



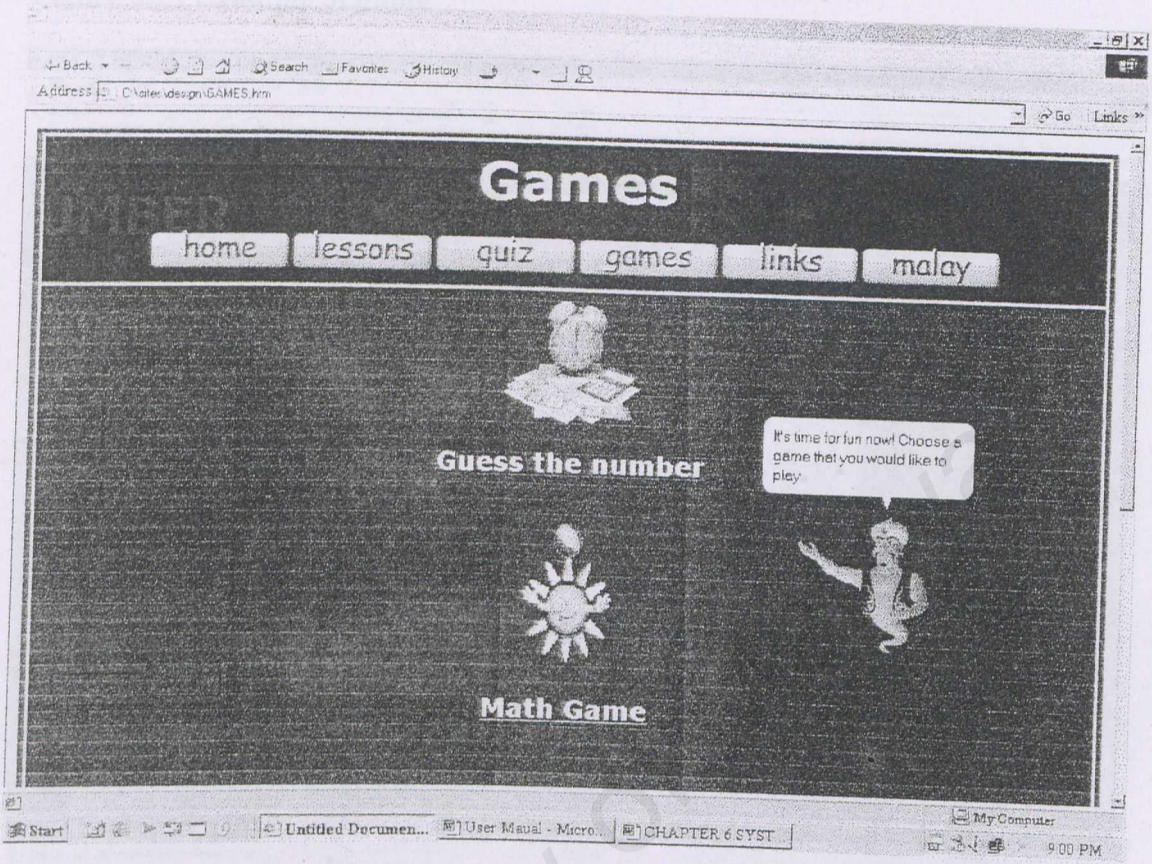

At every page the malay version of the site can be viewed by clicking the "malay" button.

**Figure 6.5 : Interactive Quiz**



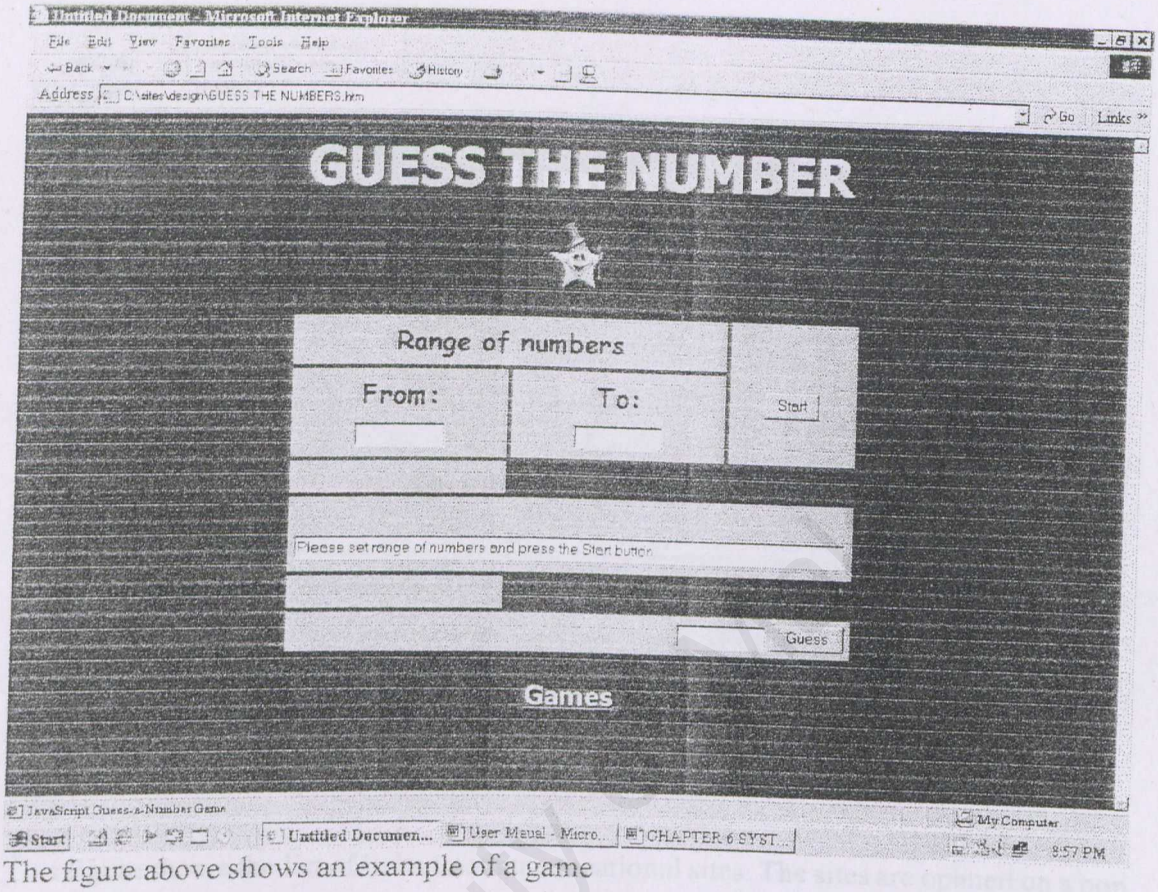

This figure is an example of the interactive quiz questions.

Figure 6.6 : Games



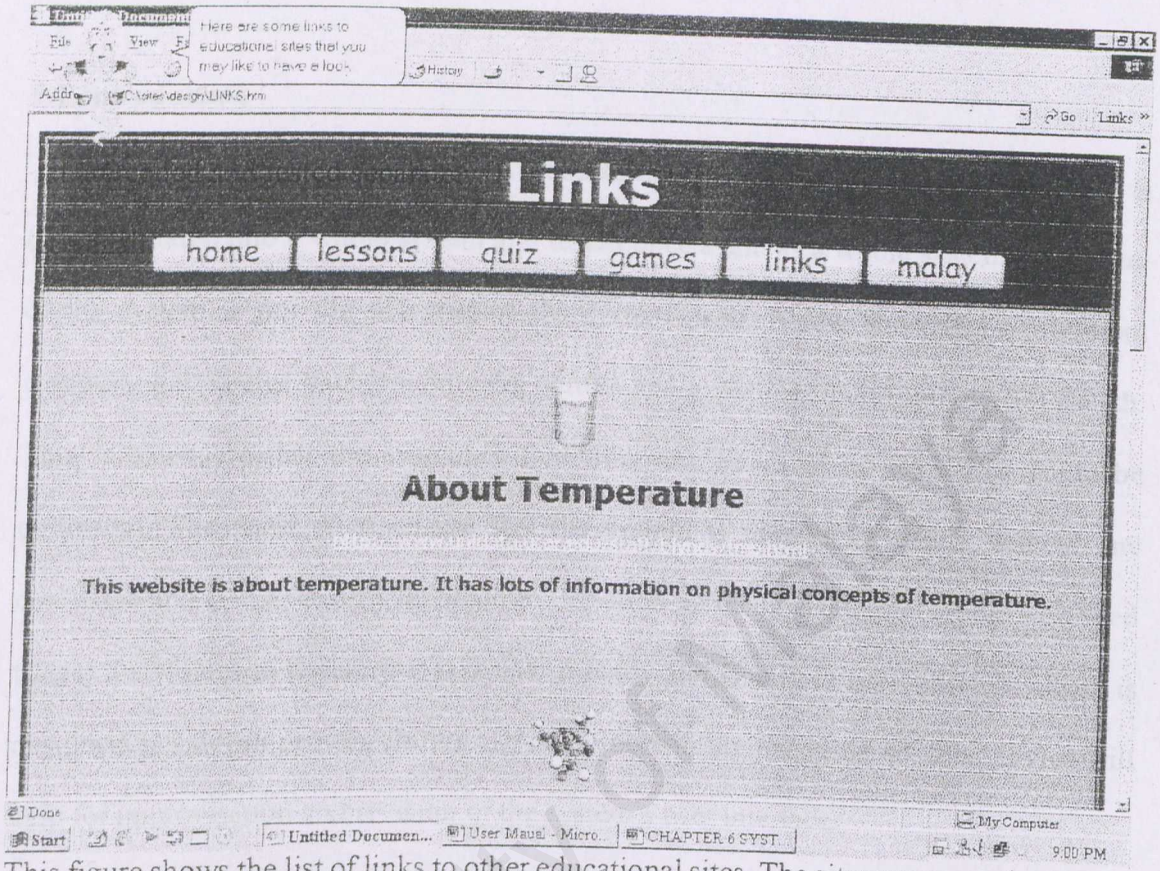

This is the game menu which list all the games that are available.

Figure 6.7 : Example of game




The figure above shows an example of a game

**Figure 6.8 : Links**




This figure shows the list of links to other educational sites. The sites are opened on a pop up window.

# Chapter 7 – System Testing

## 7.1 Introduction

These system consist of a few modules that are coded and tested separately. It is then integrated into a whole system and tested once again as a whole system. The tester of the system is not the designer of the system itself. A few end users of different computer knowledge background were chosen and given the opportunity to test Emath. This is to ensure that the system is free from any errors or misleads that could be confusing. The tester is to ensure that the system is running smoothly without any confusion and also to ensure the functions function perfectly. The tester would also need to test the system to ensure that it is user friendly and is easy to use beacause Emath is designed and developed for children. If any problems are encountered, their advice will help for improvisation and revision of the system's user interface.

## 7.2 The Process of Testing

Large programs cannot be tested as a single unit because of the complexity of it's development. Therefore, the testing process should be carried out stage by stage. Following are the steps on the testing process of Emath :

### 7.2.1 Unit Testing

Unit testing is done on the individual components of the system. The units or modules that were tested independently and separately are the interactive quiz questions, games and also the talking wizard.

### 7.2.1 a Interactive quiz questions

The questions of the quiz that are generated are tested to ensure that it is for the right lessons. The accuracy of the calculation and the answers are also tested. The calculation of the scores are also tested to make sure that there are no miscalculations that could lead to confusion.

### 7.2.1.b Games

Games are tested to ensure that it functions properly. It is tested with considerations given to the possibilities of errors and flaws.

### 7.2.1.c The talking wizard

The talking wizard should appear in every page. It should be tested to ensure that it appears at the right page. It should also be seen, heard and animates correctly. The make sure that the talking wizard fuctions correctly it is tested on other computers. The common problem faced and might occur is that the wizard can't be seen or heard. This can be solved by installing the applications that are neccesary, which are the Microsoft Agent Character file and Text-to-speech engines.

### 7.2.2 Integration Testing

Integration testing is done after all the web pages are tested individually and separately. The whole system is tested as one. The links are checked mainly for a few times to ensure that all the pages are linked correctly and it functions properly.

### 7.2.3 System Testing

The system testing is the last stage of testing. System testing is done to detect errors and also flaws. It is also carried out to validate the functional and the non – functional requirements of the system. There are a few categories of system testing :

#### 7.2.3.a Stress Testing

This is to ensure that the definition of the requirements of the program is fulfilled. It is also important to make sure that the program works under conditions that are extreme. Stress testing can be performed by executing the system in a manner that demands resources of abnormal, quantity, frequency or volume.

#### 7.2.3.b Performance Testing

Performance testing is done throughout the phases in the testing process. This is done to ensure that the system that provides the required function conform of the performance requirements.

## Chapter 8 – System Evaluation

### 8.1 System Strength

Below are the strength and the advantages of Emath :

#### 8.1.a Attractive Graphical User Interface

The web pages of Emath are colourful and also very attractive. The language that's used to name the buttons, links and also the instructions are simple and easy to understand. This system also has graphics and images that are interesting and suitable for children. This attractive graphic user interface is important to attract attention of the children.

#### 8.1.b User Friendly

This system is also user friendly. The navigation of pages are simple and easy to use. This is to avoid the children from getting confused. For every page a brief instruction made simple to understand is given to guide the users who are mainly children.

#### 8.1.c Bilingual Site

This system is designed to be bilingual where it is in English and also Bahasa Melayu. If the user does not understand certain words or phrases on a page, they can just choose to change the language of the same page with just a click of a button.

### 8.1.d Scope of Lesson

The lessons of Emath are based on the KBSR syllabus. Therefore, primary school children can use this system as a way to do revision in a more fun and interesting way. It's also an effective way of learning. Besides students, teachers can also use this as a tool fog guidance and also teaching in the classsroom. Parents too can use it at home to help their children in their studies.

## 8.2 System Constraints

### 8.2.a Scope of the lessons

The lessons developed in this system are limited to Standard 1 and also Standard 2 syllabus. This is because of the limitation and constraint of time.

### 8.2.b Lessons

The lessons of this system are brief. It is not in detail. Every topic is summarized due to the limitation of time factor. The wizard also gives brief and simple explanation.

### 8.2.c The talking wizard

The talking wizard cannot pronounce words well in Bahasa Melayu. Certain words may sound slightly different and this may lead to a little bit of miunderstanding and also confusion.

## 8.3 Future Enhancement

### 8.3.a Expand Lessons and Scope

The lessons should be in more detailed with detailed instructions, more examples and also more interactive quiz questions. The scope of lessons should also be broaden so that the other students of various ages can also use and benefit from this system.

### 8.3.b Creation of a Database

A database is needed so that the score of the last quiz or game played by the student can be kept. This will enable the students to check their last score and improve themselves to beat the previous score. This will be more fun, interesting and also challenging.

## 8.4 Knowledge and Experienced Gained

Very valuable knowledge and experience were gained during the development of the Emath. Knowledge was gained on web development and also programming and coding skills have been improved. Besides that, the knowledge gained through the course of Computer Science has helped to practice and apply the knowledge.

Besides that, knowledge has also been gained on the needs of users and the flow of system. In developing a system, it is very important to know the user's needs. The system has to be user friendly and also designed accordingly to meet the target user's requirements and needs.

There are also improvement on the way to gather information and also classify them. Skills on solving problems have been improved and planning and managing to finish a project in a given time has also been accomplished.

I have learned on how to plan and develop a project on my own. It is very imprtant to move and flow with the changing technology. Being on track helps to develop projects with ease and also solve problems without much difficulty. This will really help me to prepare to face challenges that will be encountered in the working environment. Building this project has given me an idea on how the working environment might be.

**8.5 Problems Encountered and Solutions**

The problems encountered and the solutions thought of during the design of this system are as follows :

a) Inability of the wizard to recognize Bahasa Melayu

The problem with MASH is that it can only recognize English and not Bahasa Melayu.

The solution:

The text for Bahasa Melayu will have to be typed in a way that the talking wizard can pronounce clearly and accurately.

b) Flash elements would increase the download time of the site.

The use of Flash to develop graphics and animation of the system will increase the download time.

The solution :

I've decided to decrease the use of graphics and animation to the level that is reasonable and will not cause the increase of download time of this site.

**8.6 Expected Outcome**

Below are the expected outcome of this Interactive Mathematics Learning System ( Emath ) :

1. To be an effective learning and teaching tool.
2. To be user friendly, interesting, fun and easy to use.
3. To give an understanding on basic mathematics.
4. To give exposure to children on the basic use of computers and also the use of internet at an early age.
5. To help develop and build the interest on learning mathematics and also to use computers for educational purposes.
6. To promote the use of internet as an effective tool of teaching and learning.

**8.7 Conclusion**

Building a web based application is a very challenging task. A lot of time is needed to conduct research and to gain knowledge related to the development of web pages. A lot of effort is needed to ensure that all the system requirements are fulfilled and the objectives of the system realized.

As a conclusion, this system when developed will fulfill the objective of creating a multimedia teaching and learning tool. This system is very attractive, interactive and most of all it is easy to use as it is developed for children. This system is also easy to learn and users can learn how to use it without any confusion or difficulties.

## Chapter 9 User Manual

### 9.1 Introduction

Emath is an Interactive Mathematics Learning System designed for children aged 7 & 8. The system provides lessons with interactive quiz questions, games and also links to interesting educational sites suitable for children.

### 9.1.1 Run – time Requirements

#### 9.1.1.a Hardware Configuration requirements

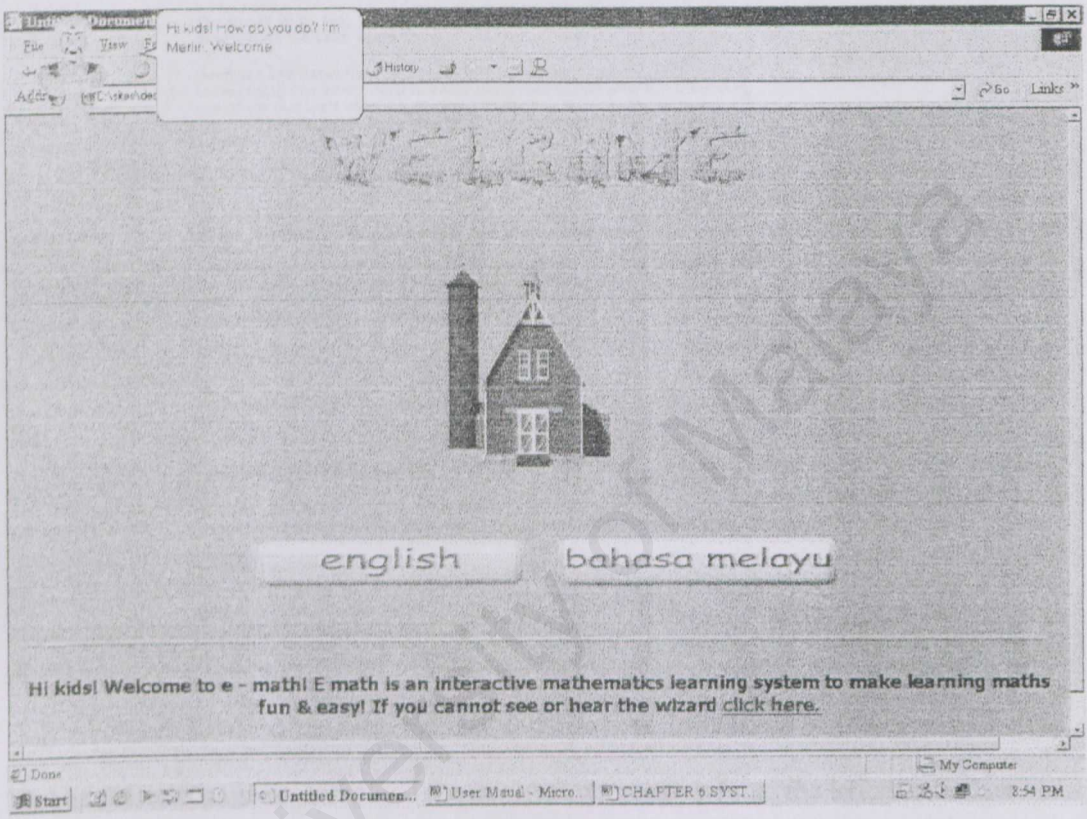
- Operating system of Windows 98 and above
- Pentium 366Mhz and above processor
- 64 MB RAM and above memory
- 2GB and above with 500MB of free disk space hard disk
- Access to the Internet
- 56K and above of connection speed
- 800 x 600 pixels of screen resolution
- 256and above colours on screen
- 8 bit and above of sound handling

#### 9.1.1.b Software Configuration Requirements

- Windows 98 and above operating system
- Internet Explorer 5.5 and above as browser

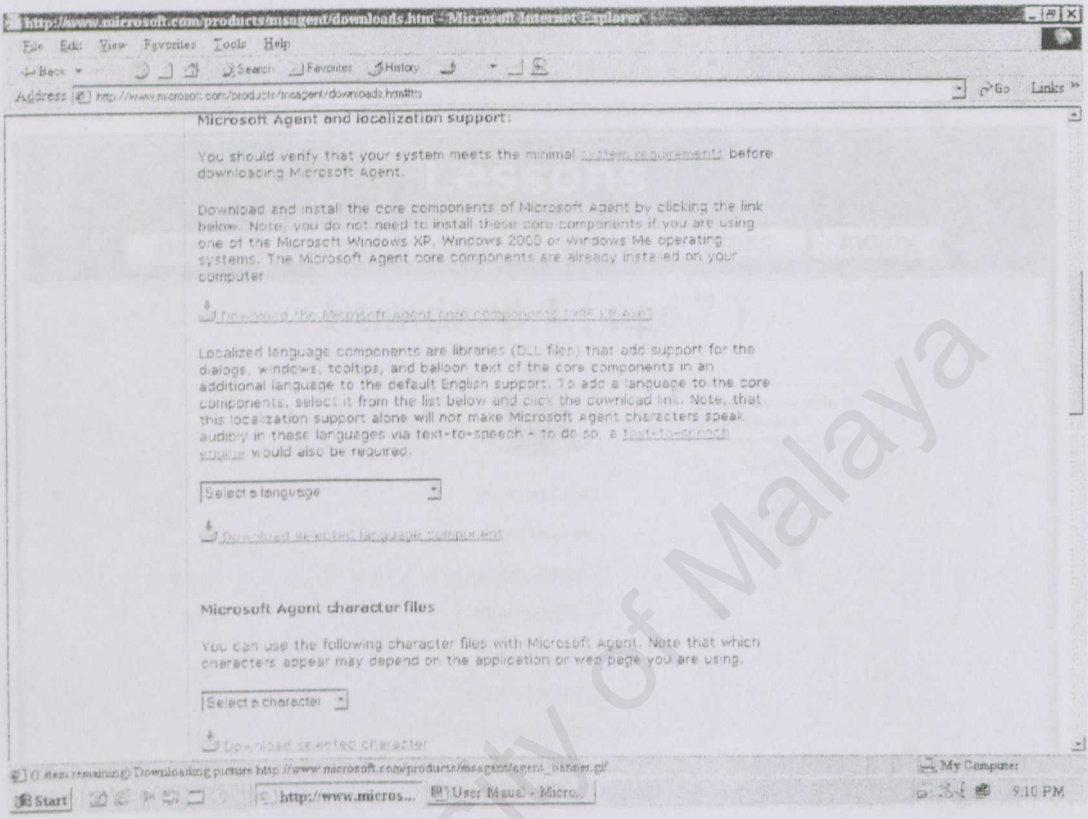
## 9.2 Getting Started

**Figure 9.1 Welcome page of Emath**



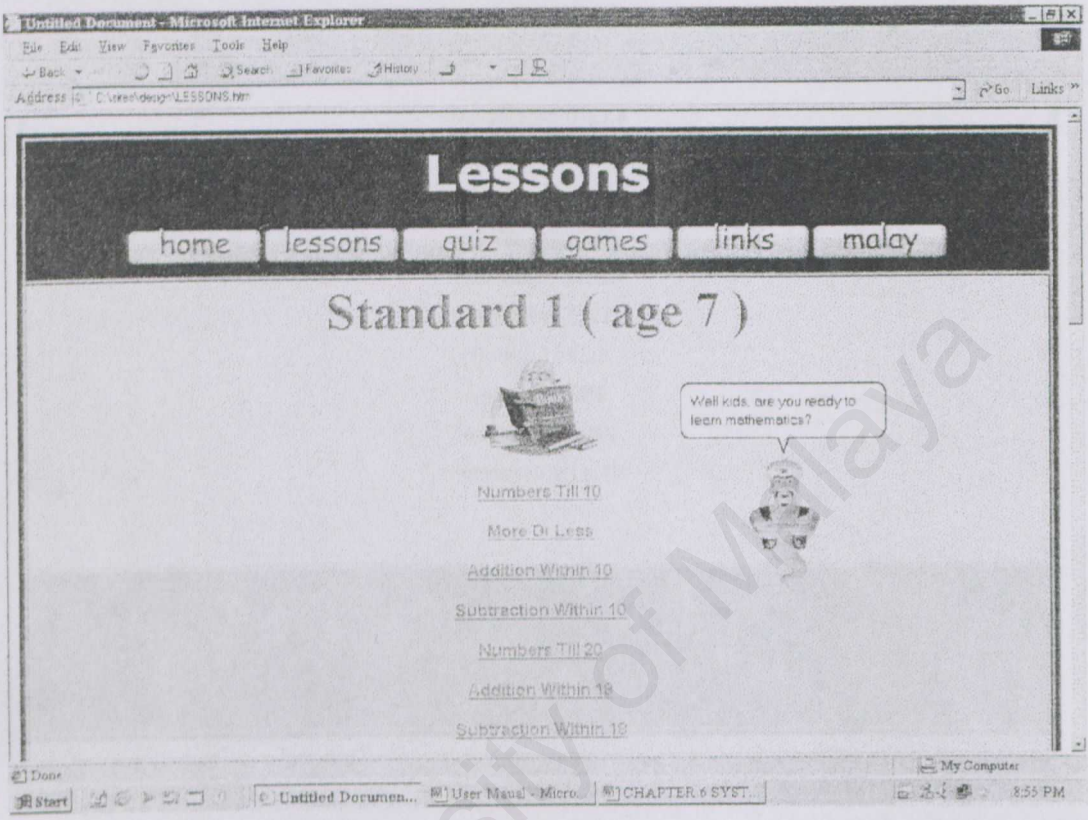

This page gives the user the option to either view the report in English or in Bahasa Melayu. At every page users can switch the language at any time. As soon as the page is accessed, the talking genie will appear to give a brief introduction. If the Genie cannot be heard than users should click on ' click here ' to download the necessary applications.

**Figure 9.2 Instructions on how to download Microsoft Agent**



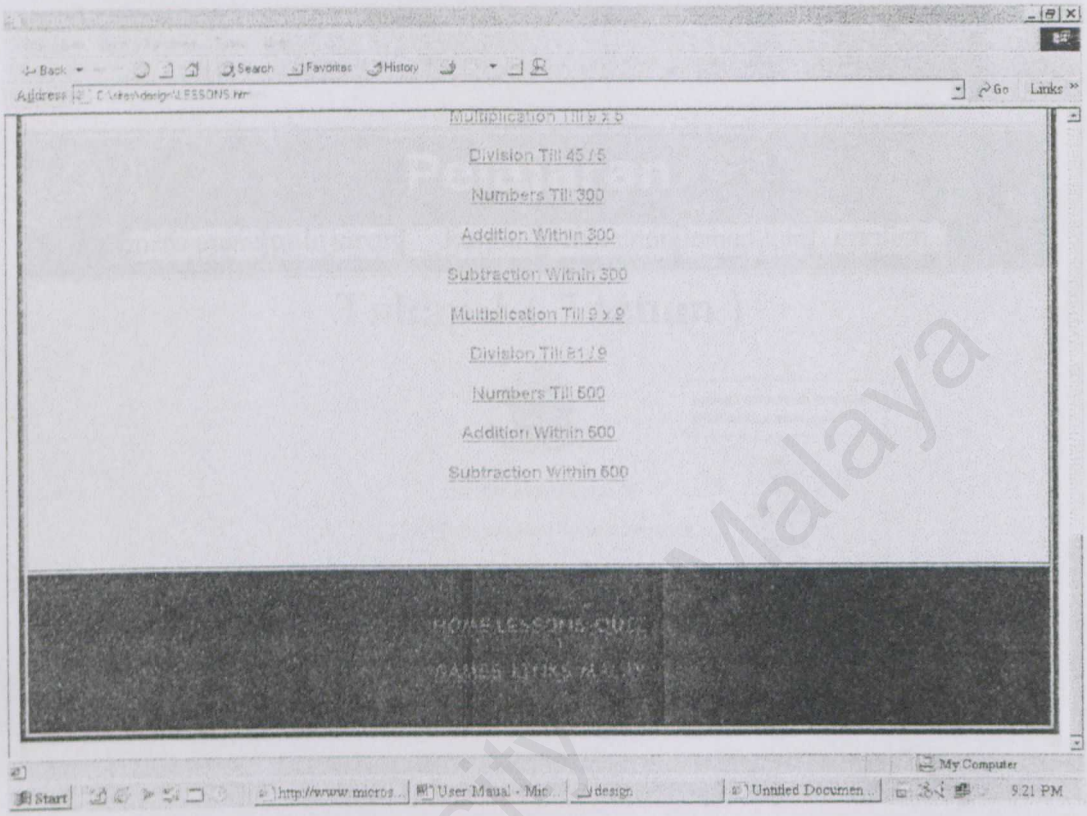

This is the web page to download the application needed. First, the Microsoft Core Components should be downloaded. Then, select the Genie character and download it. Finally, download the American English text – to – speech recognition engine.

Figure 9.3 Lessons ( English version )



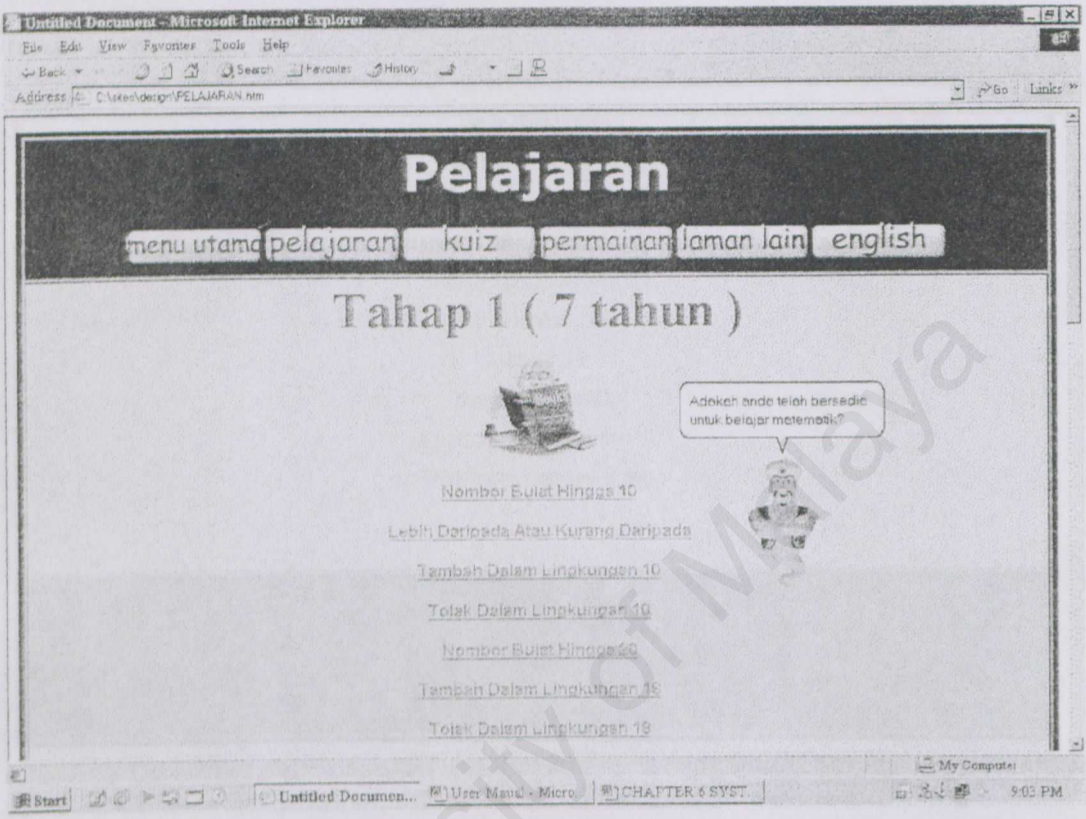

This is a lesson menu. Users can choose Standard 1 or Standard 2 topics from here. The user will have the option to either view the page in English or Malay.

**Figure 9.4 Bottom part of page**



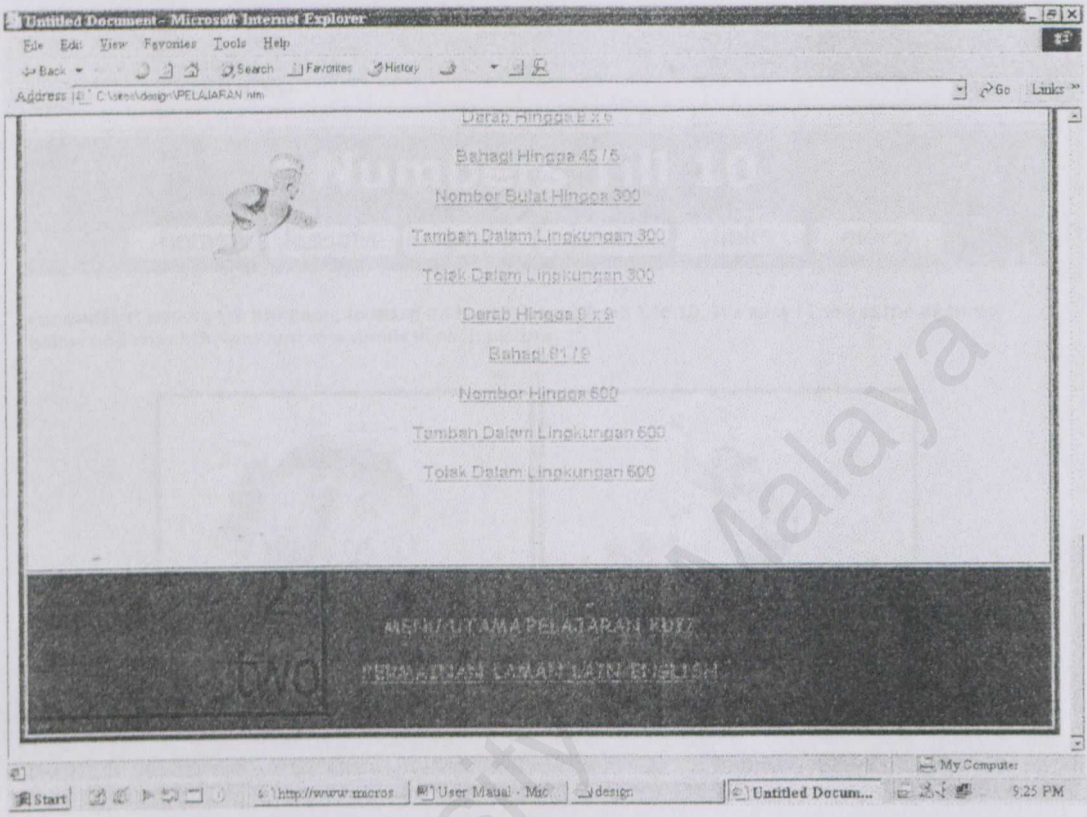

At the bottom of every page, the users can choose the links to the six main modules.

Figure 9.5 Lessons ( Bahasa Melayu version )



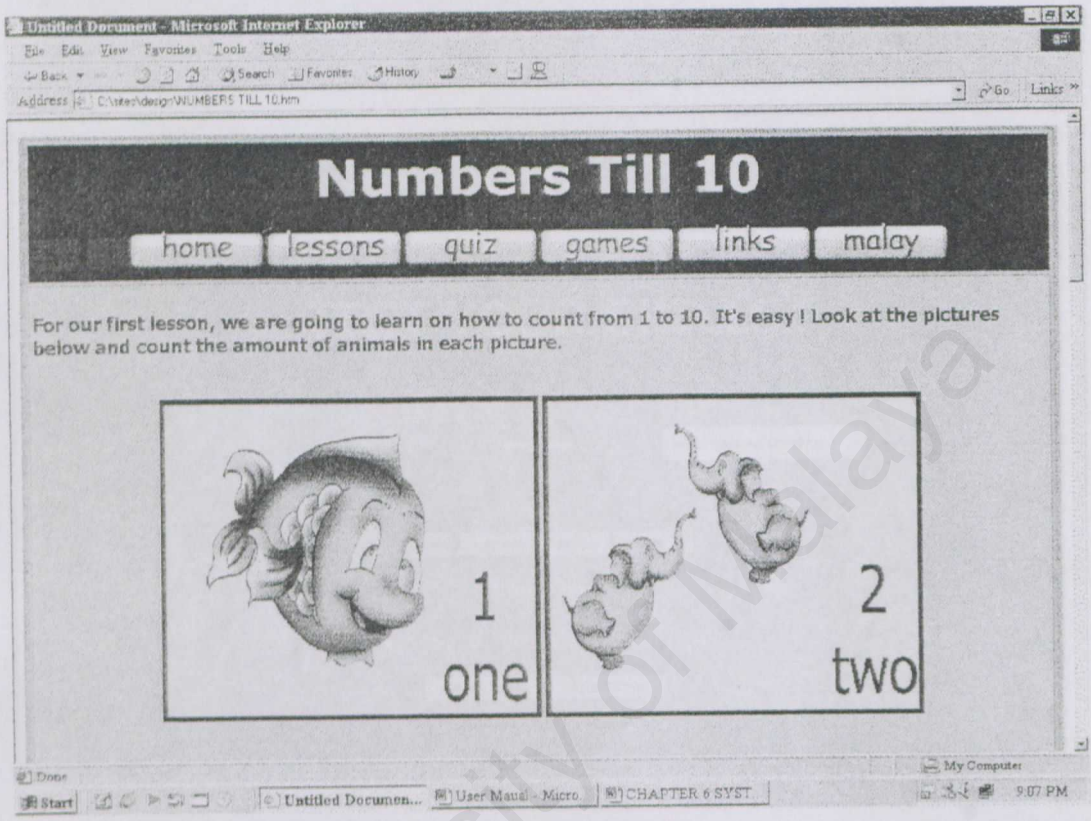

If the user wishes to change the language, for example, from English to Bahasa Melayu, a page like the example above would be displayed. It will be the exact same page with a different language.

Figure 9.6 Bottom part of page ( Bahasa Melayu version )



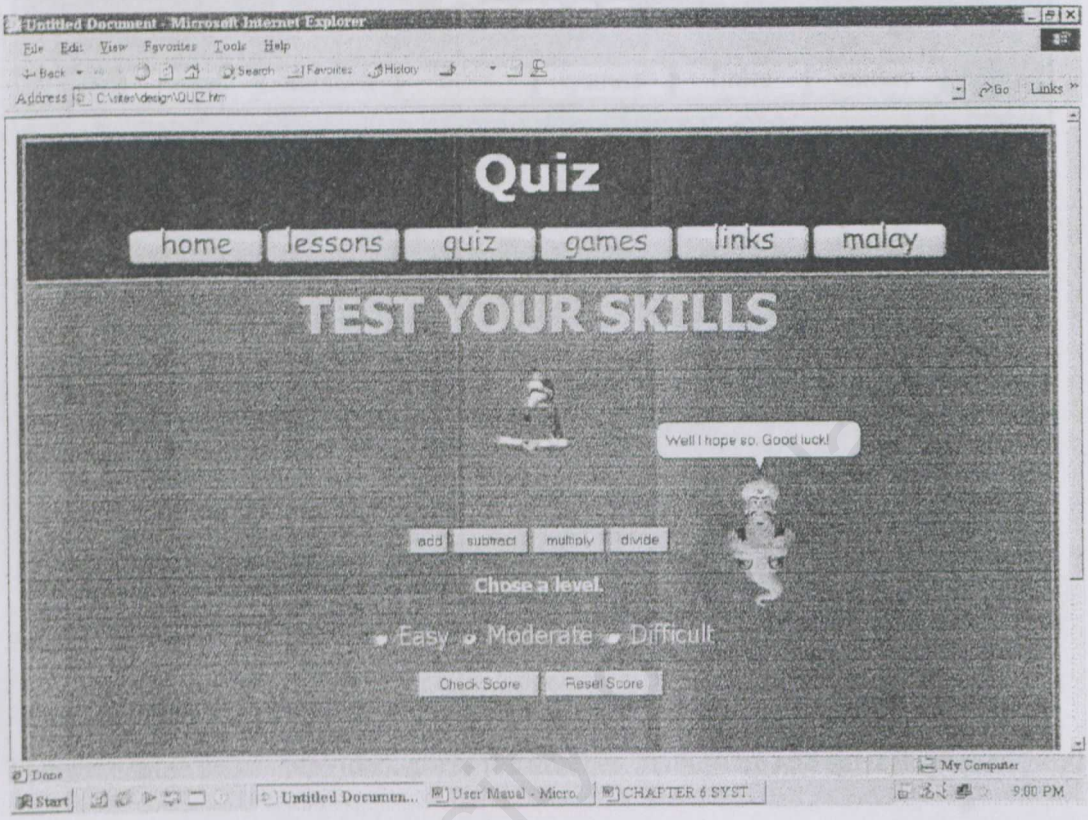

The bottom part of the page is also the same as in the English version. It has links to all the main six modules.

Figure 9.7 Example of lessons ( English version )



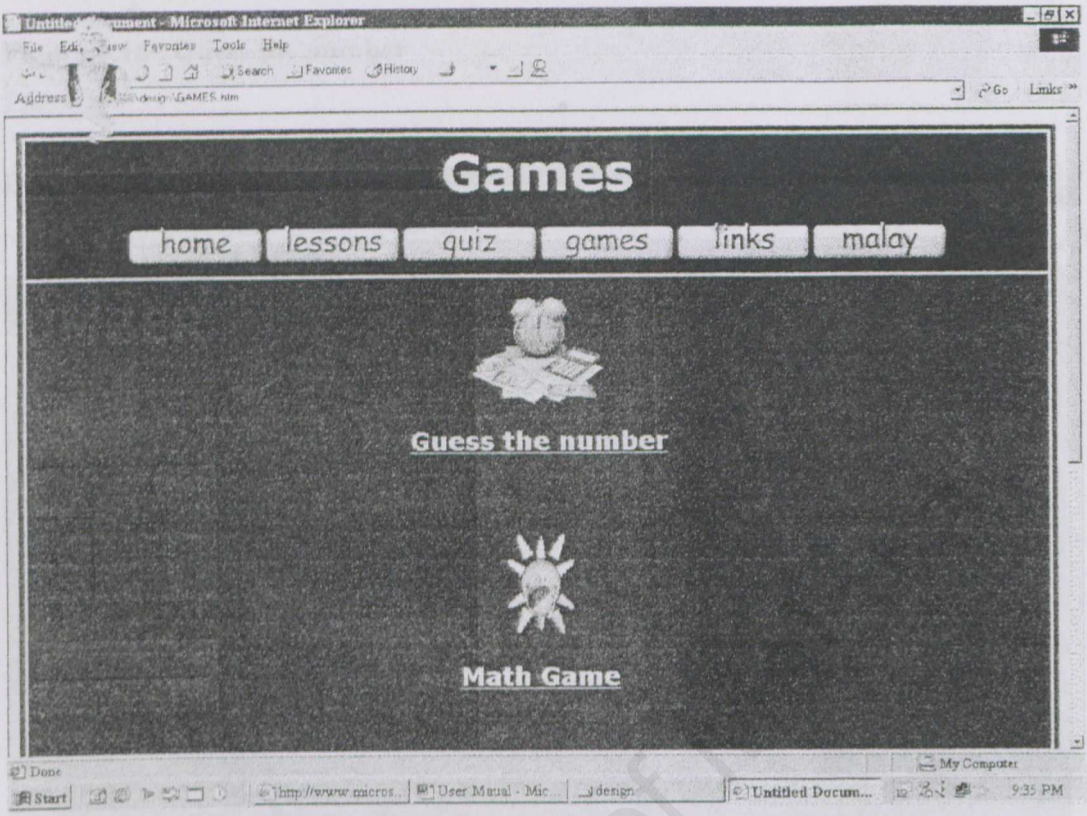

This is an example of a lesson. Simple instructions are given for each lessons to guide the users.

**Figure 9.8 Interactive Quiz Questions**



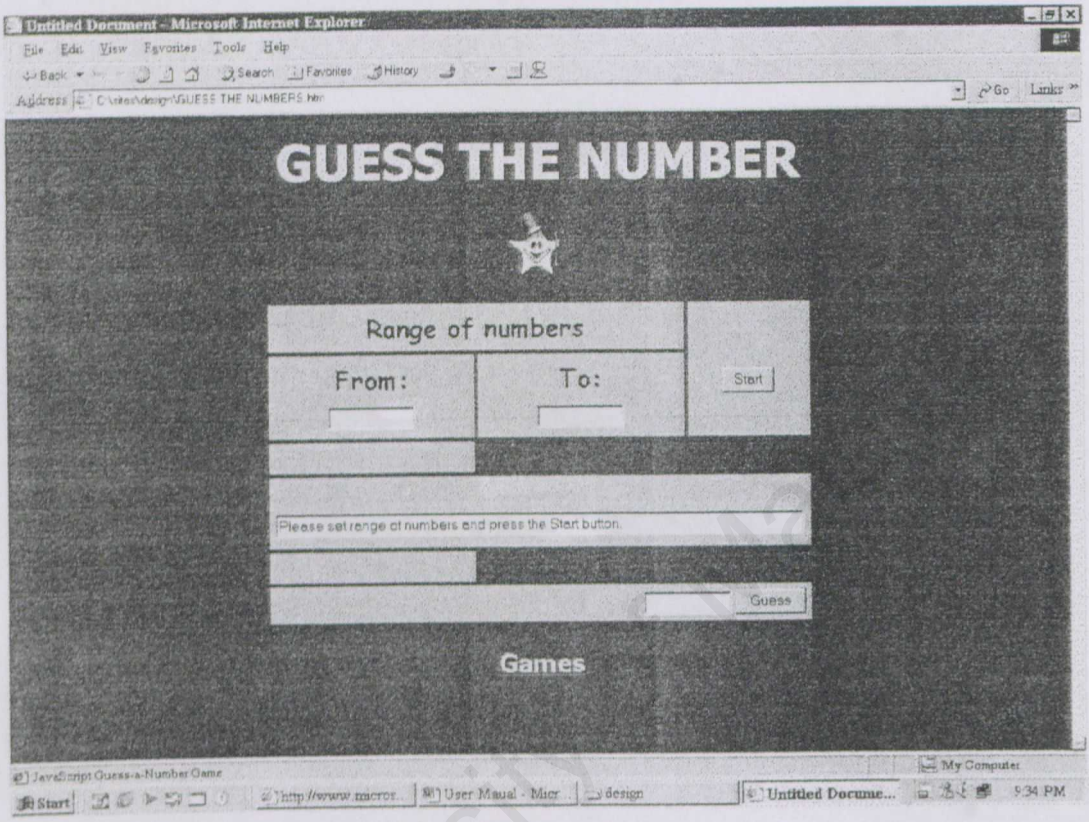

There's three levels provided for the interactive quiz questions. Users can choose the easy, moderate or the difficult level based on their capability. The four main operations, add, subtract, divide, and multiply can also be chosen. The score will be recorded and users can check their score. The score can also be reset. For every correct answer a pop up window will appear to inform the users that they have gotten the correct answer. If the wrong answer is given, the pop up window that appears will show otherwise.

**Figure 9.9 : Games**



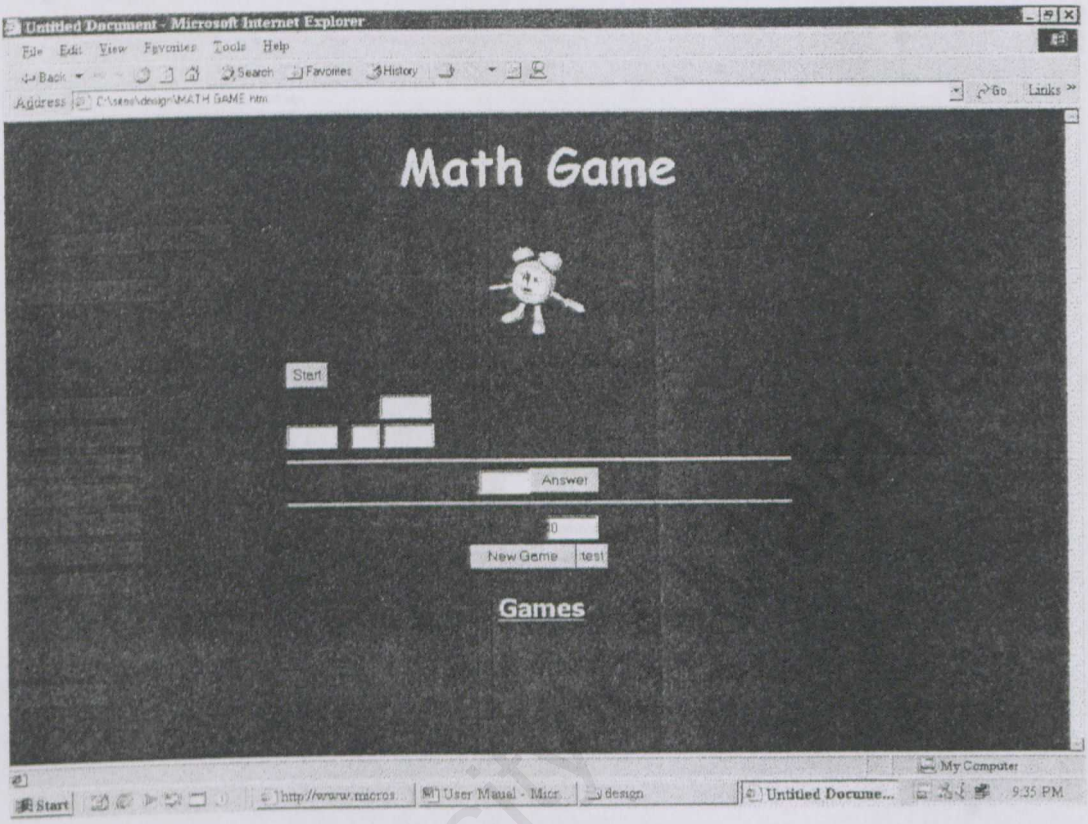

There are three games provided, guess the number, math game and age calculator.

**Figure 9.10 : Guess the number**



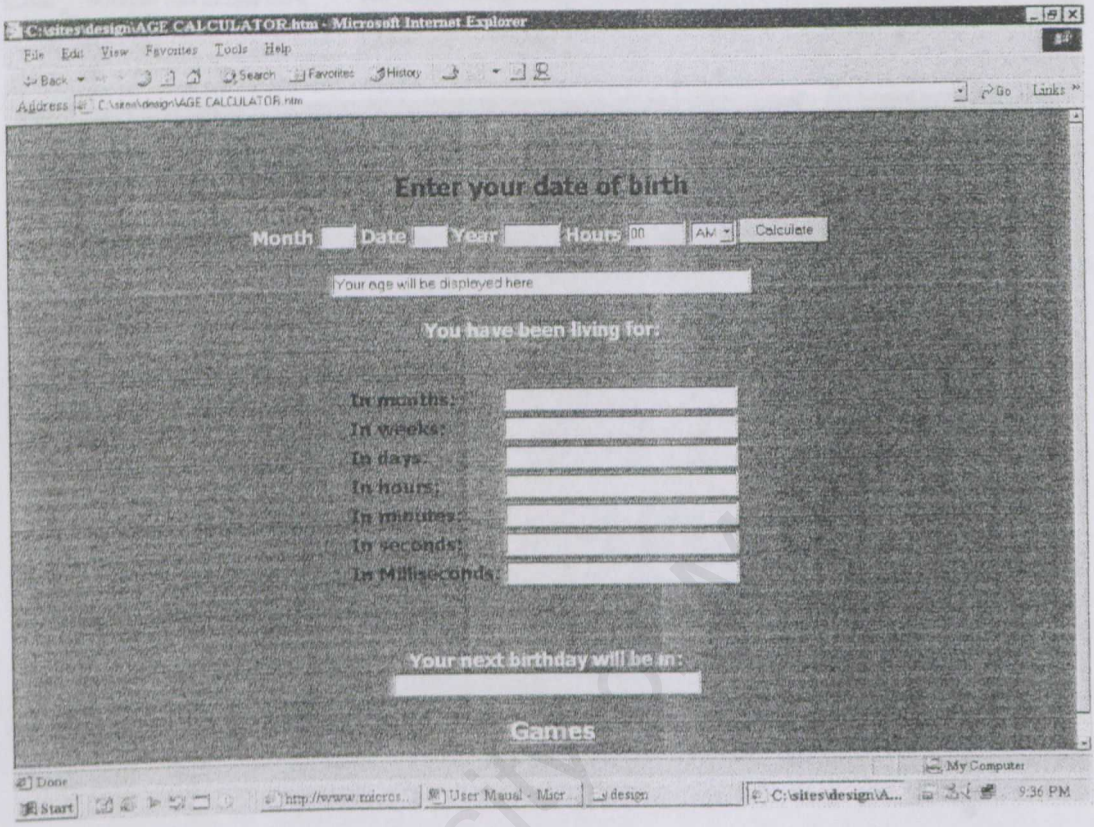

Users will have to click start and then input the range of numbers desired. After that, a number should be typed in the box and the button ' guess ' should be clicked. This is repeated till the right number is guessed.

Figure 9.11 : Math game



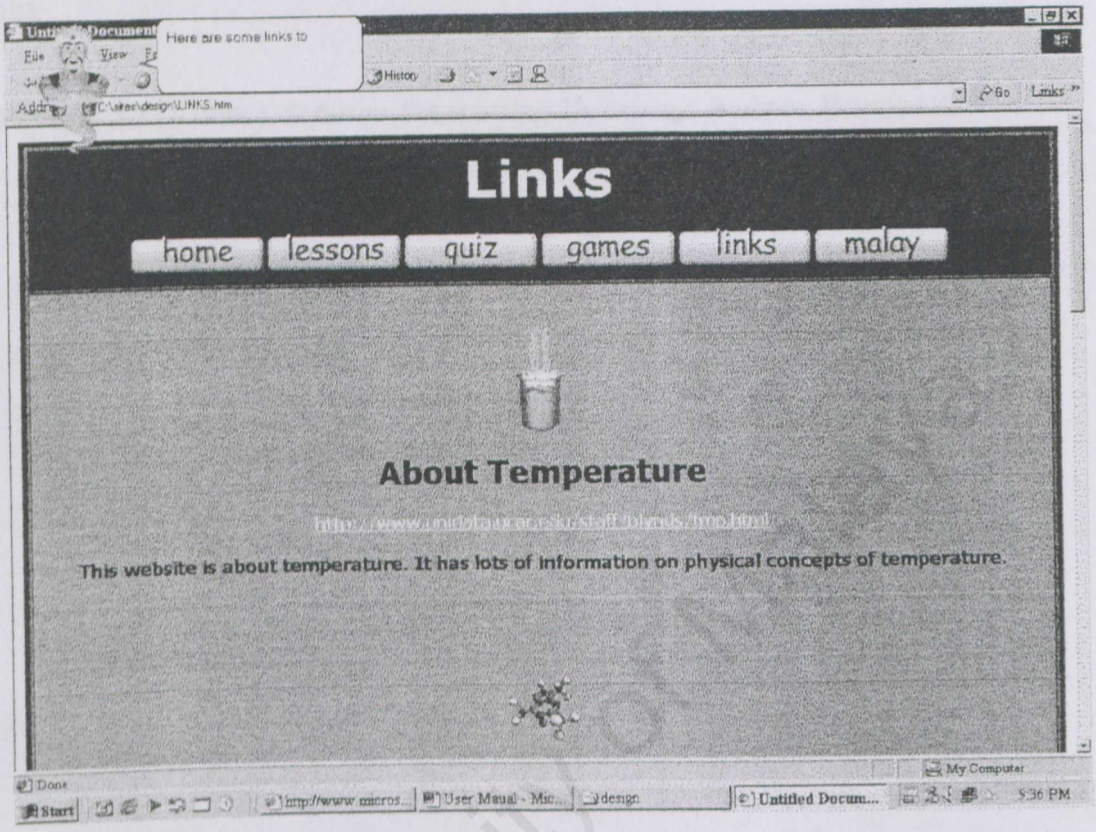

This is a timed math game. The user has to click start then answer the questions that are displayed at a given time. Each time an answer is given by the user, the ' answer ' button should be clicked in order to check the answer. The user can play again till the previous score is beaten.

Figure 9.12 : Age calculator




This game displays few interesting facts when the user inputs their birth date. The number of days of the user's next birth date and the age of the user will be displayed in detail till the present millisecond.

**Figure 1.13 Links**




Links in this page are to educational sites and also related mathematics sites. These links are interesting and contains useful information for students.

## REFERENCE

**Books**

[a] Pfleeger, S.L. ( 1998 ). *Software Engineering Theory and Practice*. Prentice Hall.

[b] Jeffrey L. W., Lonnie D. B., Kevin C. D. ( 2000 ). *System Analysis and Design Methods*. 5 th ed. Mc Graw Hill.

**URL**

[1] http://searchwebmanagement.techtarget.com/sDefinition/0,,sid27_gci332239,00.html
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[2] http://www.chips.navy.mil/archives/94_jan/file10.html
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[3] http://www.hodi.com/CD-ROM_advantages.html
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[7] http://www.stemnet.nf.ca/~elmurphy/emurphy/ile.html
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[8] http://www.students.cs.uu.nl/~ahurk/scriptie/waterfall.html
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[9] http://searchvb.techtarget.com/sDefinition/0,,sid8_gci519580,00.html
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[13] http://www.Google.com
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[17] http://www.whatis.com
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Systems analysis and design methods