WEB-BASED E-LEARNING SYSTEM SCIENCE YEAR ONE

EXPLORE SCIENCE AND MATHS

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Abstract

Explore Science & Maths System is a Web-based E-learning System Science for Year One students. The e-learning system enables the users to access Science Year One syllabus as an alternative process in learning.

The Explore Science & Maths System refers to a well-designed set of interactions with sufficient contents of notes, exercise, quiz and revision activities. Games are included to create potential creative skills and understanding. Besides, there is an animated genie to guide and make the learning environment more fun and interesting.

The e-learning system as a learning tool is developed based on increment development model. Functional and non-functional requirements of this system discussed to ensure system requirements are delivered efficiently so system functionality is available earlier.

Basic technologies concept of the system for example ASP, Microsoft FrontPage and Flash MX and Adobe Photoshop 7.0 are selected in the system development. The features of Explore Science & Maths System such as user friendly, easy to navigate, interactive and modularity is flexible enough to allow for different learning paths on learning styles and abilities for the users.

Acknowledgement

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CHAPTER 1

Introduction

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Chapter 1: Introduction

1.1 Problem Domain

Learning is a life-long process. Education is crucial in the creation of knowledge manpower to support the activities of our country. In fact, education is priceless investments that would satisfy personal goals as well as the varied and changing needs of the national and global marketplace, economy and society. Clearly, the potential of learning in advance of Information and Communications Technology (ICT) is the biggest thing to hit the education arena since the adoption of mass schooling.

The domain problem of the project will discuss

- need to develop an online system despite of traditional learning limitations.
- Bahasa Melayu as medium instruction

1.1.1 Why develop an online system?

The style of education in Malaysia is mostly traditional classrooms. Here, learning if often focused on the instructor (teacher) whereby information tends to flow from the

instructor to the learner. Students are working together in groups to solve problems, giving knowledge a much-needed social context. Traditional pencil-and-paper tests are giving way to assessments embedded in learning that based on student portfolios, notebooks, and projects (techgap, 2003).

Children learning straightforward tasks from a book which education was based had to master basic skills before they could move on to higher-order skills. School curriculum therefore built up knowledge layer by layer, with each layer dependent upon what went before. Multiple choice tests/ exams measured whether the basic skills studied. Once students had demonstrated their mastery of the material, they could move on to the next level (techgap, 2003).

The innate learning capabilities of the young now joined with interactive learning skills achieved through encounters with game and other information technology. The new challenge for education is twofold: First, basic skills learned in school applied to aid the general educational reform effort. Second, individualizing the instructional process where the students (children) have to have an opportunity to engage in what be called playful exploration (techgap, 2003).

Therefore, the new findings of research of the domain provide a blueprint for the restructuring of education in advance of information technology generation today.

According to Dr. Abtar Kaur, director of the Centre for Instructional Design and Technology, University Terbuka Malaysia (UNITEM), creating new paradigms for education require rich learning environments supported by well-designed resources and the Internet is one such medium that can do this. According to her, compared to a traditional class, an online class on the other hand focused more on the learner. This is because online learning has more responsibility for their learning, and instructors spend much more time providing resources that delivering contents (info1, 2002).

Clearly, an online course delivery system is essential due to the following reasons:-

- improve the quality and effectives of education by using the computer support a collaborative learning process.
- to allow learners and instructors to participate in remote learning communities using personal computers at home or at work.
- to take effort and responsibility in learning where the instructors spend more time providing resources than delivering contents.

1.1.2 Usage of Language

Language is an important tool to communicate with one another. English or any other language cannot learn as a subject as effectively as it can learn through usage as a medium of instruction.

Malaysia is multi-racial country. In order to develop and to forge the national integration, the government implemented Bahasa Melayu as the national language in the last two decades. Bahasa Melayu has emerged, onto center stage in all aspects of national life; strengthening its position as the official language, the language of government and the courts, and in the process, replaced or replacing English as the key medium of instruction in all institutions of learning, from primary to universities.

The past language policy, which Datuk Suhaimi Ibrahim from Federation of Peninsular Malaysia Malay Students (GPMS), called the mistake of history, "caused the national education system to fail in providing appropriate opportunities for students to master the English language," (voice, 2003). This state of affairs is a subject of great concern and anxiety as Malaysians contemplate their position and integrate with the globalization.

In fact, the language of knowledge, the Internet and business in the single global economy is English. Bahasa Melayu is inadequate in its function as a language of knowledge, and its limited application in the world should signal a new beginning for the national language.

Nevertheless, recently the government has reviewed English as its medium of instruction. Along this policy, the government has implemented a policy learning Mathematics and Science in English effective this year, 2003 for Year One, Form One

and Lower Six students. One of several support mechanisms introduced by the Ministry of Education is **ETeMS** or English for Teaching Mathematics and Science to ensure that teachers will have basic capacity to use English as the medium of instruction in schools.

1.2 Research Objectives

The concept of e-learning in education includes systems that enable information gathering, management, manipulation, access and communication in various forms.
In fact, an e-learning system for Year One students will enable them to realize their capabilities and learning skills in the new challenge of their education.

1.2.1 E-learning Objectives

1. Provide learning Science in English for Year One students, mainly to enhance the English language skills.
2. To promote, enhance and strengthen the English language as a medium of instruction.
3. The innate learning capabilities of the Year One students with interactive learning skills achieved through online learning.

4. Save time – learners can learn at their own pace since they decide according to their own schedules when the lesson times will be.
5. Anywhere – learners' learning options are not constrained by their geographic location.
6. Faster learning – at reduced costs because learners do not have to worry about travel costs or waste time commuting to classes.
7. Skills – the side benefits of learning new technologies and technical skills.
8. Commitment - the online system focus more on the learner and less on the instructor, which means that instruction, can be more customized and flexible.

1.3 Scope of Research

1. Targeted for users - students Year One, parents and teachers.
2. The system is freeware and without any of the traditional learning limitations of time, space and place.
3. It is a web-based system.
4. The system is in English.

ID	Task Name	Start Date	End Date	Duration
1	**Initial Studies and Investigations**	**6/16/2003**	**6/23/2003**	**8d**
1.1	Initiation	6/16/2003	6/19/2003	4d
1.2	Feasibility studies	6/19/2003	6/22/2003	4d
2	**Research and Analysis**	**6/23/2003**	**7/1/2003**	**9d**
2.1	Planning design	6/23/2003	6/26/2003	4d
2.2	Analysis on feasibility studies	6/26/2003	6/30/2003	5d
3	**Methodology**	**7/2/2003**	**7/16/2003**	**15d**
3.1	Model	7/2/2003	7/4/2003	3d
3.2	Questionnaire and Interviews	7/4/2003	7/11/2003	8d
3.3	Electronic Survey	7/13/2003	7/16/2003	4d
4	**System Analysis**	**7/15/2003**	**7/29/2003**	**15d**
4.1	Functional requirement	7/15/2003	7/18/2003	4d
4.2	Non-functional requirement	7/18/2003	7/20/2003	3d
4.3	Hardware requirement	7/20/2003	7/23/2003	4d
4.4	Software requirement	7/23/2003	7/26/2003	4d
5	**System Design**	**7/29/2003**	**8/20/2003**	**23d**
5.1	System architecture design	7/29/2003	7/31/2003	3d
5.2	Structural design and flow chart	7/31/2003	8/4/2003	5d
5.3	Storyboard	8/4/2003	8/18/2003	15d
6	**Discussion**	**8/18/2003**	**8/25/2003**	**8d**
6.1	Problems encountered	8/18/2003	8/19/2003	2d
6.2	System advantages	8/19/2003	8/20/2003	2d
6.3	System limitations	8/20/2003	8/21/2003	2d
6.4	Evaluation results and future enhancement	8/21/2003	8/22/2003	2d
7	**Documentation**	**7/10/2003**	**9/14/2003**	**66d**

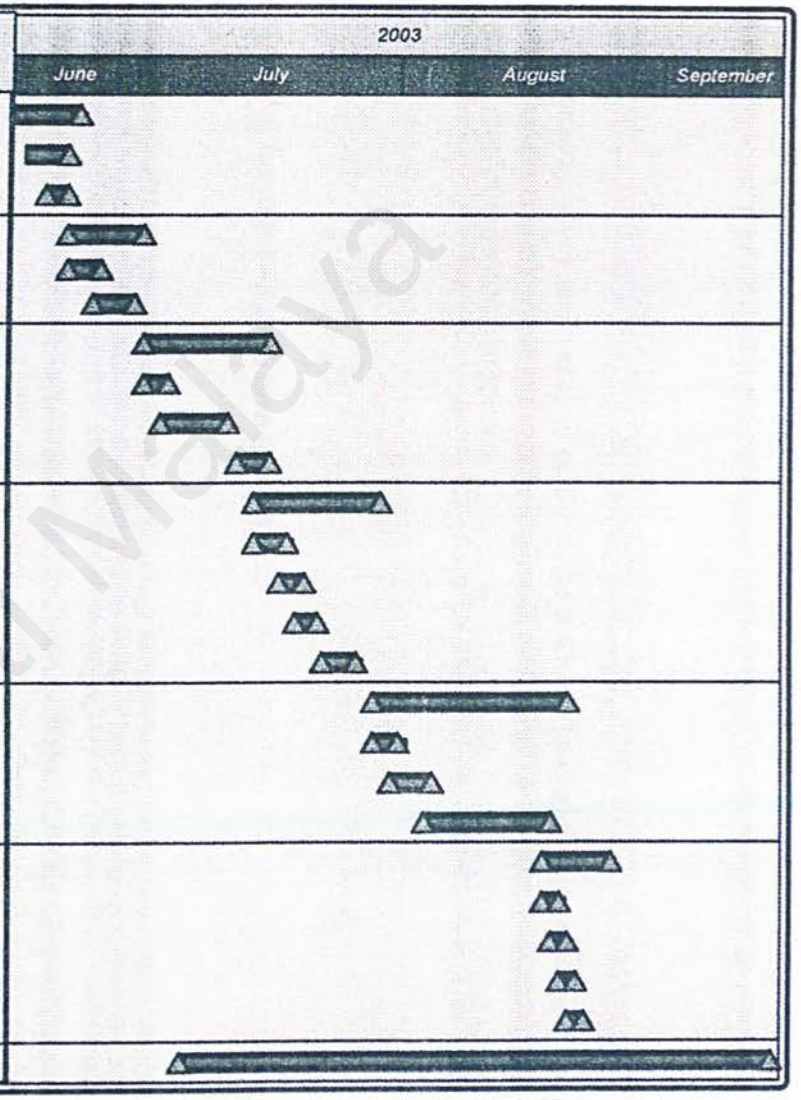


Table 1.4: Project Timeline (E-learning System Science Year One)

Prepared by: Sandhya @ 25/9/2003

1.5 Content of dissertation

1.5.1 Chapter 1 – Introduction

This chapter gives an overview of the system to be developed. It provides an overall perception of the system proposed.

1.5.2 Chapter 2 - Literature Review

This chapter reviews in detail the education policy by the Malaysia government in teaching-learning Mathematics and Science in English. In addition, the research analysis includes surveys carried out prior to design and implementation of the system. Decision made on the proposed system will be based on the research results acquired from this chapter.

1.5.3 Chapter 3 - Methodology

The contents of this chapter include software process models and research methods used to develop the system. In addition, various development tools and software requirements also concluded in this chapter.

1.5.4 Chapter 4 - System Analysis

This chapter is inclusive of the project needs that align with the user requirements and other environmental factors. The topics discussed are functional requirement, non-functional requirement, hardware requirement and software requirement.

1.5.5 Chapter 5 - System Design

The content noted covers the aspects in designing throughout the project. The techniques used are system architecture design, structural design, flow chart and storyboard.

1.5.6 Chapter 6 - Discussion

The topic focus on analysis studies, output of research, problems encountered throughout the analysis phases and solutions, limitations and suggestion to enhance the project in near future.

1.5.7 Appendix

Questionnaires, brochures and articles about e-learning are being attached.

1.5.8 References

This topic conclude all references used throughout the project.

1.6 Conclusion

The aim of this project is to develop a Web-based E-learning System Science for Year One where the user can access the website at any time and any where.

Thus, the project quality is relied on the ability of the program to meet the objectives and scope along with the right alignment with user needs.

CHAPTER 2

Literature Review

Objectives

- **Online definitions**
- **Project analysis**
- **Questionnaire analysis**
- **Human computer interaction**

Chapter 2: Literature Review

2.1 Definitions

In order to fully understand the concept of e-learning, it is important to understand the difference between web-based instruction and web-based learning.

2.1.1 Web-based Instruction

Web-based instruction (WBI) is a hypermedia-based instructional program, which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning fostered and supported. WBI should therefore include many resources, support, collaboration, implement web-based as part of the learning framework and support both novices' experts (info1, 2002).

2.1.2 Web-based Learning

Web-based learning (WBL) meanwhile, refers to a well-designed set of interactions that harness with Web to ensure learning achievement, but is flexible enough to allow for different learning paths based on learner experiences, prior knowledge, learning styles and abilities. It is a technique for engaging students in active learning, which uses the Web and other resources as they strive to understand a topic (info1, 2002).

2.1.3 E-learning Defined

There are numerous names for *open, flexible and distributed learning* activities, including E-Learning, Web-Based Learning (WBL), Web-Based Instruction (WBI), Web-Based Training (WBT), Internet-Based Training (IBT), Distributed Learning (DL), Advanced Distributed Learning (ADL), Distance Learning, Online Learning (OL), Mobile Learning (or M-Learning) or Nomadic Learning, Remote Learning and Off-site Learning (framework, 2003).

Design, development, implementation and evaluation of open, flexible and distributed learning systems require thoughtful analysis and investigation of how to use the attributes and resources of the Internet and digital technologies in concert with

instructional design principles and issues important to various dimensions of online learning environments (framework, 2003).

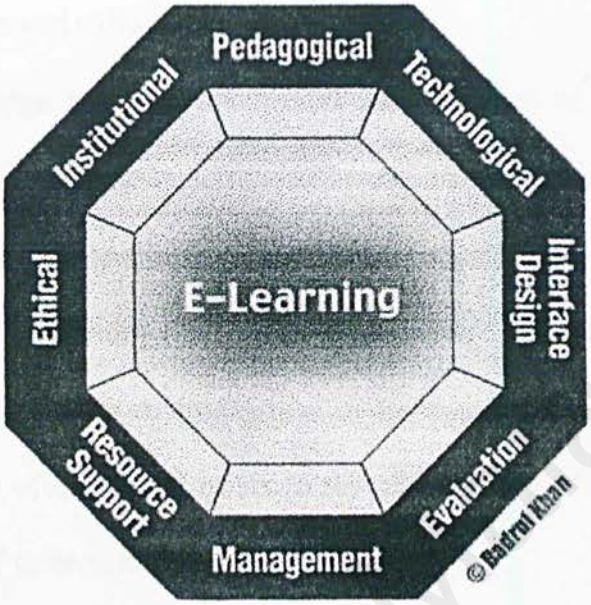


Figure 2.1.3: The E-learning Framework

According Dr. Badrul Khan, the E-learning Framework encompasses various factors discussed in the eight dimensions of the framework as shown in Figure 2.1.3 can provide guidance in the design, development, delivery and evaluation of flexible, open and distance learning environment.

1. The **pedagogical** dimension of E-learning refers to teaching and learning. This dimension addresses issues concerning content analysis, audience analysis, goal

analysis, medium analysis, design approach, organization and *methods and strategies* of e-learning environments.

2. The **technological** dimension of the E-Learning Framework examines issues of technology infrastructure in e-learning environments. This includes infrastructure planning, hardware and software.
3. The **interface design** refers to the overall look and feel of e-learning programs. Interface design dimension encompasses page and site design, content design, navigation, and usability testing.
4. The **evaluation** for e-learning includes both assessment of learners and evaluation of the instruction and learning environment
5. The **management** of e-learning refers to the maintenance of learning environment and distribution of information.
6. The **resource support** dimension of the E-Learning Framework examines the online support and resources required to foster meaningful learning environments.
7. The **ethical** considerations of e-learning relate to social and political influence, cultural diversity, bias, geographical diversity, learner diversity, information accessibility, etiquette, and the legal issues.
8. The **institutional** dimension is concerned with issues of administrative affairs, academic affairs and student services related to e-learning (framework, 2003).

The Internet and the enormous opportunity embedded in global education have propelled the rapid growth of e-learning. In fact, the fast development of e-learning as a viable

alternative to traditional learning methods has become inevitable, given the widespread acceptance of the Internet as a vehicle for communications and information retrieval (info1, 2002).

So, what is e-learning then? E-learning refers to the use of the Internet to deliver a broad array of solutions that enhance knowledge and performance. E-learning involves accessing information and communicating with online instructors through the Internet. It combines both WBL and knowledge management attributes. Precisely, e-learning is the alternative leaning process (info1, 2002).

The components of e-learning include content delivery in multiple formats, management of the learning experience, and a networked community of learners, content developers and subject matter experts (info1, 2002).

2.2 Research Analysis

The analysis of the project includes

- the Malaysian government policy
- the implementation of ETeMS
- evaluation on existing online (e-learning) systems

- limitation on existing systems
- survey methods

2.2.1 Malaysia Government Policy

According to the Third Outline Perspective Plan 2001 – 2010, Malaysia will upgrade its communications and multimedia infrastructure to excellent standards in that period so that it can support the rapid flow and accessibility of information within the country and across other countries at competitive rates. This includes an integrated bandwidth national backbone to keep in pace with the rapid advances in ICT (info1, 2002).

As part of this initiative, the government has made e-learning one of the seven flagship applications of the Multimedia Super Corridor (MSC), via the Smart School Project, which aimed at assisting the country in managing development and change to become a fully knowledge-based industrialized nation (info1 2002).

In support of this, school and universities have decided to take up the challenges of globalization by changing not only the content of their curriculum and programmes, but more importantly, their delivery systems as well. Information Technology (IT)

enhanced teaching and learning is already making computer in schools, distance-learning, video-conferencing and Internet research a common occurrence (info1, 2002).

2.2.1.1 Initiatives taken

The concept of e-learning in education, as seen by the Ministry of Education, includes systems that enable information gathering, management, manipulation, access and communication in various forms.

According to the Ministry of Education department of higher education director Professor Dr. Hassan Said in his presentation titled *Government and e-Learning: Harnessing e-Learning Values in the Education Sector* during the recent National Conference on Electronic Learning 2002, the ministry has adopter a few strategies aimed at enhancing the use of ICT e-learning (info1, 2002).

This includes several projects, for example:

1. The **Smart School Project** – launched by the Prime Minster in July 1997. The aim of the project was to capitalize on leading-edge technologies and the rapid deployment of the MSC's infrastructure to jumpstart deployment of enabling

technology to schools. There are two components - browser-based teaching-learning materials for Bahasa Malaysia, English, Science and Mathematics, and a computerized smart school management system (info1, 2002).

2. Create a website, **MySchoolNet** - to help increase the use of ICT in education. This website provides links to help teachers and students access educational information readily (info1, 2002).

2.2.1.2 Promoting English as a medium instruction in schools

The proposal of introducing English medium in schools by Prime Minister Datuk Seri Dr Mahathir Mohamad's highlights a few issues:-

1. Firstly, the status of Bahasa Malaysia is at a level where its dominance according to National Education Act 1996 will not be challenged by the introduction of English medium schools

2. Dr Mahathir's pragmatism in recognizing that Malaysians are sorely lacking in their command of English and that this is a structural deficiency that needs to be urgently corrected such as given a globalize ICT environment
3. Teaching-learning Mathematics and Science in English will ensure the status of the national language. The implementation of the policy on a national level will increase

exposure to English in rural areas. It also gives impetus to the training of more teachers who can teach these two subjects in English.

4. The forces of globalization have forced to adopt a more favorable stance towards English. Clearly, Malaysia is given an opportunity relatively in open economy and dependence on foreign trade and investment (ciknet, 2003).

Recently, on August 4, 2003 at the East Asian Congress, Prime Minister Datuk Seri Dr. Mahathir Mohamad said Malaysia has taken the pragmatic approach in adopting English as the language to teach Mathematics and Science while continuing the use of the mother tongue to preserve the country's identity (info2, 2003).

In his speech, he added the government decided that Science and Mathematics taught in English because it is impossible to translate all the words into Bahasa Melayu language. "*Translating a technical paper requires three qualifications - the person must be fluent in English and Malay, as well as conversant with the subject*", he said (info2, 2003).

2.2.2 Implementation of ETeMS

The government on July 16, 2002 announced the teaching of Mathematics and Science in English (mynet, 2002). The project will discuss

- Defined ETeMS
- ETeMS framework
- Levels of implementation
- Teaching materials

2.2.2.1 Defined ETeMS

ETeMS is not to regarded as a complete language development course (due to limited duration of interaction). ETeMS is rather, one of several support mechanisms introduced by the Ministry of Education to encourage the Mathematics and Science or **MST** to develop further the English language competence to a level that will engender optimal performance in and outside the classroom (etems, 2002).

The aim of ETeMS is to ***enhance*** the English language skills of Mathematics and Science teachers to enable them to reach effectively using English as the medium of instruction (etems, 2002).

2.2.2.2 ETeMS Framework

Mrs. Sivagnana Chelvi from the Curriculum Development Centre of MOE dictated (thru interview) the ETeMS framework about the background, preparatory and implementation of the course.

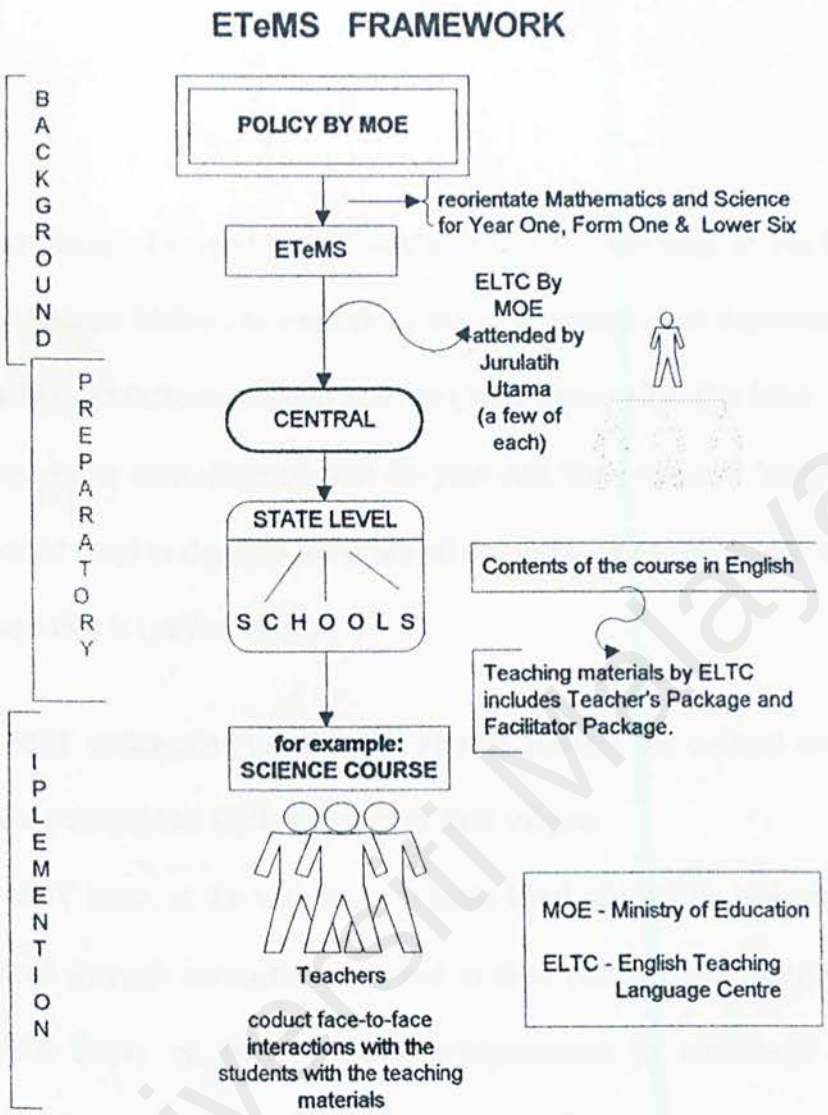


Figure 2.2.2.2 : ETeMS Framework

2.2.2.2.1 Background

The policy to change the medium of instruction in the teaching of Mathematics and Science from Bahasa Melayu to English by the government is an important innovation-affecting teacher of Mathematics and Science (**MST**) generally. The MOE has proposed ETeMS course as an immediate context for year one, form one and lower six students. The **MST** would need to develop the practical competence to deliver the subject matter in the language that is (etems, 2002):

- The **MST** undergoing the **ETeMS** already possess the content area knowledge and the pedagogical skills relevant to their subject
- The **MST** have, at the very least, a basic level of English language proficiency acquired through instruction received in their primary and secondary schooling **ETeMS** draws on these existing competencies to encourage the language development of **MST** in 3 broad areas (etems, 2002):

    a. Language for accessing information
    b. Language for teaching Mathematics and Science
    c. Language for Professional Exchange

2.2.2.2.2 Preparatory

At this stage, the English Language Teaching Centre, Malaysia (ELTC) at the Central Level proposes an English language enhancement programme known as English for Teaching of Mathematics and Science (ETeMS). A few of *Jurulatih Utama* from states level in a number of selected batches from different schools attend the English Language Teaching Centre or ELTC programme. The content of the course is in English (etems, 2002).

2.2.2.2.3 Implementation

Training materials prepared by **ELTC** will form the basis of instruction. Separate courses held for primary and secondary **MST,** and for this purpose, separate training materials have been prepared. Both sets of materials will broadly cover the same skills, using similar- approaches. However, the choice of reading texts and classroom simulation activities will reflect the actual contexts in which the teachers will be working (etems, 2002).

Teachers who attend the course delivery of ETeMS will use self-instructional materials provided by ELTC to teach the students. Materials developed based on modules. For each module, there is a Teacher's Package and a Facilitator's Package. The Teacher's Package contains all the materials that the teacher will need during the module, including texts, task sheets and supplementary notes. The Facilitator's package will consist of trainer notes, suggested answers to tasks in the teacher's package, and additional reference materials. For example, science in English for year one students, the materials used are software of teaching courseware, in face-to-face interactions with the students (etems, 2002).

2.2.2.3 Levels of Implementation

2.2.2.3.1 National (Government) Schools

Beginning of the year 2003, the teaching of Mathematics and Science in English conducted at different levels:

- Year One – all primary schools (SK, SRJKT, SRJKC) and Sekolah Pendidikan Khas (SPK)
- Form One – all secondary schools (SMK)

- Form Six – all secondary schools (SMK)
- 2004 – complete teaching in English will be implemented in Matriculation Program
- 2008 – complete teaching in English will be implemented in Polytechnics
- 2003 too – the teaching of mathematics and Science in English is half-implemented in Year Two, Year Three, Year Four, Year Five, Year Six, Form Two, Form Three, Form Five, Upper Six, Matriculation Program and Polytechnics (mynet, 2002).

2.2.2.3.2 The Malaysia Smart Schools

The Malaysian Smart School is a learning institution that *systemically* reinvented in terms of teaching-learning and management practices to help children cope with the Information Age (bestari, 2002).

The main components of the Smart School identified as follows:

- The teaching-learning environment

- The school management system
- Policies
- People, skills, and attitudes
- Technology
- Processes

These components were examined and reengineered to ensure greater efficiency and effectiveness (bestari, 2002).

Currently there are nine new-piloted Smart Schools as follows:

1. Sekolah Kebangsaan (SK) Presint 8, Putrajaya, Selangor
2. SK Presint 9, Putrajaya, Selangor
3. Sekolah Menengah Kebangsaan (SMK) Putrajaya Presint 8, Putrajaya, Selangor
4. SK Seri Bintang Utara, Taman Shamelin Perkasa, Cheras, Kuala Lumpur
5. SK Seri Bintang Selatan, Taman Shamelin Perkasa, Cheras, Kuala Lumpur
6. SMK Seri Bintang Utara, Taman Shamelin Perkasa, Cheras, Kuala Lumpur
7. SMK Seri Bintang Selatan, Taman Shamelin Perkasa, Cheras, Kuala Lumpur
8. SR Kompleks Batu Permai, Kuala Lumpur
9. Sekolah Menengah Kompleks Batu Permai, Kuala Lumpur (bestari, 2002).

Puan Wan Patanah from SK Seri Bintang Utara, Kuala Lumpur (interview) said the smart school is following the teaching learning of Mathematic and Science in English. Apart from that, she said that currently there is no online system for Mathematics and Science in English for Year One, Form One and Lower Six yet.

2.2.2.3.3 The Malaysian Vision School

A Vision School consists of students from national, Chinese and Tamil schools share common facilities with a view to fostering racial integration. For example is the Subang Jaya Vision School complex. The three schools in the Subang Jaya Vision School complex, which opened in June2002, are SK Datuk Onn Jaafar, SRJK (C) Tun Tan Cheng Lock and SRJK (Tamil) Tun Sambanthan. These schools are participating in teaching and learning Mathematics and Science in English for Year One, Form One and Lower Six students (ciknet2, 2002).

2.2.2.4 Teaching Materials

The teachers are equipped with tools in aid of teaching Mathematics and Science in English to students in the classroom. A few of the teaching materials is for example the teaching courseware developed by Curriculum Development Centre together with a few local multimedia companies selected by the MOE. The software provided includes a few phases as mentioned below (mynet1, 2002):

- Year One - Science, Mathematics, English SK, English SJK
- Form One - Science, Mathematics, English
- Lower Six - Biology, Chemistry, Physics, Addition Mathematics T, Mathematics S, Mathematics T

Each school provided five sets of software of teaching courseware and five sets of software of Teachers Guideline for each subject. The Teachers Guideline CD guides how to use the CD, for example Teaching Program and Students Activity Worksheet for each topic. Figure 2.2.2.4 shows a sample of software of teaching courseware for the teachers to teach in science in English for Year One students (mynet1, 2002).

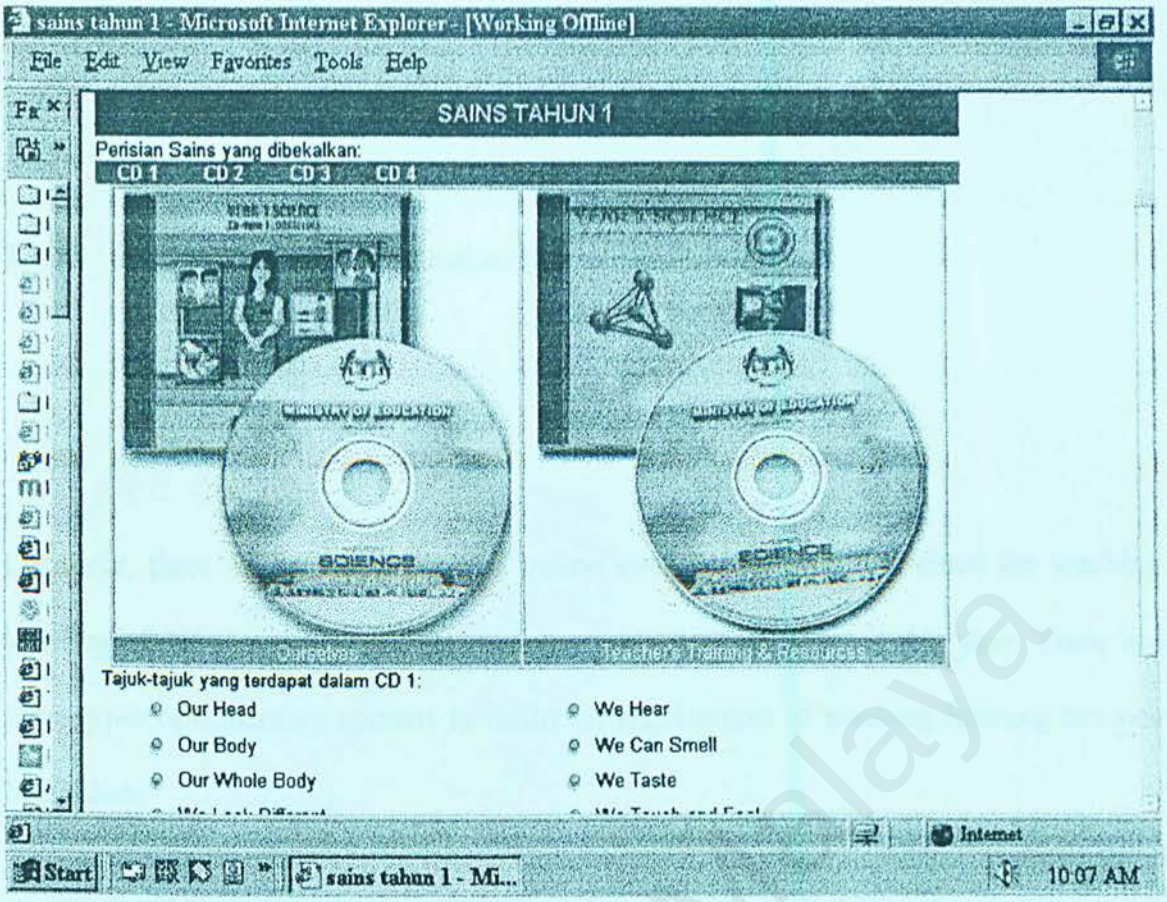


Figure 2.2.2.4: Sample of software of teaching courseware

Besides, ICT tools provided to teachers who are involved in EteMS as follows:

- Notebook
- LCD Projector
- Television (for smaller schools, which LCD Projector not provided)
- Trolley
- Speaker and Subwoofer
- Uninterruptable Power Supply (UPS)

- Generator Sets provided to schools, which have no power supply (mynet2, 2002).

2.2.3 Evaluation on existing online (e-learning) systems

Currently, there is limited web-based online system in the market since the teaching learning of Science for Year One students was only implemented this year. There are three types of e-learning systems to fulfill the requirement of teaching learning Science in English:

- Standalone program
- Online (paid) system
- Online (freeware) system

2.2.3.1 Standalone Program (Single System)

Standalone refers to any program or system that not connected to anything else. It exists or runs completely by itself. The term standalone defined as programs or software that

can run without an operating system. For example, a "standalone program" compared to "a client-server system" means a program that runs by itself rather than being distributed or networked as shown in Figure 2.2.3.1..

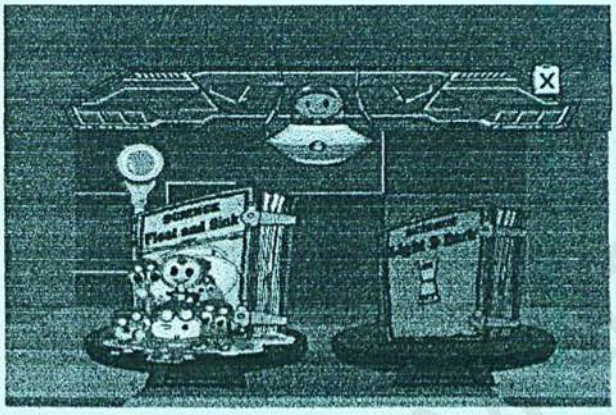


Figure 2.2.3.1: Standalone Program

Currently, there is very limited compact disc (CD) available in the market to help and support users to teach learn Science in English. A user has to buy the CD of the subject concerned.

2.2.2.2 Online (paid) System

Online (paid) system that runs with an operating system and connected to a network, for example is Internet. The user has to pay in order to access the online system. This type of system is very expensive. For example is the Edu-2U Portal Sdn. Bhd. organization where the users need to purchase the Score-A programme costing RM660.00 to access the e-learning system. Please refer to the appendix for the sample of the brochure.

2.2.2.3 Online (freeware) System

Any user can access a freeware system that connected to a network at their convenience in addition, at minimal cost. Currently there are a few existing online systems science for year one on the website. Each system has its own features and advantages.

2.2.2.3.2 WebSekolah Berita Harian

WebSekolah Berita Harian is a freeware online system jointly organized by MOE Malaysia and Public Institutions of Higher Learning.

Step1

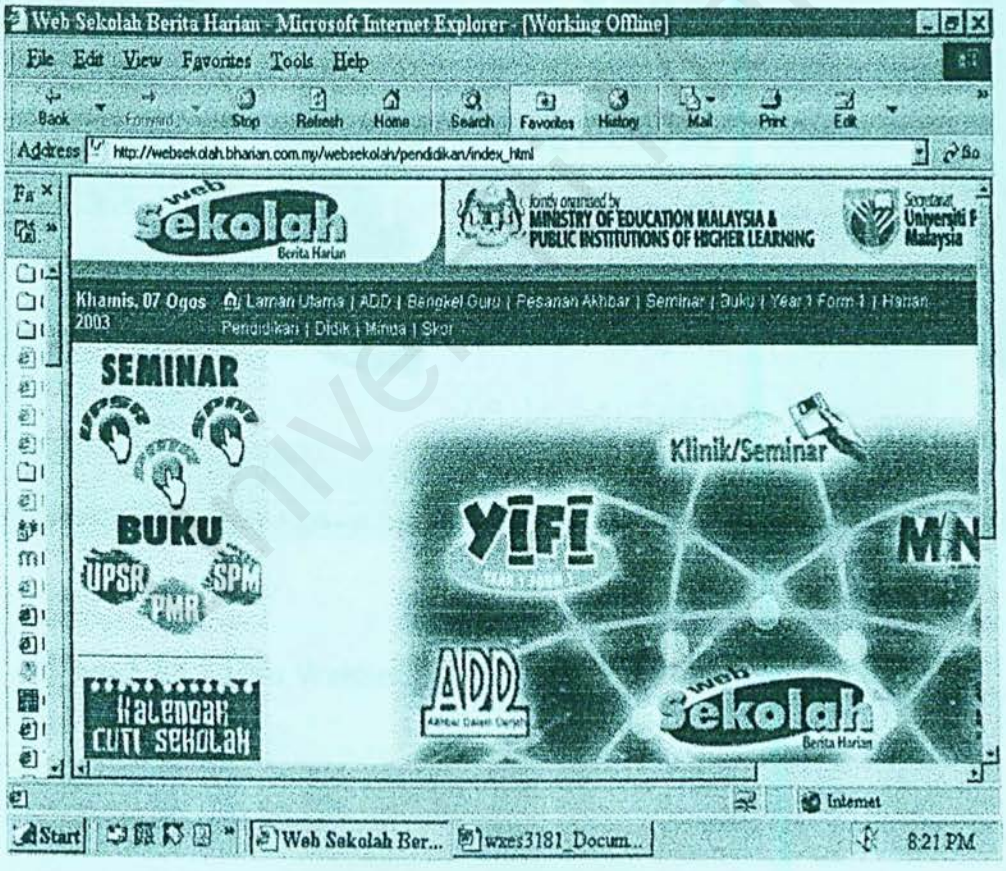


Figure 2.2.3.3.1(a): WebSekolah Berita Harian - Click YIFI

On the website of WebSekolah Berita Harian (berita1, 2002), the user need to click YIFI Year 1 Form 1 accesses the information of Year One.

Step2

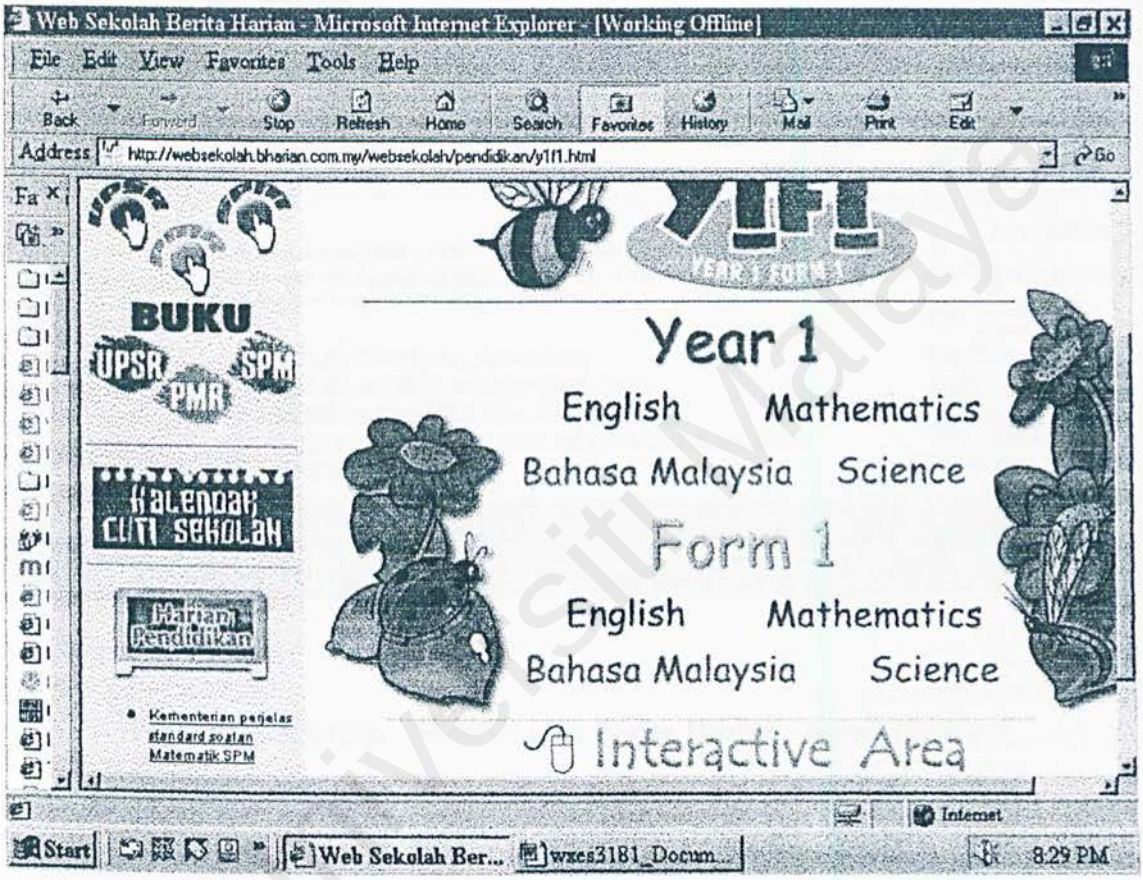


Figure 2.2.3.3.1(b): WebSekolah Berita Harian - Select Science Year 1

Next, the user has to select Science Year 1(berita2, 2002).

Step3

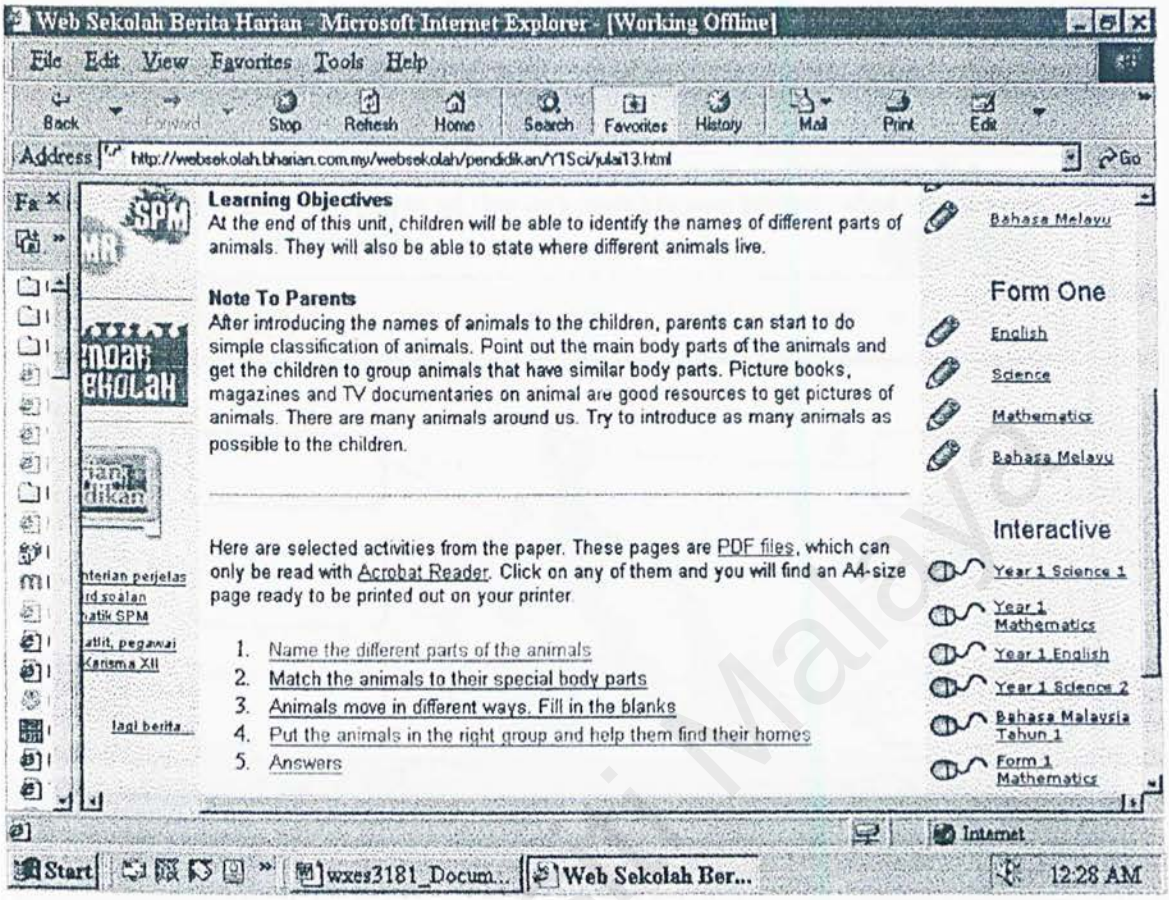


Figure 2.2.3.3.1(c): WebSekolah Berita Harian - Select the topic

The user needs to download the Acrobat reader before reading the topic of the activities (berita3, 2002).

Step4

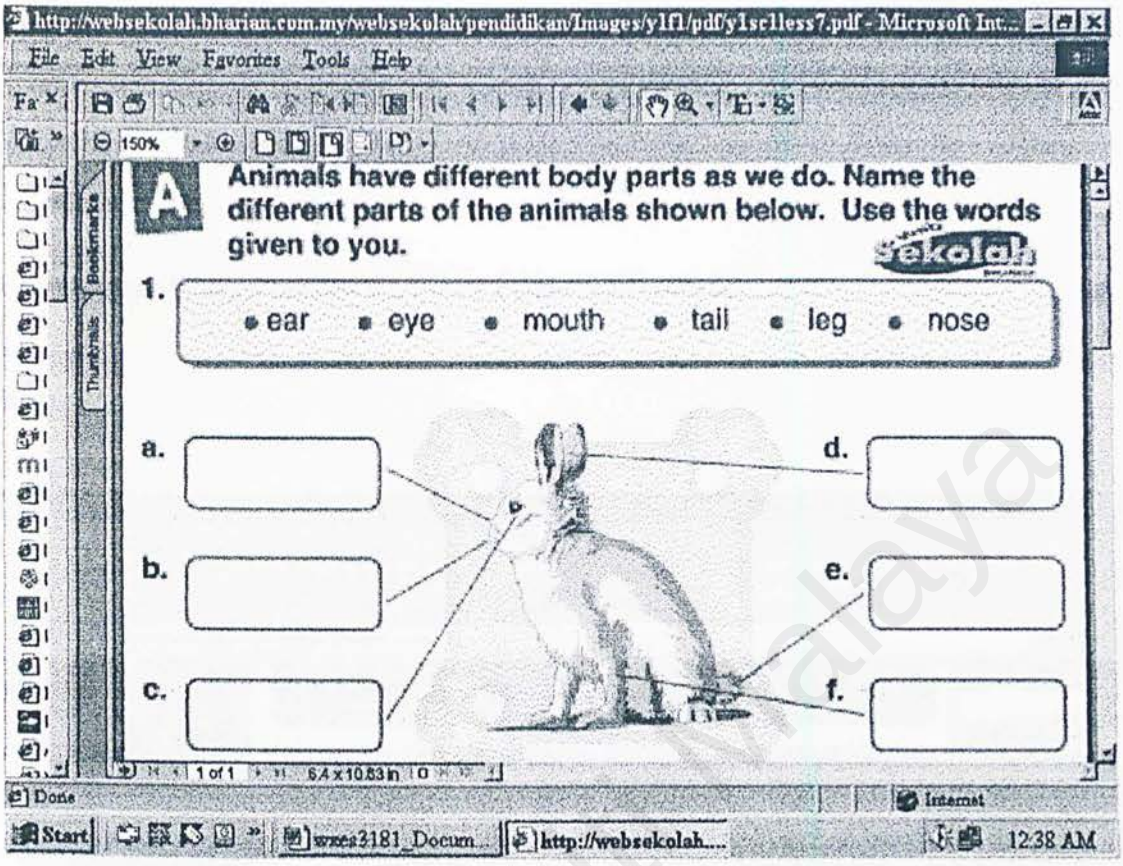


Figure 2.2.3.3.1(d): WebSekolah Berita Harian - Students Worksheet

The activity requires the user to print out the worksheet and do the exercise (berita4, 2002).

2.2.2.3.3 Portal Pendidikan Utusan Malaysia

The Utusan Malaysis creates the Portal Pendidikan website.

Step1

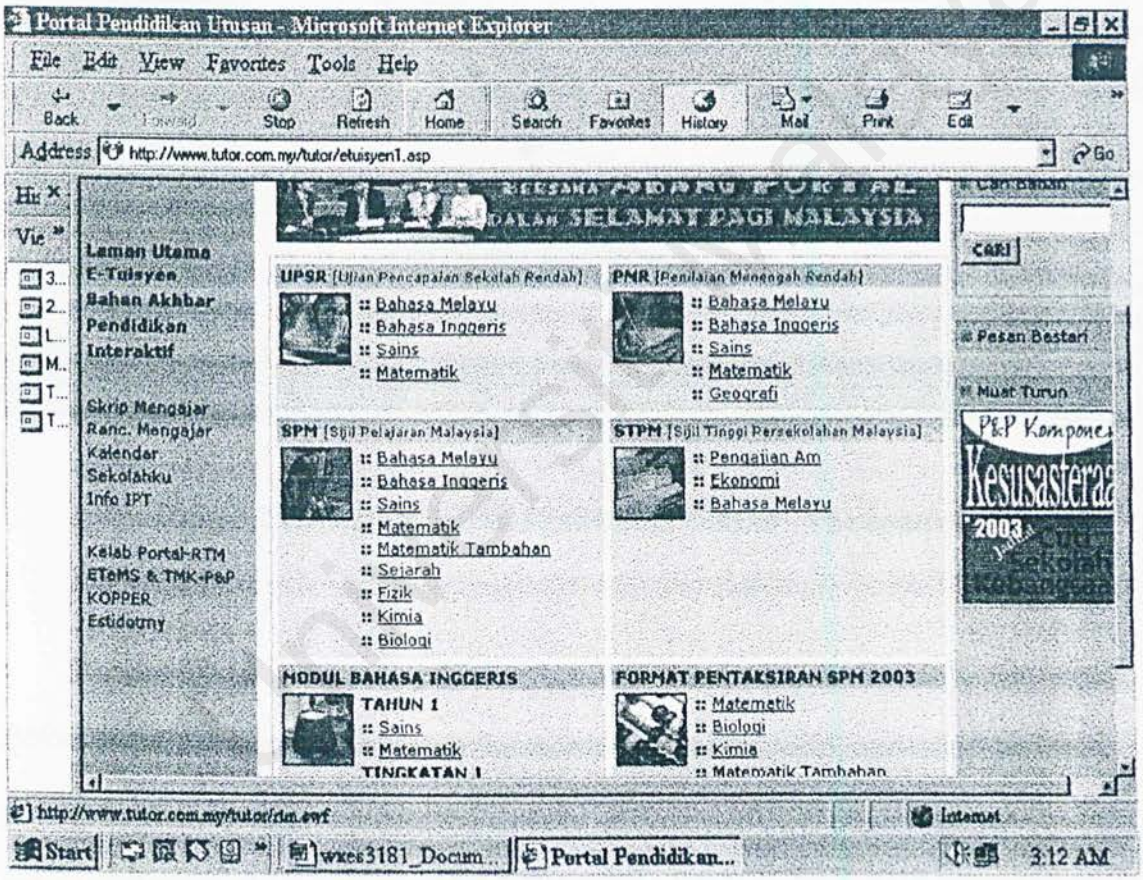


Figure 2.2.3.3.2(a): Portal Pendidikan Utusan - Click *Tahun 1 Sains*

On the website of Portal Pendidikan Utusan Malaysia (utusan1, 2002), the user need to click the English module of science year 1.

Step2

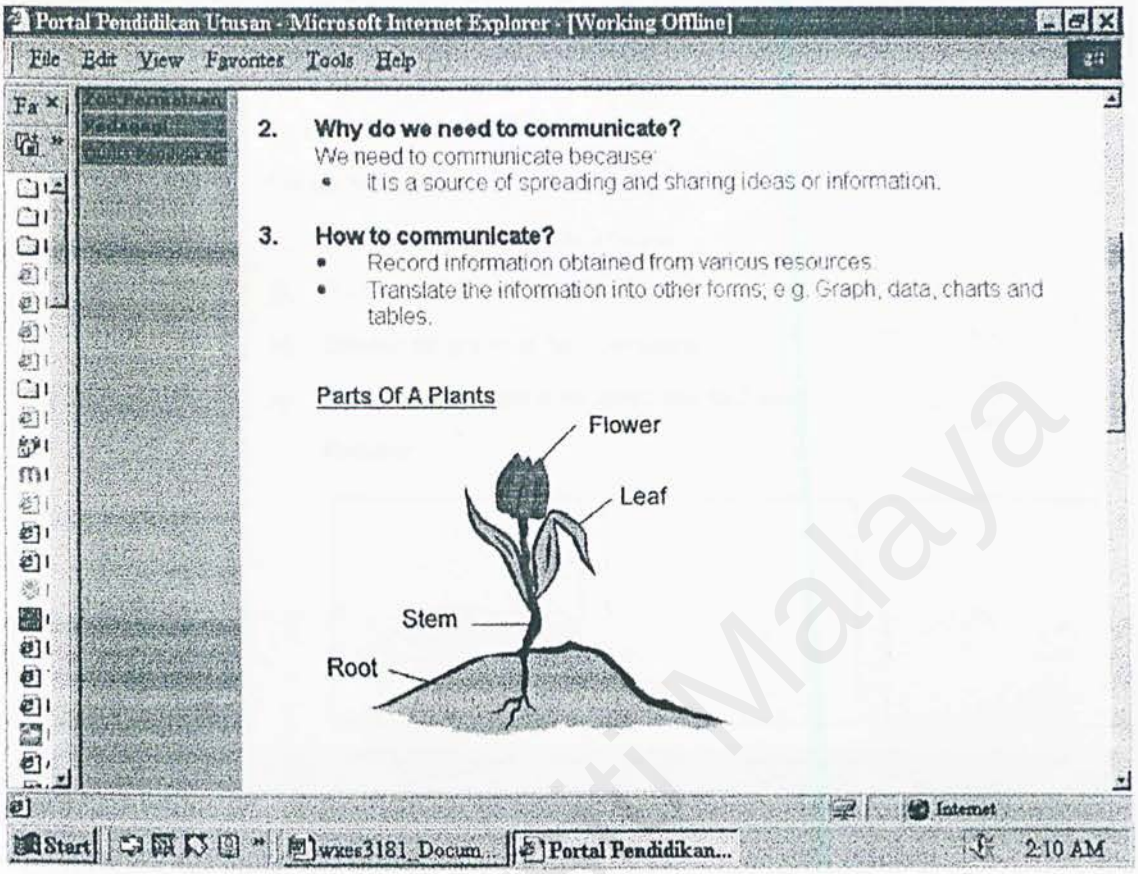


Figure 2.2.3.3.2(b): Portal Pendidikan Utusan - The contents

Before step2, the user need to select the month-week of the topic, next select by clicking parents or students icon to access the notes of science year 1. The user can only read the contents of the website and print the notes if necessary (utusan2, 2002).

Step3

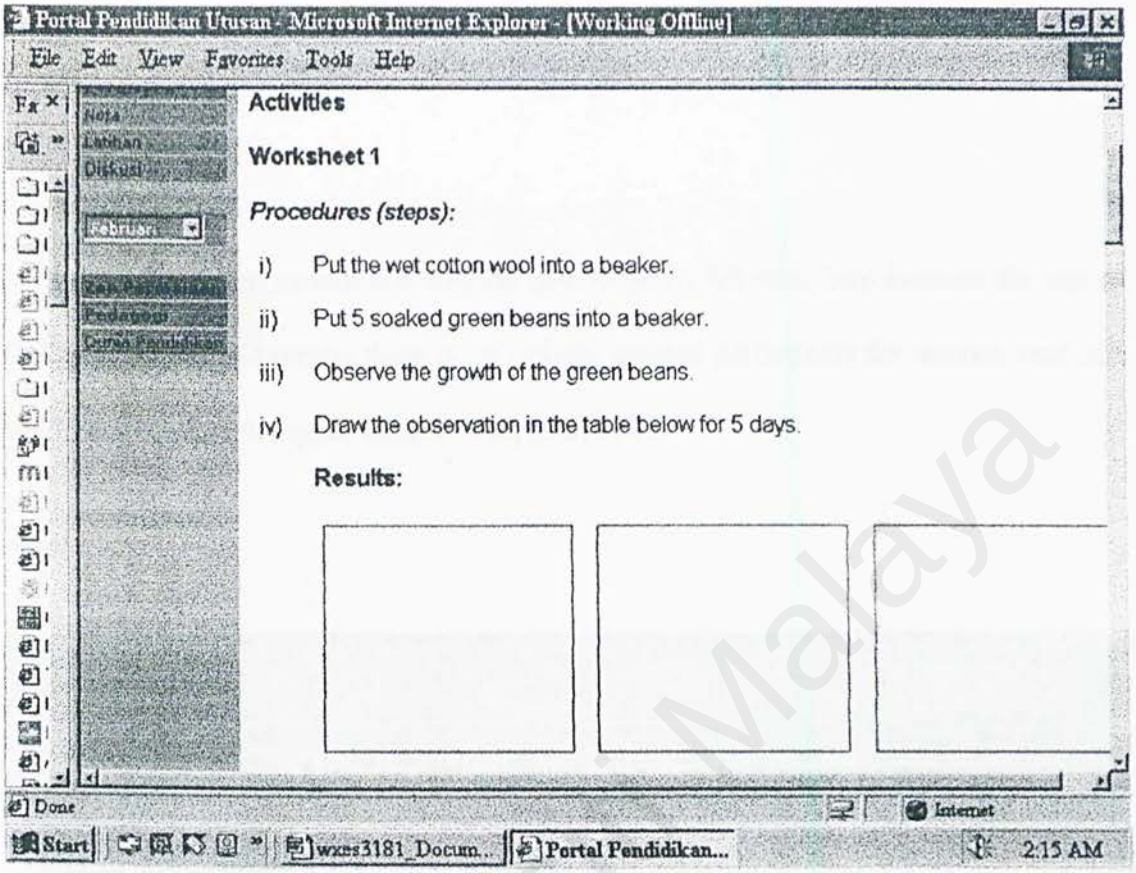


Figure 2.2.3.3.2(c): Portal Pendidikan Utusan - Worksheet

The activity worksheet encourages the users to do experiment as the above sample. Another activity of the worksheet requires the user to print the worksheet to "cut and paste" the parts of an animal. This system is monotonous and regarded as a traditional classroom of teaching learning (utusan3, 2002).

2.2.2.3.4 MySchoolNet

MySchoolNet online system is a website developed by MOE to help increase the use of ICT in education. Currently there is no website created particularly for science year one child yet as shown in Figure 2.2.3.3.3 (mynet3, 2002).

Step1

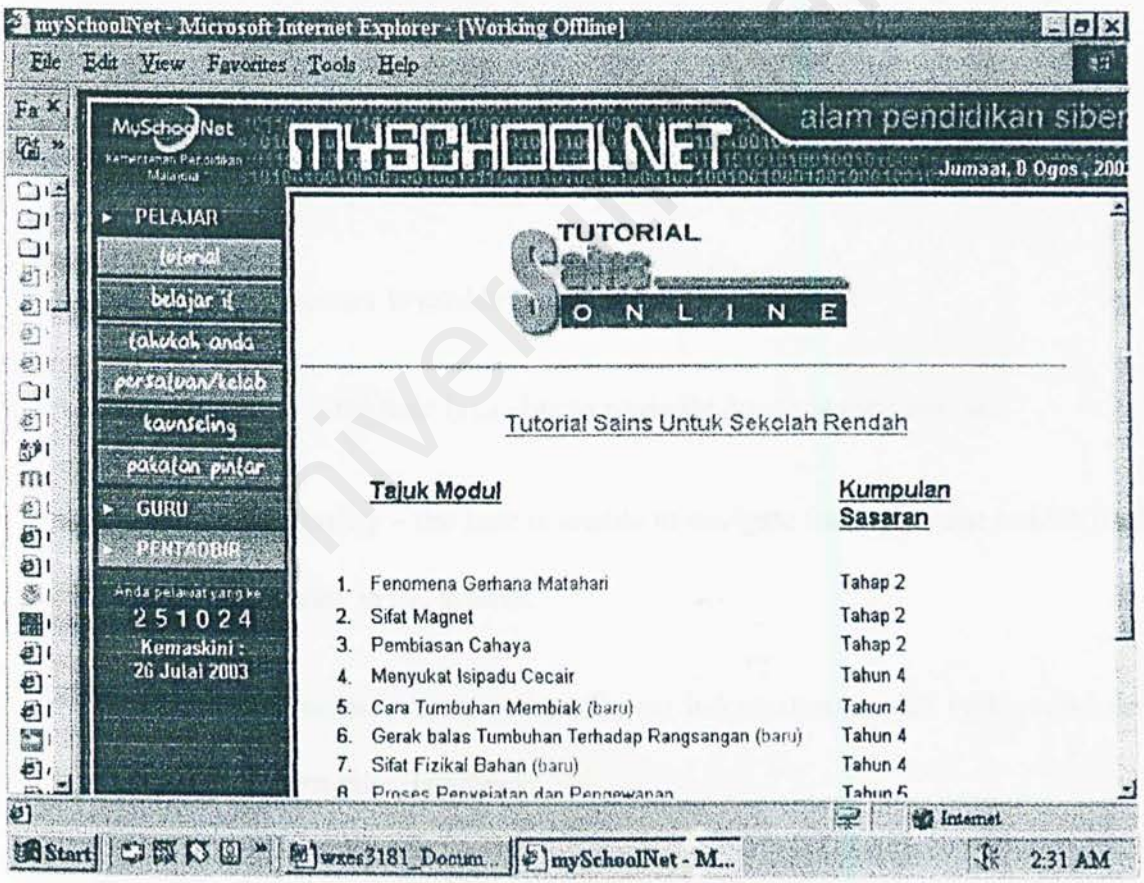


Figure 2.2.3.3.3: MySchoolNet

2.2.4 Limitations on existing online systems

There are many limitations of the abovementioned online systems developed by Berita Harian and Utusan Malaysia for the Science Year One children:

- Graphical user interface (GUI) – the interface and menu design is limited and monotonous to the user.
- No exercises except worksheets provided.
- User's manual not provided.
- Interaction – the user is unable to interact with the system.
- Static interface – the user is unable to navigate due to static interface.
- Limited functionality – the user is unable to navigate the topics due to lack of the functionality icons in the system.
- Lack of information – there is insufficient information in this system and there none offer informative feedback.

2.2.5 Conclusion

The research analysis of the project concludes that is no proper learning (freeware) system for Science in English Year One in the market. Nevertheless, there is a necessity to develop an online or e-learning system Science in English for Year One students. Hence, the most appropriate is to develop a web-base system that can help the users in teaching-learning Science in English for Year One Students. The new online system should be interactive and user friendly, which is suitable for the users, based on teaching-learning skills. Besides, the system should encourage the users to attempt the test, quiz and play games.

2.3 Questionnaire Analysis

The questionnaire analysis conducted consists of two stages:

- User Characteristic Analyst and E-learning Request – Parents of student Year One
- E-learning System Analysis – Teachers

2.3.1 User Characteristic Analyst and E-learning request

The analysis of user characteristic level was conducted by questionnaire. A sample of the questionnaire is attached to the appendix of the project. The parents of students Year One have answered about 30 sets of questionnaires. Five main topics focused in the questionnaire are:

- Computer user level
- Awareness of learning Mathematics and Science in English.
- Difficulty to understand the learning of Science in English
- Support learning Science in English
- E-learning System Request

Table 2.3.1: Results of E-learning Analysis

RESULTS FROM E-LEARNING SYSTEM ANALYSIS							
	Status	Total	Computer Literate %	Awareness Teaching Science & Maths in English %	Difficulty understanding Science in English %	Support learning Science in English %	E-learning System Request %
English – speaking home	Yes	13	100	69.23	7.69	84.62	76.92
	No		-	30.77	92.31	15.38	23.08
Non-English-speaking home	Yes	17	94.12	52.94	17.65	64.71	41.18
	No		5.88	47.06	82.35	35.29	58.62

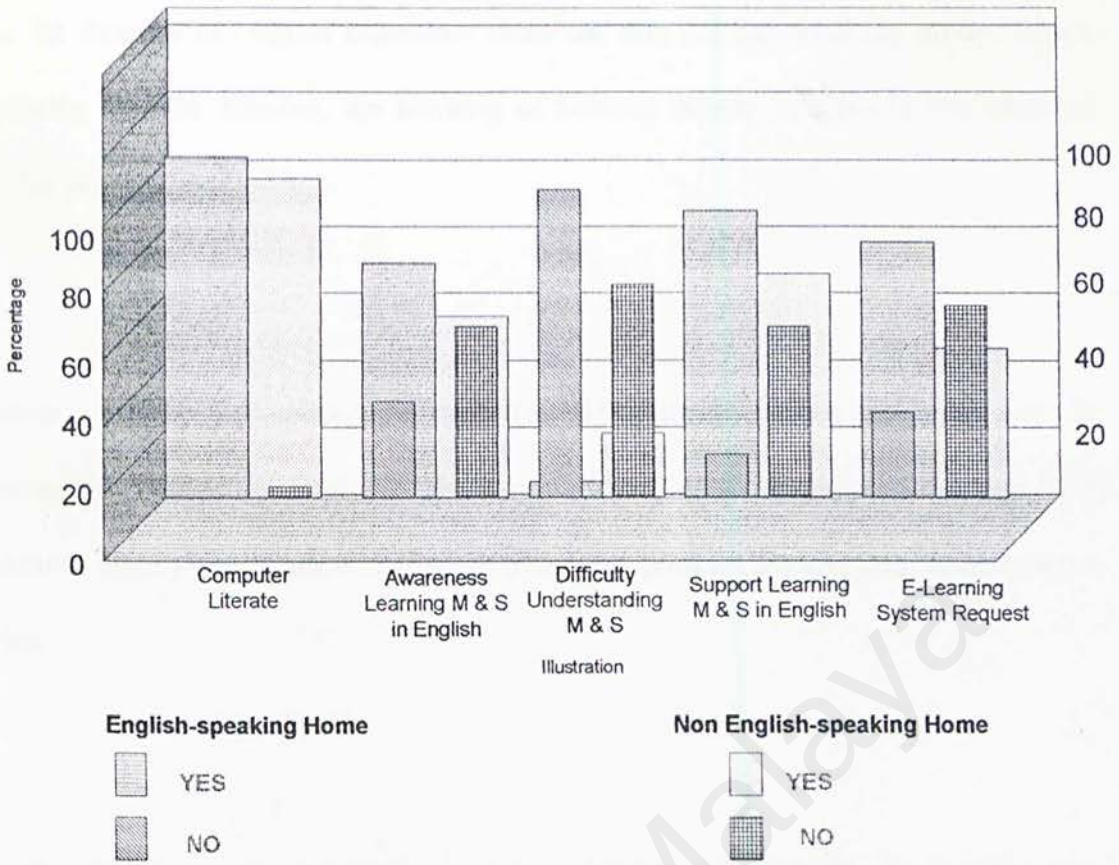


Figure 2.3.1: Illustration on E-Learning Analysis Result

Please refer Table 2.3.1 for the results of e-learning analysis. The results obtained from the survey shown in the graph shown as Figure 2.3.1 above. The contents of the survey discuss about two groups that are the English-speaking home and the non-English-speaking home. From the survey, most of the parents are computer literate. English-speaking group has the maximum level of computer literate (100%) compared to non-English speaking group (94.12%). This is due to the advent and rapid spread of the ICT, and multimedia technologies today.

An average of 60% only from both groups is aware about learning Mathematic and Science in English. This is due to the difficultly in understanding and learning new

terms for Science in English especially from the non-English-speaking group, which contributes 82.35%. Besides, the learning of Science subject in schools implemented only this year.

However, the English-speaking group (92.31%) mostly faces no difficulty in understanding Science in English. The parents from this group support and help their children to understand Science in English by buying books, CDs and cutting newspaper articles.

Majority of both groups support the learning of Science in English. In fact, the non-English-speaking group contributes 64.71% to the new implementation introduced by the government.

Based on E-learning System Request, the request of freeware online system Science in English shows a disappointment especially from the non-English-speaking group. Most of them from this group preferred Science in Bahasa Malaysia rather than English. Meanwhile, others commented that the implementation of learning Science subject is too early for the Year One children. Nevertheless, the English-speaking group was eager to have a freeware online system for their children that will benefit parent, students and teachers. Concisely, the users of the e-learning system Science in English will take time

to adjust and by then will definitely benefit from the system that is simple and user friendly.

2.3.2 E-learning System Analysis

A range of five teachers form three different schools answered the questionnaire analysis. Refer to appendix of the project for the sample of the questionnaire. The issues highlighted in the questionnaire are:

- Objective of ETeMS implementation by MOE
- Effectiveness of ETeMS
- Response of students in Year One
- Sufficient ICT tools in schools
- Online system request

A teacher must attend the ETeMS course implemented by MOE before the deliverance of Science in schools. The results from the teachers commented the aim of implementation ETeMS is to improve and enhance the English language skill.

Apparently, this is not the end. Another reason ETeMS implementation is to facilitate and develop students in schools and higher learning institution to keep up the rapid growth in line with Knowledge based Economy, MSC and ICT.

All the teachers agreed that ETeMS course has been effective teaching Science in English for Year One students. This is because the course provides sufficient teaching materials and develops confidence in delivering Science to the students.

Since the teaching of Science is in English, all schools are equipped with ICT tools for example, laptop computers, LCD projectors and software. Therefore, the method of teaching Science in English with these tools is more encouraging and effective to the students, thus the students respond fairly in the classroom.

The results for an online system request from all teachers were somehow overwhelming. Some of the comments are as following:

- The target users that are the teachers, students and parents would definitely benefit a freeware online system.
- The online system allows the user to access the website at any time and anywhere.
- The requested system too will minimize computer literacy especially among the non-English-speaking home group and give them confidence and understanding to learn Science in English.

- With an online system, the learning of Science in English will be interesting and effective compared to the traditional classroom teaching-learning method.

2.3.3 Interview

Interview could be conducted either on telephone or face-to-face with students. A multi-racial group of ten students of Year One in SRK (2) Simpang Lima, Klang were interviewed. A number of questions asked to acquire information from the students are:

- Do they come from English-speaking home?
- Do they like learning Science in English?
- What is the difficulty faced in understanding Science in English.
- What method is preferred in learning Science in English – based on textbook or LCD projector and software where the contents displayed on the screen.
- Is it easy or difficult to answer Science test questions in the classroom.

As a result, most of non-English-speaking group find it difficult to understand Science in English. Such problems faced because the parents find difficulty to cope teaching their children due to new used in Science and the introduction of this subject is still fresh. However, the students preferred the method of teaching-learning Science in English with ICT tools compared to textbooks. Again, the English-speaking group could answer the Science test in English easily compared to the non-English-speaking group.

2.3.4 Conclusion

The survey method carried out for the e-learning system request includes questionnaires and interviews. The research elements gathered is essential to understand the background of each group to analyze the requirement of e-learning system request.

2.4 Human Computer Interaction (HCI)

2.4.1 What is HCI

HCI (human-computer interaction) is the study of how people interact with computers and to what extent computers are or are not developed for successful interaction with human beings (whatis, 2000). Another definition for HCI is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them (sigchi, 2002).

2.4.2 Goals of HCI

The goals of HCI are to produce usable and safe systems, as well as functional systems. In order to produce computer systems with good usability, developers must attempt to:

- **understand** the factors that determine how people use technology
- **develop** tools and techniques to enable building suitable systems
- **achieve** efficient, effective, and safe interaction (sitepoint, 2001).

2.4.3 Basic Principles of HCI

1. Requirements Analysis

- Establish the goals for the Website from the standpoint of the user and the business.
- Agree on the users' needs and aim for usability requirements.
- Appraise existing versions of the Website (if any).
- Carry out an analysis of the competition.
- Complete discussions with potential users and questionnaires (sitepoint, 2001)

2. Conceptual Proposal

- Outline site design and architecture at an abstract level.

- Perform a task analysis to identify essential features (sitepoint, 2001).

3. Prototyping

- Create visual representations (mock ups) or interactive representations (prototypes) of the Website.
- Evaluate usability using a proven method.
- Using the results, create more mock ups or improve the prototypes.
- Repeat this process until the design and usability goals are met (sitepoint, 2001).

4. Development

- Create the final product.
- Evaluate functionality through testing, quality assurance, usability testing, and field testing.
- Use the evaluation results to improve the product.
- Repeat this process until the business goals are met (sitepoint, 2001).

5. Launch and Housekeeping

- Launch the Website.
- Maintain and tweak with user feedback (housekeeping).

- Use the feedback to create new requirements, and begin major design improvements (system iteration) (sitepoint, 2001).

2.4.4 HCI Research

The foundation of HCI research is based on:

1. Theories
   - **Cognitive Psychology** is the study of how people think and learn (charm, 2001).
   - **Perceptual Psychology** studies how people acquire information from their environment, through their senses, and how that knowledge is then encoded for use in future processes (charm, 2001).
   - **Social Psychology** studies how people behave in the context of their interactions with others (charm, 2001).

2. Models
   - Information Processing Model characterizes humans as information processors. The model explains the movement of information from input to output within a human, via a series of processing stages as shown in Figure 2.4.4 (charm, 2001).

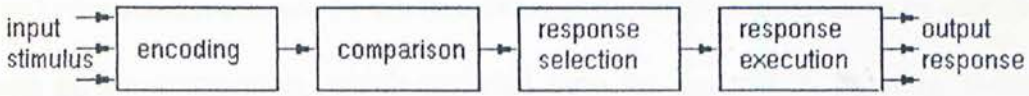


Figure 2.4.4: Information Processing Model

The project will discuss major areas of HCI research, their descriptions, as well as examples of theories and models.

2.4.4.1 Design Theories

Design theories help guide the design of interfaces and the selection of components contained within interfaces. Provided is a list of the areas within interface design that have been subject to investigation and research.

2.4.4.2 GOMS (Goals, Operators, Methods, Selection rules) Model

The GOMS model deconstructs the activities of a user task into components of activity and the respective information processes. Users formulate goals (and subgoals), achieve those goals by using methods and procedures, via operators (e.g. move mouse), and use selection rules to choose appropriate methods and operators. The keystroke-level

predictive model was developed. It predicts performance time of tasks by calculating the sum of the lesser parts, which included time for keystrokes, pointing, thinking and waiting (charm, 2001).

2.4.4.3 Menu Design

Menu structures are an important component of interfaces, and the appropriate menus can greatly enhance or detract from the user's experience and efficiency. The combination of the variety of menus (e.g. between scrolling, two-dimensional, alpha sliders, pop-up menus), menu phrasing, presentation sequence, etc. offer many trade-offs between speed, efficiency, and time (charm, 2001).

2.4.4.4 User Control/ Direct Manipulation

The ability to enable a user with control over the tool/interface is an essential component of the HCI interaction. Rather than leaving users with a feeling that they are slaves to a technology, users should have feelings of control and mastery over an interface. The central ideas of user control, which include:

- Visibility of Object and Actions

- Rapid, reversible, incremental actions
- Replacement of complex command-language syntax with direct, visual manipulation of the object of interest.

2.4.4.5 Anthropomorphic design

Designing technology to act and behave like humans is another debate of HCI. Many people feel that computers should be more human like, which is generally a naïve interpretation of making technology "user-friendly".

2.4.5 The importance of HCI in the website development

The importance of HCI in the future of Website development is not to be taken lightly. It has been shown that a large percentage of the design and programming effort of projects go into the actual Website design. The interface is a fundamental part of making the site more successful, safe, useful, functional and, in the long run, more pleasurable for the user.

The tools and techniques that have been developed in this field have contributed immensely towards decreasing costs and increasing productivity. Savings have been created through decreased task time, fewer user errors, greatly reduced user disruption, reduced burden on support staff, the elimination of training, and avoidance of changes in maintenance and redesign costs. HCI is a Web imperative now, and it'll continue to be so in future.

2.5.2 Conclusion

The analysis stage of the development has been successful due to ample effort allocated to it. The most essential and knowledgeable in this analysis is the feasibility study of the current education in schools in Malaysia. The research includes how the concepts and methodologies work and what is lacking and need some improvement on the existing education system.

The manner in investigations conducted from different resources will determine the information gathered before the nest stage in designing and development. Precisely, it is vital to understand the requirements and trends of development in order to develop a good system.

CHAPTER 3

Methodology

Objectives

- Models
- Survey methods
- Proposed authoring tools, graphic software, software development, programming language, scripting language and database

Chapter 3: Methodology

3.1 Methodology defined

Methodology is term as a recommended collection of philosophies, phases, procedures, rules, techniques, tools, documentation, management and training for developers of information systems.

Selecting the appropriate methodology is an important criterion to improve the final product to the extent of perfection of a development process. This refers only to a particular rationale and not the quality of a development process. Different methodology methods utilize different development process and strategies. A suitable methodology may vary from the type of "product" that to be developed. As a result, the output in terms of quality and performance (zero defects) to develop products relies on good methodologies.

Precisely, in order to develop a good system, one has to choose a methodology, which is familiar to the developer, and eliminates the need for training in familiarizing other methodologies (Pfleeger, 2001). Therefore, a careful selection of methodology generates

- productive system
- efficient in terms of speed
- a complete potential system

3.2 Software Process

3.2.1 Software process defined

A software process is a structured set of activities to develop a software system. There are many different software processes, but the common fundamental activities categorized as:

- Software specification – the functionality of the software and constraints on its operation must be defined.
- Software design and implementation – the software to meet the specification must be produced.
- Software validation – the software must be validated to ensure that it does what the customer wants.
- Software evaluation – the software must evolve to meet charging customer needs.

3.2.2 Software process models

A software process model is an abstract representation of a process. It presents a description of a process from a specific perspective, for example:

- Workflow perspective – sequence of activities
- Data-flow perspective – information flow
- Role/action perspective – roles of people involved

There are different general models or paradigms of software development:

- Waterfall model
- Prototype model
- Evolutionary Development
- Incremental Development

3.3 Models

3.3.1 Waterfall Model

The waterfall model is also known as software life cycle is traditional approach .nodel. It was first described in 1970 for aerospace and defense projects. This model is a series

of steps phases. A waterfall model is only appropriate when the requirements are well understood

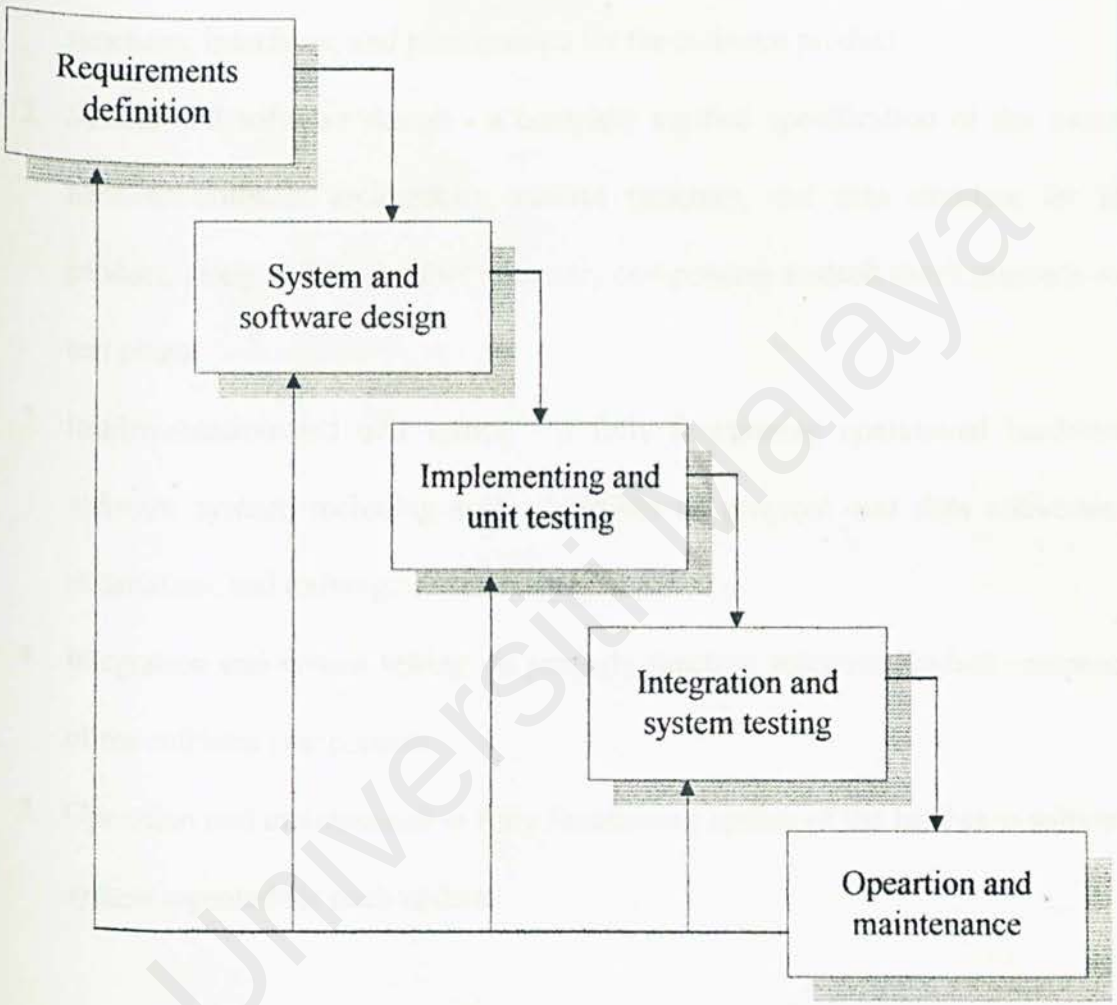


Figure 3.3.1: Waterfall Model

3.3.1.1 Phases of Waterfall Model

The waterfall model consists of five major phases:

1. Requirement definition - a complete, verified specification of the required functions, interfaces, and performance for the software product.
2. System and software design - a complete verified specification of the overall hardware-software architecture, control structure, and data structure for the product, along with such other necessary components as draft user's manuals and test plans.
3. Implementation and unit testing - a fully functioning operational hardware-software system, including such objectives as program and data conversion, installation, and training.
4. Integration and system testing - a properly function software product composed of the software components.
5. Operation and maintenance -a fully functioning update of the hardware-software system repeated for each update.

3.3.1.2 Limitations of Waterfall Model

1. It is difficult to accommodate changes after the process is underway.

2. Inflexible partitioning of the project into distinct stages makes it difficult to respond to changing customer requirements.
3. All delivery is at the end where the system delivered in one piece. Before that, only documents are available. This explains poor progress visibility.

3.3.2 Prototyping

Prototype construction is standard practice in engineering. Prototype defined as:

- a pre-production, functioning specimen(s) that is the first of its type, typically used for the evaluation of design, performance, and/or production potential.
- model suitable for evaluation of design, performance, and production potential (prototype, 2003)

3.3.2.1 Advantages in Prototyping

- Better feedback of requirements where requirements can be validated by prototyping – to explore whether requirements really reflect users needs.
- Prototypes reduce risks – prototypes are used feasibility studies.
- Prototypes can be constructed from reusable parts – for example developing the interface builder and application libraries.

- Prototype provide common medium of communication (users and experience develop better working relationship)

3.3.2.2 Disadvantages of Prototyping

- Difficult to plan and control prototype development
- Temptation not to *throw away* or modify prototype requirements
- Easy to oversell a prototype model

3.3.2.3 Waterfall Model with Prototyping

Waterfall model can be amended with prototyping activities to improve understanding. The requirement of prototyping the waterfall model is to ensure that the requirements are feasible and practical, if not revisions are made at the requirements stages.In designing a prototype waterfall model, the developers can access the alternative design strategies and decide which the best for a particular project.

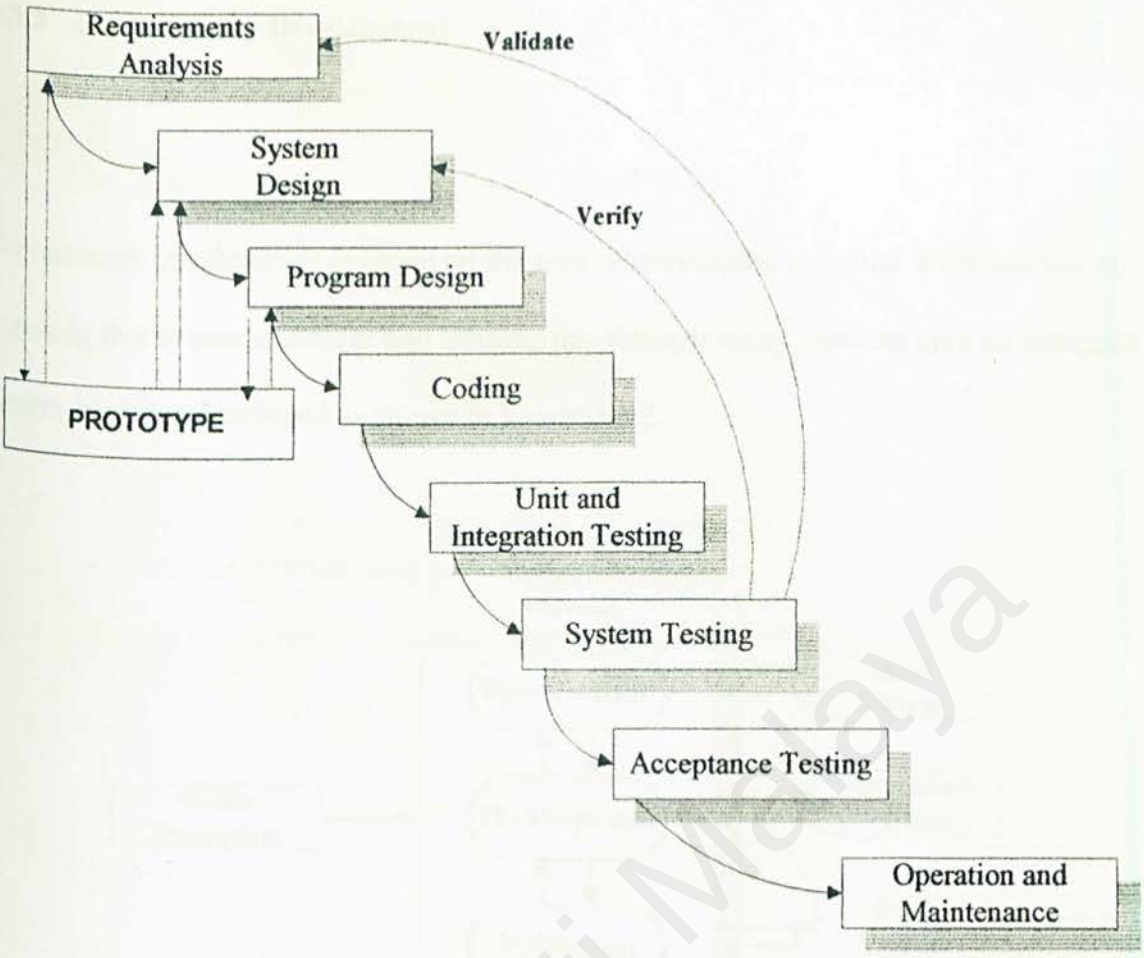


Figure 3.3.2.3: Waterfall Model with Prototyping

During the system testing as shown in the figure above, two important factors are considered:

- Validation - to ensure that the system has implemented all of the requirements so that each system function can be traced back to particular requirements in the specification.
- Verification – in order to check the quality of the implementation and ensure that each function work correctly as needed.

3.3.3 Evolutionary Development

Evolutionary development is based on the idea of developing an initial implementation, exposing this to user comment and refining this through many versions until an adequate system has been developed as shown in Figure 3.3.3.

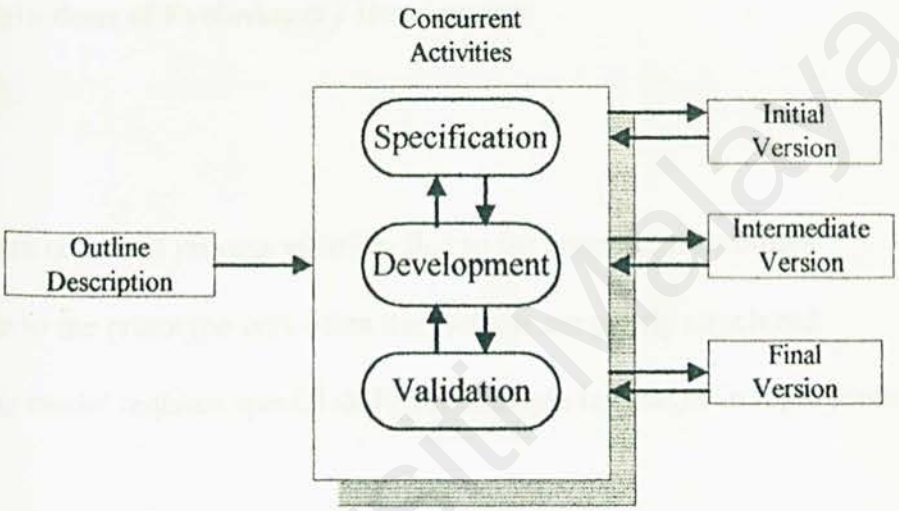


Figure 3.3.3: Evolutionery Development

There are two types of evolutionary development:

- Exploratory development – the objective is to work with customers and to evolve a final system from an initial outline specification. This model should start with well-understood requirements.
- Throw-away prototyping – the objective is to understand the system requirement

3.3.3.1 Application of Evolutionary Development

- For small or medium-size interactive systems
- For parts of large systems (for example, the user interface)
- For short-lifetime systems

3.3.3.2 Limitations of Evolutionary Development

- There is lack of process visibility due to the concurrent activities.
- Due to the prototype very often the systems are poorly structured.
- This model requires special skills for example languages in rapid prototyping.

3.3.4 Incremental Development

The waterfall model of development requires customers for a system to commit to a set of requirements before design begins and the designers to commit to particular design strategies before implementation. By contrast, an evolutionary approach to development allows requirements and design decisions to be delayed but also leads to software which may be poorly structures and difficult to understand and main.

Meanwhile, the incremental development is an in-between approach that combines the advantages of both of these models. The Increment model compared to the Waterfall model releases each 'mini-waterfall' (mini, 2003).

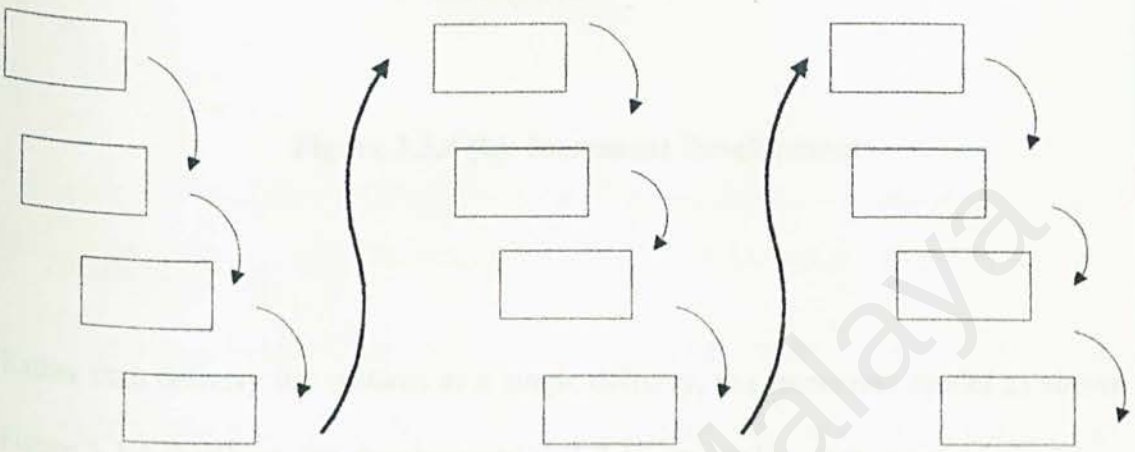


Figure 3.3.4 (a): Increment Development as 'Mini-Waterfall'

The approach of this model means of reducing rework in the development process and giving customers some opportunities to delay decisions on their detailed requirements until they had some experience with the system.

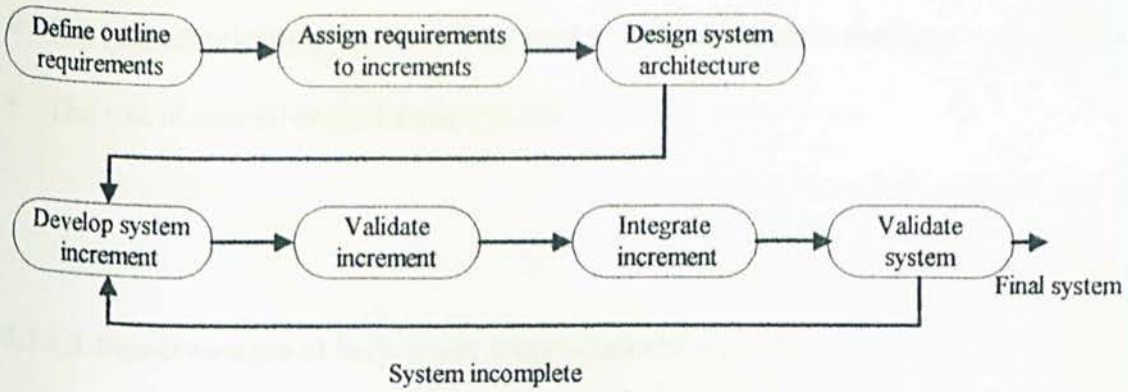


Figure 3.3.4 (b): Increment Development

Rather than delivery the systems as a single delivery, the increment model as shown in Figure 3.3.4 (b)allows the development and delivery broken into increments with each increment delivering part of the required functionality. Here, the user requirements are prioritized and the highest priority requirements are included in early increments. Once the development of an increment is started, the requirements are frozen though requirements for later increments can continue to evolve.

3.3.4.1 Advantages of Incremental Development

- Customer value can be delivered with each increment so system functionality is available earlier.
- Early increments act as prototypes to help elicit requirements for later increments

- The highest priority system services tend to receive the most testing.
- The risk of overall project failure is low.

3.3.4.2 Disadvantages of Increment Development

- The increments should be relatively small so that each increment could deliver its functionality.
- As the requirements are not defined in detail until an increment is to be implemented, it is difficult to identify common facilities that all increments require.

3.3.4.3 Comparative analysis between Increment Development and Waterfall Model

As discussed in detail, both the waterfall and Increment lifecycle models have similar features. Both the models share a rigid framework that used to complete the individual component tasks of the sequential model for the project and a single final product delivery point.

While the structure and single delivery point are common in both models, the main difference between the two models is the process in which a final product is achieved and to obtain the product as an output. The Waterfall model relies on a single iteration of the linear sequential activities to produce a deliverable product, while the Increment model incorporates more than an iteration of the Waterfall model to produce a deliverable product while still focusing on a final product delivery date. As a result, the Waterfall model produces a product that is developed on a phase of feedback and requirements; meanwhile the Increment model produces a product that is developed using multiple phases of feedback and requirements.

The singles feedback loop of the Waterfall model makes it necessary for the requirements of the project to understand by the client and developer at the beginning of the project. However, the Increment model is rigid in the aspect that the requirements must be understood before each iteration of the linear sequential model, additional requirements may be incorporated into future iterations. This is due to a greater number of requirements phases and feedback loops the evolutionary Increment model produces a more robust product.

The Waterfall model is the most rigid of the software development models. This is due to its functionality as a documentation driver, but its passive requirements make it difficult to develop the software. However, it is easier to manage compared to other models where it addresses the product control better than the Increment model.

Nevertheless, the user interface of the Waterfall model is inflexible to modify or add the changes compared to the latter. Since the Waterfall model is a slower development model, it has fewer problems with debugging and integration compared to the Increment model. Another drawback is the development of single products in the Waterfall model compared to a group of products in Increment model.

Precisely, the Waterfall model can be only used if the requirements are well-understood by the developer. However, there is no need to use the same process for the development of each increment in the Increment model.

3.3.5 Conclusion

Consequently, the Increment Development model is an important model compared to the other models. Here, the 'mini waterfall' model allows each cycle ends with a usable system. Thus, the development can be stopped without the entire project being abandoned; the spreading of risk overall is minimized. Finally, the Increment model has a better visibility of progress in developing software.

3.4 Survey Methods

Collection of information is at the core of methodology. At the outset, fact-findings are necessity about the information proposed system. It is significant to revise a series of assessment when conducting the survey methods. The common traditional ways to get information directly to design and implement the web-based system are interviews, questionnaires and newspaper articles.

3.4.1 Interview

Interviewing is one of the primary ways to gather information about an information systems project. Interviews are very effective ways of communicating with people and obtaining important information from them (Valacich *et al*, 2001).Interview is the most important technique because it is a personal form of survey.

The importance of interviewing is to acquire information about background from a clear perspective. During the interview, gathered facts, opinions and speculation and observe body language, emotions and other sign of what people want and how they access current system (Valacich *et al*, 2001). Next is the planning stage where the facts from interview can set the objectives and select the best strategy to design and implement the proposed system.

However, interviews are very expensive and time-consuming to conduct. Therefore, only a limited number of questions can be covered and people contacted (Valacich *et al*, 2001).

3.4.2 Questionnaires

Questionnaires are traditional method to survey people to discover issues and requirements. Questionnaires are usually administered on paper, although they can be administered in person (resembling a structured interview), over the phone (computer-assisted telephone interviewing), or even on diskette (Valacich *et al*, 2001) can be administered personally or in a group. Questionnaires are less expensive if they do require a person to administer them directly; that is, the people answering the questions can complete the questionnaire without help. Besides, answers provided at the convenience of the respondent, as long as they are returned by a specific date (Valacich *et al*, 2001).

Precisely, in contrast, questionnaires are passive and often yield less information than interviews, but questionnaires are not as expensive to administer per respondent. Besides, questionnaires have advantages of gathering information from many people in a relatively short time. There is also bias involved in interpreting their results (Valacich *et al*, 2001).

3.4.3 Comparison of Interviews and Questionnaires

The differences between interviews and questionnaires are important to remember during the methodology phase. Deciding which method to use and what strategy to employ to gather information will vary for the proposed system being studied. Table 3.4.3 compares the characteristics of interviews and questionnaires (Valacich *et al*, 2001).

Table 3.4.3: Comparison of Interview and Questionnaires

Characteristic	Interviews	Questionnaires
▪ Information richness	High (many channels)	Medium to low (only response)
▪ Time required	Can be extensive	Low to moderate
▪ Expense	Can be high	Moderate
▪ Chance for follow-up and probing	Good: Probing and clarification questions can be asked by either interviewer or interviewee	Limited: Probing and follow-up done after original data collection
▪ Confidentiality	Interviewee is know to the interviewer	Respondent can be unknown
▪ Involvement of subject	Interviewee is involved and committed	Respondent is passive, no clear commitment
▪ Potential audience	Limited numbers, but complete responses from those interviewed	Can be quite large, but lack of response from some can bias results

3.4.3 Newspaper Articles

The newspaper has been around in this country for many years. Newspapers are a great source for information on current events. Older editions provide day-to-day coverage of past events such as the traditional education, social and economy. Because newspapers are outlets of mass communication, they are good barometers for reading the interests of the popular culture. Probably the greatest advantage in the newspaper's corner is that of the material itself: "*... one thing remains secure. Paper. No one seems willing to give up the material...*" (Brown and Duguid, 2000 - p179.) (newspaper, 2002).

3.4.3.1 Advantages of the Newspaper

The fact that the newspaper has been around since the 17th century helps to maintain a certain degree of confidence in the product within the readership and the publishers. It is a tried and tested method of distributing the news, and with the public so used to it, it would be difficult to suggest a viable alternative capable of replacing it (newspaper, 2002). The advantages of newspapers are light, convenient, disposable, and one can

afford to lose them. Pages of headlines can easily be scanned, and reading speed and retention rates are very high (newspaper, 2002).

Whereas an alternative source of news (such as the internet) may offer a wider variety of features such as interaction and access to archive material the newspaper is a mobile source of information which can be read on the move and disregarded at will. Probably the best reasons for keeping faith with the newspaper is that it is already portable, recyclable, easily readable, instantly accessible, and contains all the information one would ever wish (newspaper, 2002).

3.4.3.2 Disadvantages of the Newspaper

Although, as discussed, there are many traditions and values attached to the conventional newspaper, there are also disadvantages that are becoming ever more apparent as we progress into the 21st century:

1. Cost

There are six main elements involved in the production of the newspaper:

- Content;
- First Copy;
- Reproduction (printing/replication costs);
- Distribution;
- Storage;
- Finance and Administration;

The newspaper industry's most difficult in a decade as falling advertising revenue, higher newsprint costs and money-losing Internet operations are sapping papers' vitality nationwide (newspaper, 2002). The cost of the raw materials is rising, contributing to the difficulties involved with higher costs and lower readership. The greater the size of the circulation or distribution, the greater the rate of cost (newspaper, 2002).

2. Declining circulation

With the rapid development in technology over the past decade, reading the conventional newspaper could be construed as old-fashioned when there are more modern alternatives available such as the internet. Although the importance of the newspaper can be cumbersome to read and pose difficulties in some situations due to its

large size and when convenience is such a necessity in today's world, this may become a major disadvantage and possibly help to contribute towards the demise of the newspaper (newspaper, 2002).

3.4.4 Electronic Survey

The Internet has greatly influenced the field of survey research as the numbers of electronically administered surveys continue to grow. Unlike traditional mail and telephone surveys, it is not certain what principles should guide the construction and implementation of electronic surveys. The Internet is a great resource for getting current information on a variety of topics. Three common forms of electronic surveys:

1. World Wide Web surveys – a structured customize questionnaire developed on the web for respondent's reaction (surf, 2003).
2. Electronic mail or e-mail interview is useful for eliciting in-depth information. It has advantages of cost and timing over the web method since there is no need to develop a customize questionnaire (surf, 2003).
3. Online group discussion provides opportunities of responses of more straightforward (surf, 2003).

3.4.5.1 Advantages of Electronic Survey

a. **Cost savings** – Sending questionnaires online would be less expensive which does not require paying for postage and stamps.

b. **Faster transmission time** – Questionnaires can be delivered to recipients in seconds compared to traditional mail.

c. **Ease of editing or analysis** – Less work is needed to edit and analyze data, thus enabling changes easily to questionnaires, easier to copy and evaluating the data.

d. **Higher response rate** – The response rate on private networks are higher with electronic surveys compared to paper surveys.

e. **Quicker response time with wider magnitude of coverage** – Participants can answer in minutes due to the speed of network coverage of the survey is global and wide.

3.4.5.2 Disadvantages of Electronic Survey

a. **Lower level of confidentiality** – It is difficult to ensure all secrecy and important details of surveys due to open nature of most online networks. This may limit the respondent to answer some of the sensitive issues.

b. **Sample demographic limitations** – The scope of population and sample is limited to those only with access to computer and online network. Those places that do not have network coverage or bad network connection or computer facilities will not be covered.

c. **Additional orientation or instruction** - More instruction and guidelines are needed from the computer to complete the questionnaire. This is because respondents may lack of computer skills and knowledge.

d. **Response rate** –The increase of e-mail response rates may be high eventually at the beginning but may decrease in future.

e. **Technical problem with hardware and software** – The possibility of access virus attack, hacking and hard disk corrupted compared to oral or written forms of surveys.

3.5 Proposed Web Authoring Tools

3.5.1 Dreamweaver

Macromedia, the creator of Dreamweaver is simple professional visual design solution for creating complex web sites. Dreamweaver lets even the most inexperienced user

easily create professional looking web sites. Virtually no knowledge of HTML code is required for web page creation. The strength of Macromedia Dreamweaver is:

1. It provides the user with the ability to alternate between working in the "design view" and the HTML code view.
2. The Dreamweaver browser-compatible provides the ability to identify and fix broken links.
3. Dreamweaver's use of layers in designing a web page gives the user the opportunity to make the web page more dynamic.
4. The user can create one or more templates that are then applied to all the pages on the site.
5. One can work on two copies of a web site and synchronize the two when changes are made to either one. This feature is useful for keeping back up copies, as well as working locally on the pages.
6. The ability to import Flash and Fireworks objects (these are also Macromedia products, mainly used for creation of graphics and animations).
7. Dreamweaver presents the user with the ability to choose between DOS, Mac or UNIX line feeds. This is particularly important when editing CGI files on a UNIX server, in which case the line feeds must be UNIX.

However, Dreamweaver lacks some of the features offered by other software, such as converting HTML into XML (Extended Mark-up Language). Dreamweaver also has a

somewhat confusing interface cluttered with numerous toolbars and palettes that are sure to confuse an inexperienced user.

3.5.2 Flash

Flash is the technology created by Macromedia. Flash is a web-authoring tool that creates rich content and application across desktop and devices. Web designers use Flash to create navigation controls, animated logos, long-form animations with synchronized sound and even complete, sensory-rich Web sites.

The strength of Flash is create rich interactive and animation experiences with a simplify common timeline and scripting task. Flash uses vector graphics, which means that the graphics can be scaled to any size without losing clarity or quality. Flash also gives the viewer a "high-tech" impression of an organization with interactive animation for entertaining "Splash" pages and even games. Finally, with Flash one can deliver the viewer engaging applications and web interfaces such as training courses, tutorials and presentations.

However, there are many drawbacks when using Flash.

- Before accessing the Flash contents, Flash files require a plug-in called the Flash Player. Many older browsers do not support this plug-in so individuals using those browsers will not be able to view Flash content.
- The "Find in page" feature does not work. In general, Flash integrates poorly with search.
- The "Back" button does not work. If one navigate within a Flash object, the standard backtracking method takes out of the multimedia object and not, as expected, to the previous state.
- Link colors do not work. Given this, one cannot easily see where have been and which links you have yet to visit. This lack of orientation creates navigational confusion.
- The "Make text bigger/smaller" button does not work.

3.6 Graphic Software

3.6.1 Adobe Photoshop

Photoshop has been the industry standard for print, publishing and photo editing of graphics for several years. Adobe has integrated into Photoshop a design based upon traditional photo manipulation technique, where tools and process directly correspond

with those used in 'physical' photography. Photoshop introduces features and enhancements, which go far beyond the capabilities of the darkroom technician, thanks to digital technology, yet through an interface based on traditional technique, Adobe ensures a relevant, familiar, but powerful program environment.

3.7 Proposed Software Development

3.7.1 Microsoft FrontPage

FrontPage - the first software for creating and managing Web sites when it was introduced in 1995 - has always emphasized ease of use for both new users and Web professionals. FrontPage 98 continues to define its category with intelligent design assistance and support for the latest Web technologies - including Java, Dynamic HTML, channel definition format and Cascading Style Sheets - as well as with expanded site management tools that help users plan, organize and update their Web sites.

The strength of FrontPage 98 is excellent tool for the beginner or occasional user where it contains familiar tool bar interface. Besides, the most important feature is that FrontPage 98 allows importing Word, Excel and PowerPoint files. In addition, FrontPage 98 comes with templates, themes, and wizards to help build sites. Internal

JavaScript (components) together with FrontPage 98 allows animation, actions, and interactivity.

However, the limitation of FrontPage 98 is that it re-writes HTML codes. The templates & themes created looks like 'canned' and not genuine. The JavaScript used in FrontPage 98 is not easily editable. Besides, it does not work on UNIX servers.

3.7.2 Microsoft Visual InterDev

Visual InterDev is Microsoft's development tool for building a dynamic, data-driven Web site. Whereas Microsoft's FrontPage is an HTML editor aimed at letting non-programmers build the pages for a Web site, Visual InterDev provides the tools for programmers to build a Web site. (FrontPage and Visual InterDev are said to be compatible.) Visual InterDev offers a user interface similar to those for Visual Basic, Visual J++, and Visual Studio. Using Visual InterDev, one can assemble pages that use Microsoft's ActiveX technologies, including Active Server Page (ASP) technology. The developer can build and insert ActiveX control or Java applets. Visual InterDev includes an HTML editor and support for dynamic HTML. The Web site can be integrated with server programs written in any language and access to almost any database using Microsoft's Universal Data Access, including ActiveX Data Objects, Open Database Connectivity, and OLE DB.

3.7.3 Microsoft Agent Scripting Helper (MASH)

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 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. The conventional interface approach facilitated by the Microsoft Agent services does not replace conventional GUI design. Instead, character interaction can be blended with the conventional interface components such as windows, menus, and controls to extend and enhance your application's interface.

Precisely, MASH is an easy-to-use program that lets you record and playback entertaining Microsoft Agent character presentations by simply dragging characters around the screen and directing what they say and do. MASH is used in captivating

technologies include talking websites, interactive presentations, self-running kiosks/demos, tutorials, tour guides, clipboard and text file readers.

3.8 Proposed Programming Language

3.8.1 HyperText Markup Language or 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 provide some additional non-standard codes.

3.8.2 Active Server Page or ASP

Microsoft Active Server Pages (ASP) is a server-side scripting environment that you can use to create and run dynamic, interactive Web server applications. With ASP, one can

combine HTML pages, and script commands to create interactive Web pages or powerful Web-based applications, which are easy to develop and modify. ASP can perform the following functions:

- Create dynamic Web content
- Retrieve HTTP header, cookies and user information
- Process form inputs
- Create, read, append and write to text files on the Web server
- Retrieve directory information and file attributes on the Web server
- Send E-mails
- Connect to database, extract and display information from the database
- Add and modify database records

Hence, it is an important complement to HTML and is used in many applications, including Web trackers and counters, automated form processing, online polls, search engines, quizzes, forums, message boards and e-commerce.

3.9 Scripting Language

3.9.1 VBScript

Microsoft Visual Basic Scripting Edition brings active scripting to a wide variety of environments, including Web client scripting in Microsoft Internet Explorer and Web server scripting in Microsoft Internet Information Service.

VBScript talks to host applications using Windows Script. With Windows Script, browsers and other host applications do not require special integration code for each scripting component. Windows Script enables a host to compile scripts, obtain and call entry points, and manage the namespace available to the developer. With Windows Script, language vendors can create standard language run times for scripting. Microsoft will provide run-time support for VBScript. Microsoft is working with various Internet groups to define the Windows Script standard so that scripting engines can be interchangeable. Windows Script is used in Microsoft Internet Explorer and in Microsoft Internet Information Service.

3.9.2 JavaScript

JavaScript is a new scripting language for Web- pages. Scripts written with JavaScript can be embedded into HTML- pages. With JavaScript, there are possibilities for enhancing HTML- page with interesting elements. Some effects that are now possible with JavaScript were some time ago only possible with Common Gateway Interface (CGI). Therefore, one can create sophisticated pages with the help of JavaScript where

there is no need any special tools, programs, or compilers to write JavaScript; whatever one is currently using to write HTML should work just fine.

JavaScript can be used to make the Web pages interactive and dynamic. A static HTML page without any JavaScript just sits there -- if a visitor returns to the site some time later, it will look the same as it did today. With JavaScript, one can display different images, give feedback on forms, control the user's browser (for instance, displaying different pages based on the user's plug-ins), and manage framed sites. Overall, when using JavaScript, it is able to give the user feedback: the feeling that the site is responsive to their actions.

The most common use of JavaScript is the ubiquitous image rollover. It is to the point on the Web where if one does not use JavaScript to change the clickable buttons, some users will not click on them, as they will not realize that they have that option. Image rollovers have become a de facto Web user interface standard, so one should use them if want to impress anyone.

3.10 Proposed Database

3.10.1 Microsoft Access

Microsoft Access is relational database management system (RDBMS). Whether users are creating a stand-alone desktop database for personal use, departmental use or for an entire organization, Access offers an easy-to-use database for managing and sharing data. Access 2000 brings not only the traditional broad range of easy data management tools but also adds increased integration with the Web for easier sharing of data across a variety of platforms and user levels and additional ease-of-use enhancements to assist with personal productivity. Access 2000 allows easily sharing information via the corporate intranet and the ability to host a database within the browser. This combines the power of a desktop database with the power of the web.

3.11 Conclusion

The chapter reviews about the methodology Increment Development model used to develop the system. The research methods collecting the system requirements are equally important to integrate and implement the system. In addition, several proposed tools, software development and programming languages discussed in detail to develop for the proposed system.

CHAPTER 4

System Analysis

Objectives

- **Functional requirement**
- **Non-functional requirement**
- **Hardware requirement**
- **Software requirement**

Chapter 4: System Analysis

4.1 System Analysis Process

System analysis is the part of the systems development life cycle in which you determine how a current information system in an organization (Valacich *et al*, 2001). Requirement expresses the system's behavior, which explains the system and object states and the transitions from one state to another (Pfleeger, 2001). The importance in identifying the system requirements precedes the functionality of a system developed divided as:

- Functional requirement
- Non-functional requirement
- Hardware requirement
- Software requirement

4.2 Functional Requirement

A functional requirement describes an interaction between the system and environment. It explains how the system will function when a certain stimuli (Pfleeger, 2001). The

functional requirement for "Web-based E-learning System Science for Year One" described in the following modules:

a) **Module One: Learning Center**

The online system offers courses and resources especially teachers and students. The Explore Science & Maths System is where the users will meet the genie and have fun and adventurous lessons.

b) **Module Two: Course**

The main module of Explore Science & Maths System is Science and Mathematics. There are three levels (Year 1- 3) for each subject respectively. Currently, the project can only access to Science Year 1 as the main requirement of the system to be developed. There are six lessons in Science Year One. Each lesson comprises of different topics. Every topic has an exercise and a quiz.

c) **Module Three: Games**

There are a few games where the users can play. Every game has a set of rules. User can select the type of operation they wish to play. Users will receive feedback for each answer input by them as a guidance to motivate the users to be more alert in the game.

d) **Module Four: Parents Info**

This module is to inform the parents of their children (users) that the Internet can be fun and educational place but it can also 'dangerous' without proper guidance. Besides, parents are conveyed that the web-based online system aim to enable the Explore Science & Maths System a safe environment for their children in the learning activities.

e) **Module Five: Educational Link Sites**

This module provides the link to other educational sites. Users can select the link listed and the site will be displayed as a pop-up window.

4.3 Non-functional Requirement

A non-functional requirement or constraint describes a restriction on the system that limits one choice for constructing a solution to the problem (Pfleeger, 2001). The non-functional requirements for the project are:

- **User-friendly**

A system can be considered as attractive and an easy to use application because the users will only have to click on the hypertext or image by using the mouse. A friendly user

interface allows the users browse the site easily and minimize the learning time. The grouping of the information provided by sub-modules and graphical screens make it easier for the user to browse. The use of suitable frames and navigation applet will help the user to use the system with more confidence. In addition, the talking genie guides and explains the sites in every page.

- **Attractive Interface**

The Adventure-Maths&Science designed for the school curriculum *Kurikulum Bersepadu Sekolah Rendah* or KBSR. The attractive interface with colorful graphical icons displayed attracts and make the users more inquisitive to find out more about the system. Besides, adequate multimedia elements with animation characters comply and fulfill the amusement of the users.

- **Modularity**

Modularity is a key factor in a good program design. The way the system works is that it is decomposed into modules so that distinct functions of modules would be isolated from each other. Modularity has the advantage of making testing and maintenance much easier. In the system, modularity of program will be applied from the beginning, as this will lead to easy modification in future. The modules in the design approved means that other small modules may be easily combined or joined at a later stage.

- **Easy to navigate**

Since Explore Science & Maths System designed for the primary level, it ensures sufficient navigation to the users. The navigation buttons and icons with bright link are either graphics or symbols used in the system.

- **Interactive**

The Explore Science & Maths System interface ensures interactivity between the users and the system. The common form of interactivity by the users is clicking the graphical icons in the system. Some screens allow the users to enter the textual information. The exercises and quizzes support the users' answers to the questions where an immediate feedback (thru progress tracker) replied.

- **Availability**

Since the project is a freeware web-based application, the Explore Science & Maths System makes it easier and reliable for the users to access the system at anytime and anywhere at minimal cost.

- **Learn-ability**

Learn-ability refers to the ease with which new or occasional users may accomplish certain task or lesson in using Explore Science & Maths System. Users are quickly able

to understand the basic commands and navigation options of the interface. Besides, the occasional users face no problems to navigate the system after periods of no-use.

4.4 Development Tools Analysis

Five golden factors comply in selecting an appropriate development tool. These factors are budget allocated, time constraints, application type, technical expertise and distribution media (Chai, 1999).

Table 4.4: A Comparison of Popular Development Tools

Factors	Reasons
1. Budget	Allocation of money for the project is essential. Thrifty spending will weaken the development of the software.
2. Time Constraint	The time allocated for the project determines a suitable type of hardware and application (Chai, 1999)
3. Application Type	Fair amount of consideration and knowledge is needed to develop the best and functionable system (Chai, 1999).
4. Technical Expertise	Technical guidance and expertise is very essential in term of utilizing the application throughout the application.
5. Distribution Media	Correct platform will ease the conversion and distribution media after completion of production (Chai, 1999).

4.4.1 Development Tools Evaluation Criteria

It is essential to revise a series of assessment when selecting the choice of development tools. The criteria discussed below are taken into consideration for evaluation.

1. Authoring environment

It is important to consider the environment, which contributes very much to the entire production process.

2. Multi-platform support

It is best if the application created on the same platform that will be applied later on. This will eliminate the problem of conflicts on instability. The development tools provide development on several different platforms. Some tools may have functionality embedded into it for multiplatform development but most of the development tools need as additional piece of conversion software to be able to run the application on another platforms (mmedia, 2002).

3. Price

The price for hardware and software development tools varies from product to product. It can range from few hundred dollars to thousand of dollars. Extra cost incurred related directly to the production tool such as run cost of runtime version of the software (Chai, 1999).

4. Text and graphic support

The application being develop depends on what text and how much text and graphics needed in the development. Therefore, the tool selected should be able to handle these media efficiently. Besides, the different file of formats used in the application should be taken into account (Chai, 1999).

5. Market acceptance

Knowing in detail what development environment is most used in the larger academic community is important to understand the general users' needs among the community to produce the most effective system to help the user (Chai, 1999).

4.4.2 Hardware Requirement

Based on the evaluation of the development tools, the hardware requirement to develop the system listed in the table as shown below.

Table 4.4.2: Minimum Hardware Requirement

Resources	Description
Processor	RIVA TNT2 (128 bit colors)
Display Card	304 MB RAM
CD-ROM Drive	PC compatible
Hard Disk	10 MB free
Monitor, Keyboard and Mouse	Windows compatible
Graphic support	GIF, JPEG

4.4.3 Software Requirement

Based on the evaluation of the development tools, the hardware requirement to develop the system listed in the table as shown below.

Table 4.4.3: Minimum Software Requirement

Components	Description
Operating System	Microsoft Windows XP
Web Server	IIS Web Server
Browser	Internet Explorer 5 and above
Authoring Tools	Flash MX, Adobe Photoshop,
Software Developer	Microsoft Agent Scripting Helper (MASH), Microsoft Visio 2000 and Microsoft FrontPage
Programming Language	HTML, JavaScript, VBScript and ASP.
Player	Flash Player

4.5 Conclusion

The project has adequate information at the analysis stage. The choice of correct platform and several development tools enable to develop the proposed e-learning system. The functional and non-functional requirements will guide and understand the constraints of the application, thus ensure the smoothness of the project development.

CHAPTER 5

System Design

Objectives

- System architecture
- System functional design
- Flow chart
- Storyboard

Chapter 5: System Design

5.1 Introduction

System design is a process to convert the conceptual ideas from requirement specification in system analysis into more technical specification.

In system design phase, the system requirements gathered during the analysis phase and research conducted earlier where transmitted into a representation of system. Initially, the representation depicts a holistic view of system; subsequently refinement reads to a design representation that is close to source code. In the system design phase, input, output, file and database were produced which include the designed of input forms, screen in order to gather input data, data dictionary, file specification and report design (Jeffrey *et al*, 2000).

The objectives of system design listed below:

1. Specify logical design elements - Detailed design specifications that describe the features of information system: input, output, files, database, and procedures.

2. Meet user requirements in terms of

- presenting proper form of information
- providing accurate results
- using appropriate method of interaction
- providing overall reliability

3. Ease of use

- favorable human engineering
- ergonomic design that is physically comfortable to user effectiveness and efficiency

4. Provide software specifications -Specific components and functions with adequate details are needed to construct application software.

5.2 System Architecture

The Explore in Science & Maths System is decomposed into modules that provide some related set of services. The initial project design process of identifying these modules is establishing a framework for the proposed system. Such framework for the module control and communication is called architectural design.

The Web-based E-learning System Science for Year One is based Three-Tier Architecture, which consists of:

- **Presentation tier** – represents the user interface, which runs on the user's computer (client).
- **Application server** – the functional modules that actually process data where the middle tier runs on a server.
- **Database server** - the Database Management System (DBMS) that stores the data required by the middle tier (threeTier, 2003).

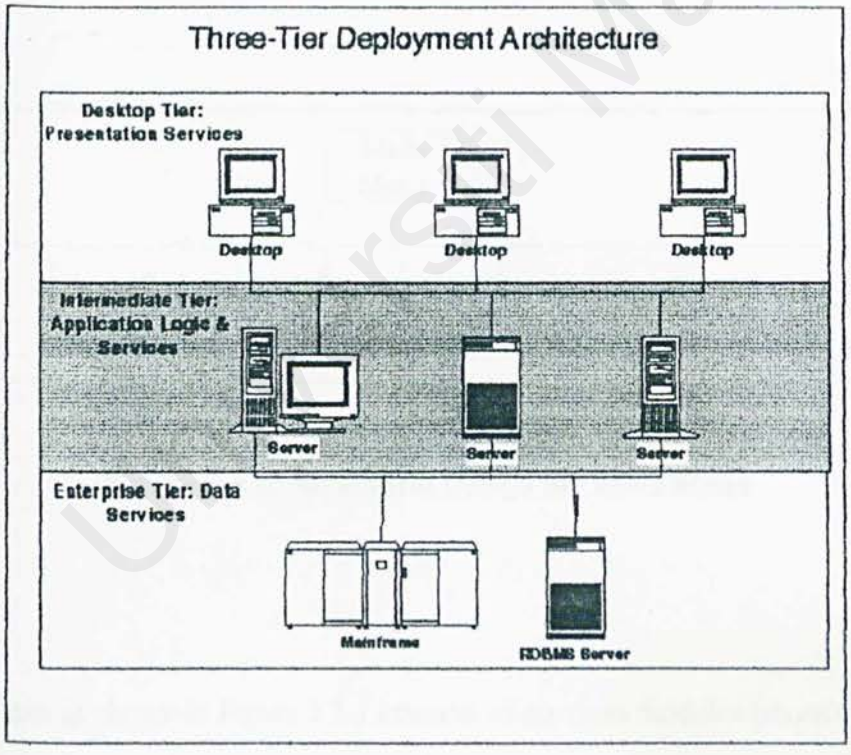


Figure 5.2: Three-tier Architecture

5.3 System Functionality Design

System functionality design is based on the system requirements stated in the previous chapters. It translates the system requirements into system functionality. The web-based design project focuses on the system structural design and flow chart diagrams.

5.3.1 System structural design of Main Menu

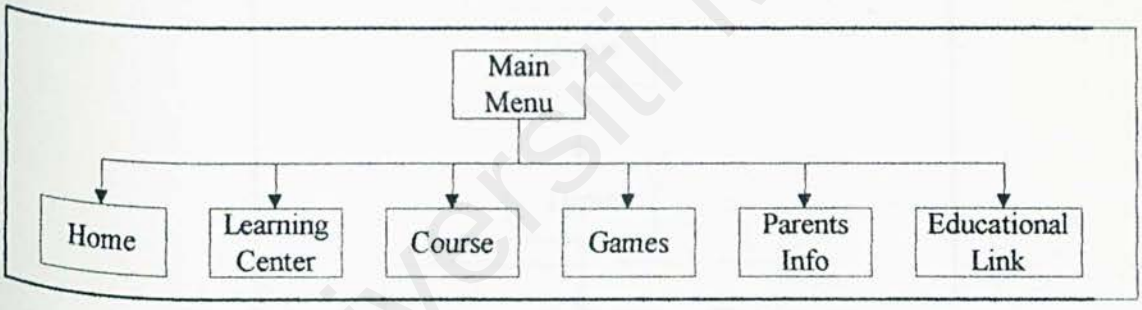


Figure 5.3.1: Structural Design for Main Menu

The main menu as shown in Figure 5.3.1 consists of six main modules (icons). User can click at any link and the screen of the site will appear. The modules are:

1. Home – the Main menu's homepage
2. Learning Centre – the important of learning Science and Mathematics in English

3. Course – the Explore in Science & Maths System consists of two main modules that are Science and Mathematics
4. Games – list type of games
5. Parents Info – to guide and support their children in using the Explore in Science and Maths System.
6. Educational Link – link to other educational sites

5.3.2 System Structural Design of Course

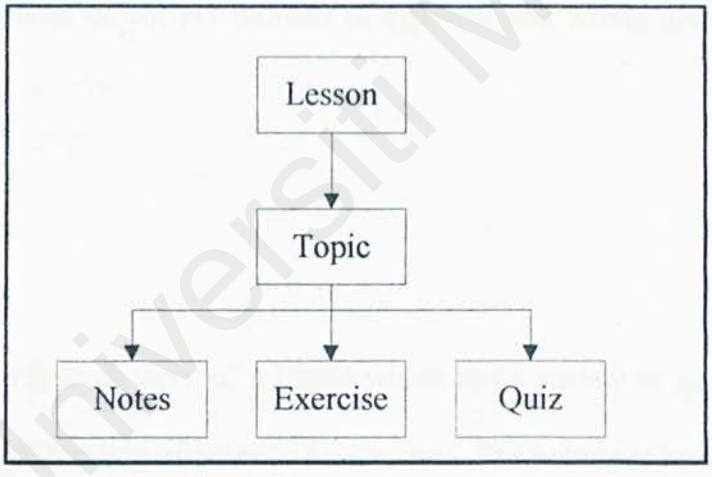


Figure 5.3.2: Structural Design for Course

The Explore in Science & Maths System consists of two main modules that are Science and Mathematics. The sub module of Science consists on six lessons. Each lesson is divided to a few topics. Every topic consists of Notes, Exercise and Quiz.

1. **Notes**

- The user can select a topic, which will display the contents of the topic.

2. **Exercise**

- At the end of each topic of a lesson, the user can practice or explore the knowledge received earlier by answering interactive questions. The user needs to attempt an exercise which consists of a few interactive questions. The genie will explain briefly how to answer the questions. After completing the questions of an exercise, the user has to submit the answers. A message box will appear that will display the percentage report of the exercise. Next, an E-Report interface will appear which displays bar charts of correct number of answers and wrong answers input by the user.

3. **Quiz**

- There is a quiz in each topic of a lesson which has a variety of questions concluded testing the understanding of Science for the user. The activities here require the users to fill in the blanks and match by labeling the textboxes provided.

5.4 Flow chart

Flow chart is an archaic form of visual control-flow specification employing arrows and "speech balloons" of various shapes.

5.4.1 Illustration of flow chart

Explore in Science & Maths system is divided into two main modules, Science and Maths. Since the requirement of the project emphasis on Science Year 1, thus the user is limited to that the particular module only.

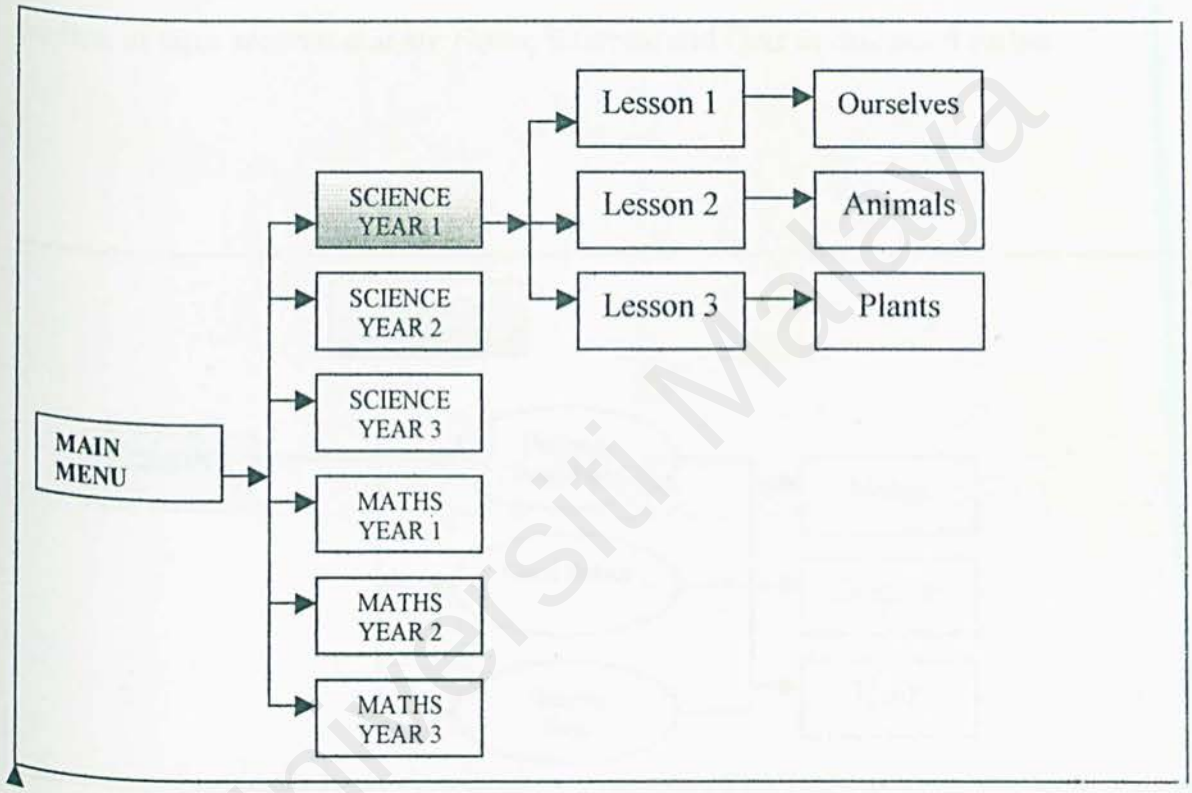


Figure 5.4.1: Illustration of Flow Chart for

Web-based E-learning System Science for Year One

Figure 5.4.1 illustrates the overview of Science Year 1 module. The Science module consists of several small sub-modules known as lessons to perform different task for the system. Each lesson covers a few topics, for example, Lesson 1 – *Ourselves* discusses about *Different Body Parts.*

5.4.2 Flow Chart Structure Level 1

Structure Level 1 concludes introduction of Science Year 1 module Lesson 1 – *Ourselves*. There are five main topics at this level as shown in Figure 5.4.2. Each topic consists of three sections that are Notes, Exercise and Quiz as discussed earlier.

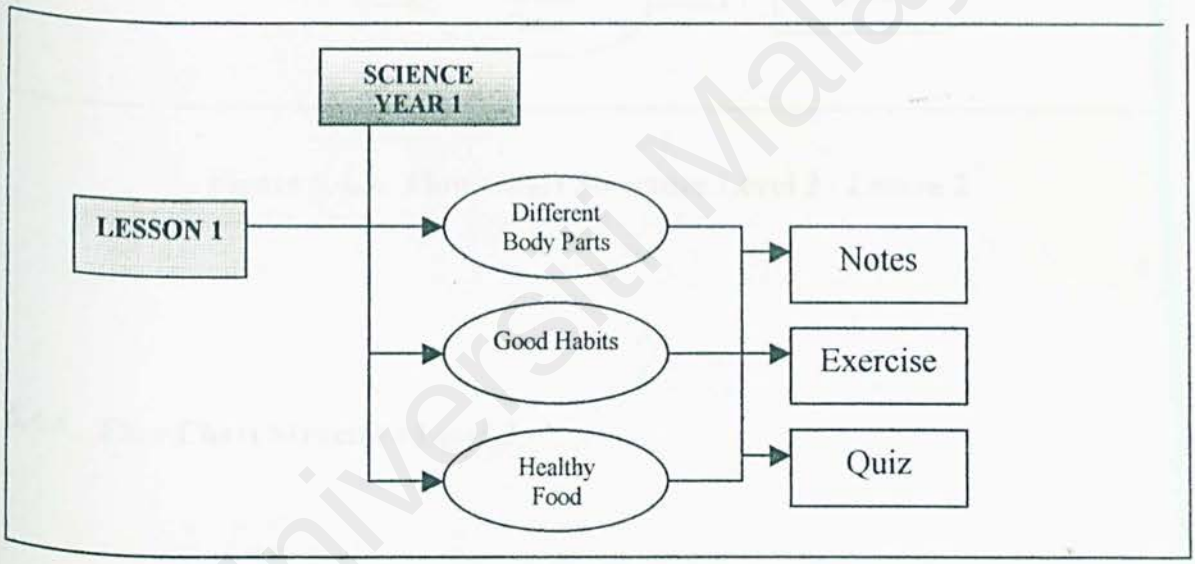


Figure 5.4.2: Flow Chart Structure Level 1 - Lesson 1

5.4.3 Flow Chart Structure Level 2

Lesson 2 discuss is about *Animals* which conclude three main topics as shown in Figure 5.4.3.

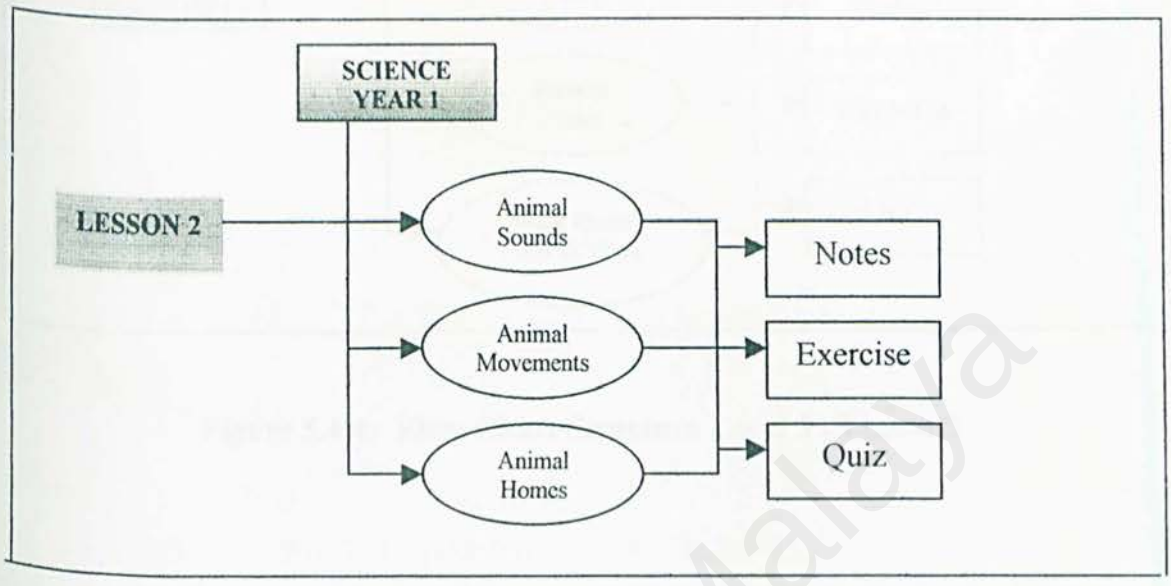


Figure 5.4.3: Flow Chart Structure Level 2 - Lesson 2

5.4.4 Flow Chart Structure Level 3

Structure Level 3 represents Lesson 3, which covers about *Plants*. There are five topics where each topic includes Notes, Exercise and Quiz as shown in Figure 5.4.4.

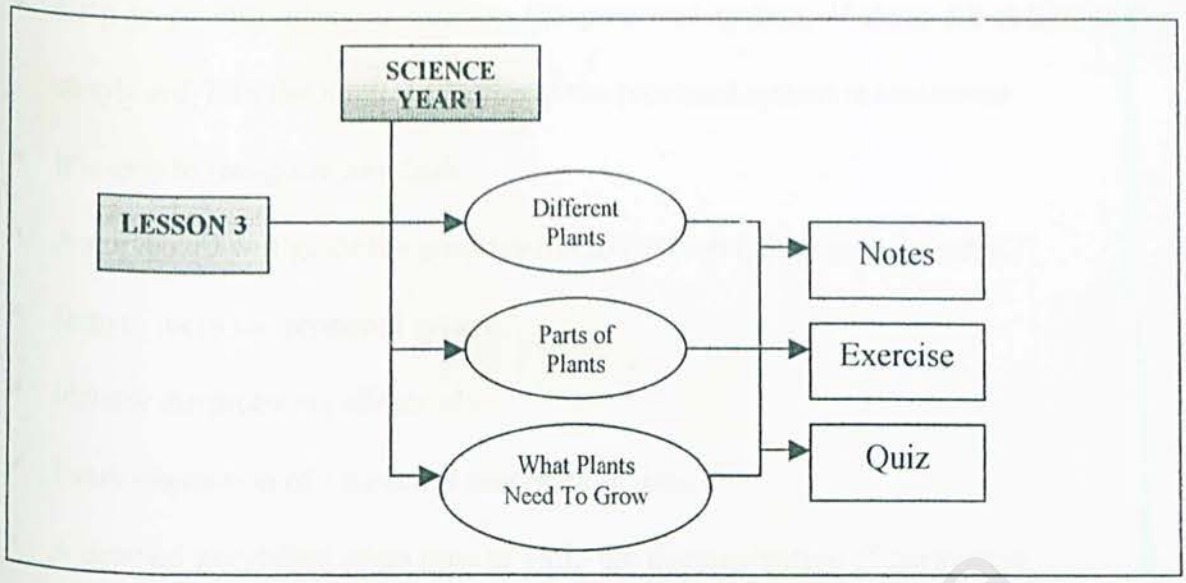


Figure 5.4.4: Flow Chart Structure Level 3 - Lesson 3

5.5 Storyboard

Storyboard is visual draft that represents all interactions of the screen in an application system. A storyboard must represent all multimedia elements such as buttons, icons, labels, color, text area, and video.

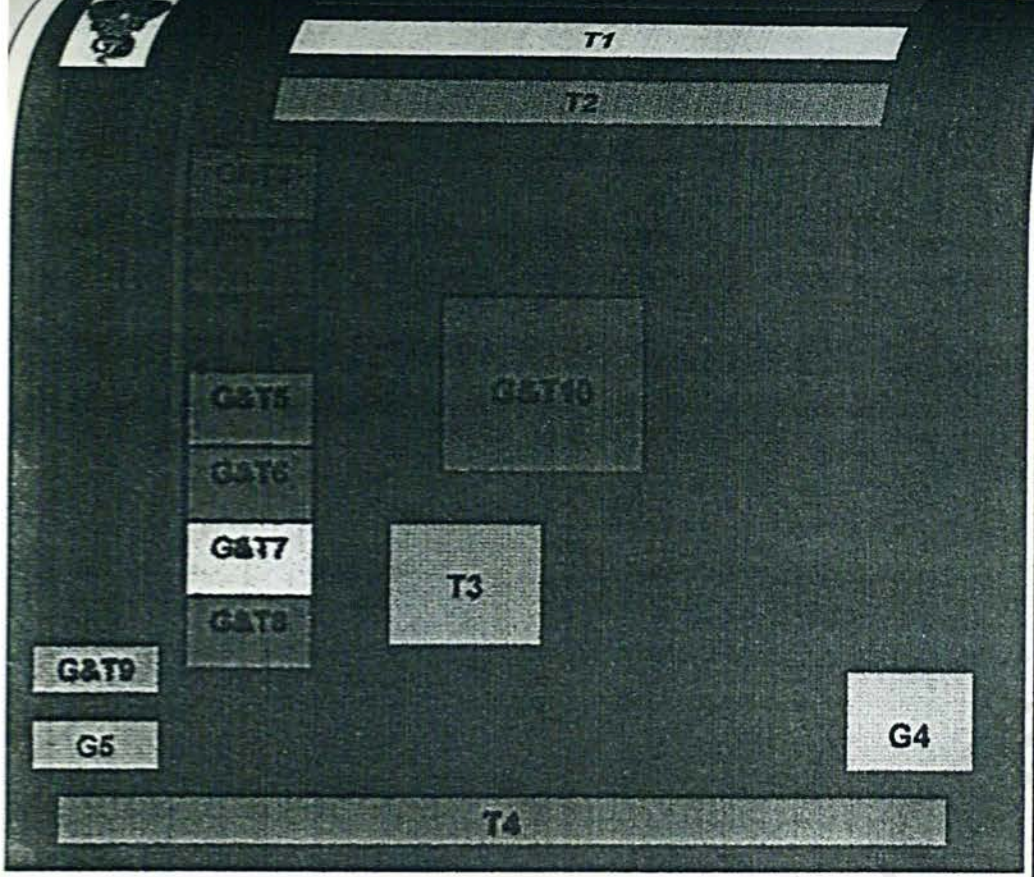
It is very essential to sketch out the storyboard for the project as a guidance to design and implement the proposed system. The strength of storyboard for the web-based project is:

- Help to provide ideas to develop the proposed system. If there are errors in the storyboard, thus the implementation of the proposed system is inaccurate.
- It is easy to recognize any fault.
- A storyboard will guide the programmer to develop the proposed system.
- Help to focus the proposed system.
- Identify the problems effectively.
- Every interaction of a screen is described in detail.
- A detailed storyboard saves time to write the documentation of the system.

5.6 Storyboard for Explore Science & Maths System

The storyboard for Explore Science & Maths System explains the draft of the user interface, graphical buttons and instructions or actions when the user clicks to any icon. In addition, there is genie's narration that will help the user and explain how to use and interact with the system

Every screen of the storyboard explained in detail of each interaction of the icons. There are nine pages of storyboard described in detail for the proposed system.



Narration: Genie

Hello, welcome to Explore Science and Maths. I'm your friendly guide, Genie. Let me introduce this site to you. Below, the animation explains the summary of the buttons on your left. Check out any menu on the left by just clicking them.

Object:

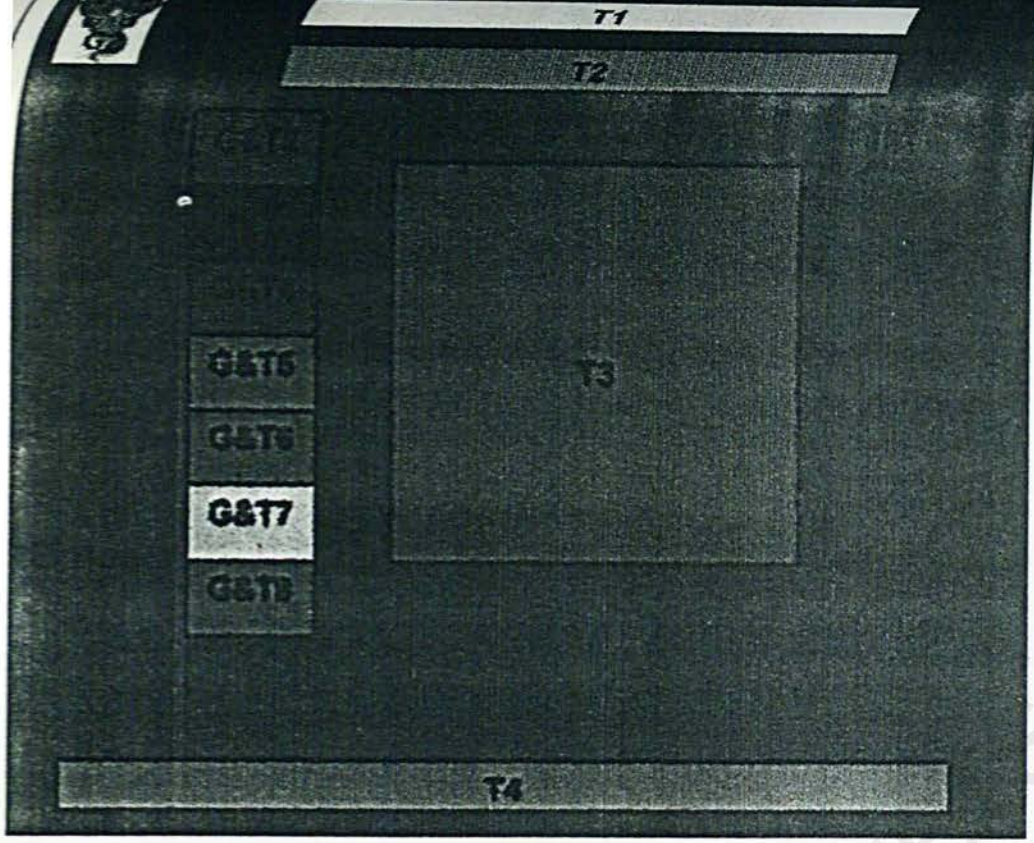
G1: Background
*G2: MASH - **Genie***
G3: System Logo
G4: Flash Animation Professor
G5: Flash player download
G&T1: Banner - Explore Science and Maths
G&T2: Education Corner
G&T3: Home Button
G&T4: Learning Center Button
G&T5: Course Button
G&T6: Games Button
G&T7: Parents Info Button
G&T8: Educational Link Button
G&T9: Finding Nemo screen saver download
G&T10: Flash animation info
T1: Marquee – Online education website
T2: Heading: Explore Science and Maths
T3: Calling All Kids text
T4: Privacy policy copyright

Animation:

- G2, G4, G5
- G&T3, G&T4, G&T5, G&T6, G&T7, G&T8, G&T9, G&T10.
- T1

*1. G2 – **Genie** appears and speaks about Explore Science and Maths Homepage menu.*
2. When user drag the mouse over G&T10, flash animation text refer to G&T3, G&T4, G&T5, G&T6, G&T7 and G&T8 buttons individually.
3. When G&T3 clicked, the Homepage screen is refreshed.
4. When G&T4 clicked, Learning Center menu appears.
5. When G&T5 clicked, Course menu appears.
6. When G&T6 clicked, Games menu appears.
7. When G&T7 clicked, Parents Info menu appears.
8. When G&T8 clicked, Educational Link menu appears.
9. Click G&T9 when user needs to download Finding Nemo screen saver.
10. Click T4 when user needs to download Flash Player.

Figure 5.6 (a): Introduction of Explore Science and Maths



Narration: Genie

This is Learning Center menu which explains about the requirements of the education system.

Object:
G1: Background
*G2: MASH - **Genie***
G3: System Logo

G&T 1: Banner – Explore Science and Maths
G&T 2: Education Corner
G&T 3: Home Button
G&T 4: Learning Center Button
G&T 5: Course Button
G&T 6: Games Button
G&T 7: Parents Info Button
G&T 8: Educational Link Button

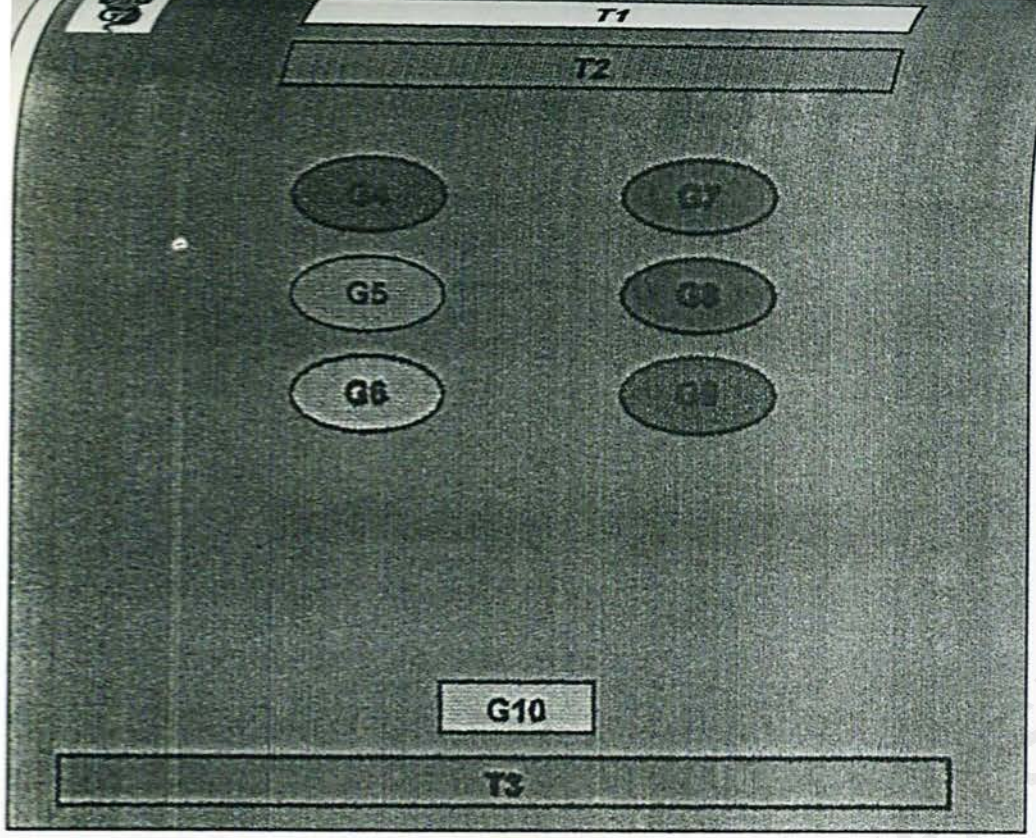
T1: Marquee – Online education website
T2: Heading: Explore Science and Maths
T3: Learning Center text
T4: Privacy policy copyright

Animation:

- G2
- G&T3, G&T4, G&T5, G&T6, G&T7, G&T8.
- T1

*1. G2 – **Genie** appears and speaks about the Learning Center menu.*
2. When G&T3 clicked, the Homepage menu appears.
3. When G&T4 clicked, Learning Center menu refreshed.
4. When G&T5 clicked, Course menu appears.
5. When G&T6 clicked, Games menu appears.
6. When G&T7 clicked, Parents Info menu appears.
7. When G&T8 clicked, Educational Link menu appears.

Figure 5.6 (b): Learning Center Menu



Narration: Genie

The Course menu provides courses that is Science and Maths for Year 1, 2 and 3.Click any of the course button to start your fun lessons!"

Object:

G1: Background
G2: MASH - Genie
G3: System Logo
G4: Science Year 1 Button
G5: Science Year 2 Button
G6: Science Year 3 Button
G7: Maths Year 1 Button
G8: Maths Year 2 Button
G9: Maths Year 3 Button
G10: Home Button

G&T1: Banner – Explore Science and Maths

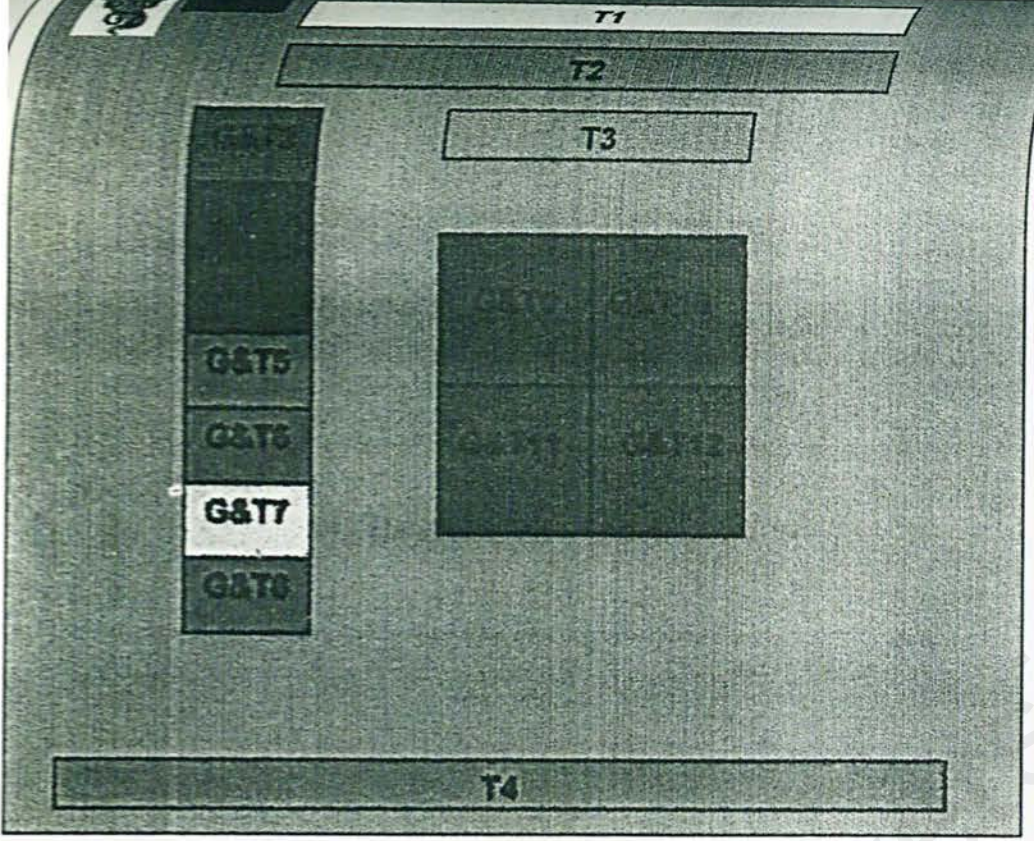
T1: Marquee – Online education website
T2: Heading: Explore Science and Maths
T3: Privacy policy copyright

Animation:

- G2, G4, G10
- T1

1. G2 - Genie appears and speaks about the Course menu.
2. When G4 clicked, the Science Year 1 menu appears.
3. When G10 clicked, the Homepage menu appears.

Figure 5.6 (c): Course Menu



Narration: Genie

The Games menu provides fun and adventurous games.

Object:
G1: Background
G2: MASH - Genie
G3: System Logo

G&T1: Banner – Explore Science and Maths
G&T2: Education Corner
G&T3: Home Button
G&T4: Learning Center Button
G&T5: Course Button
G&T6: Games Button
G&T7: Parents Info Button
G&T8: Educational Link Button

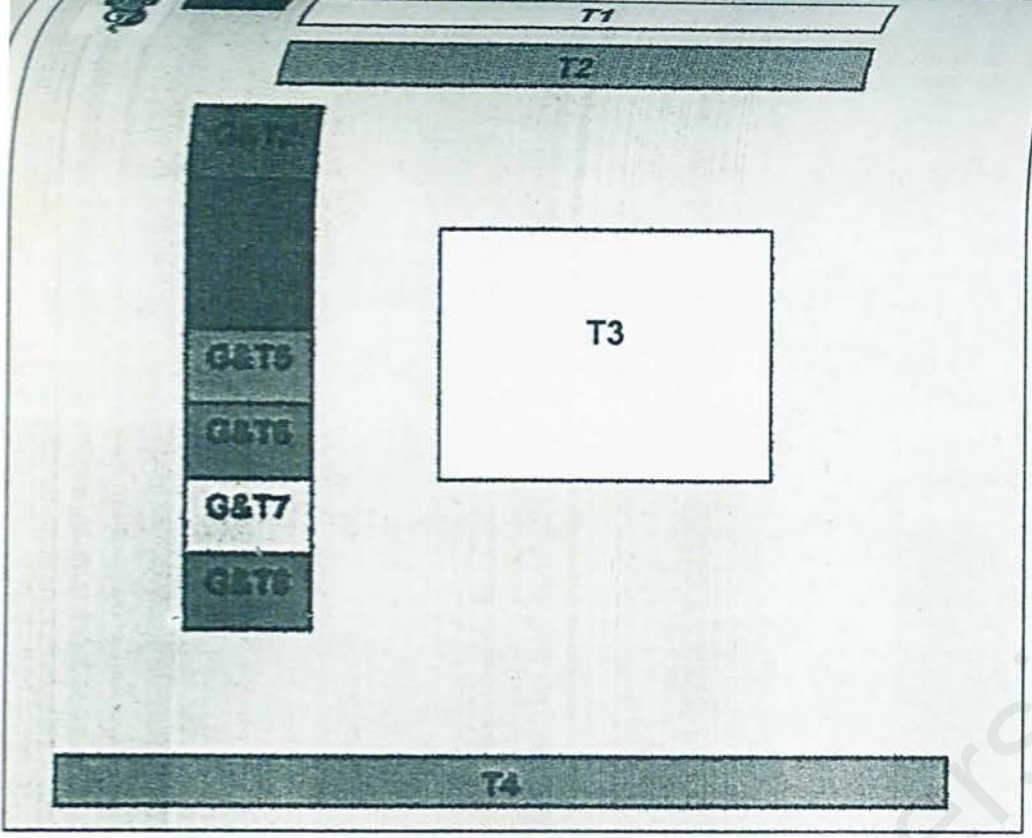
T1: Marquee – Online education website
T2: Heading: Explore Science and Maths
T3: Internet connection text
T4: Privacy policy copyright

Animation:

- G2
- G&T3, G&T4, G&T5, G&T6, G&T7, G&T8, G&T9, G&T10, G&T11, G&T12
- T1

*1. G2 – **Genie** appears and speaks about the Games menu.*
2. When G&T3 clicked, the homepage menu appears.
3. When G&T4 clicked, Learning Center menu appears.
4. When G&T5 clicked, Course menu appears.
5. When G&T6 clicked, Games menu refreshed.
6. When G&T7 clicked, Parents Info menu appears.
7. When G&T8 clicked, Educational Link menu appears.
8. When G&T9, G&T10, G&T11 and G&T12 clicked individually using Internet connection, each game screen appears respectively.

Figure 5.6(d): Games Menu



Narration: Genie

The Parents Info menu inform parents to be responsible in guiding their children during online.

Object:
G1: Background
*G2: MASH - **Genie***
G3: System Logo

G&T1: Banner – Explore Science and Maths
G&T2: Education Corner
G&T3: Home Button
G&T4: Learning Center Button
G&T5: Course Button
G&T6: Games Button
G&T7: Parents Info Button
G&T8: Educational Link Button

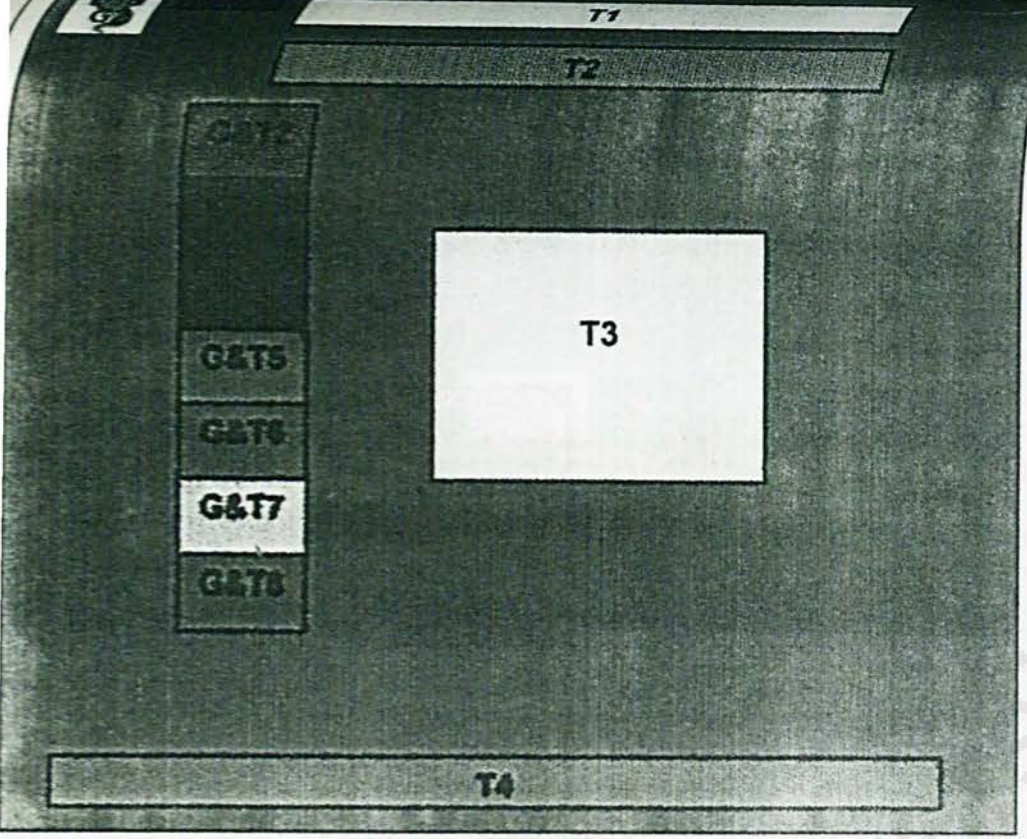
T1: Marquee – Online education website
T2: Heading: Explore Science and Maths
T3: Parents Info text
T4: Privacy policy copyright

Animation:

- G2
- G&T3, G&T4, G&T5, G&T6, G&T7, G&T8.
- T1

*1. When G2 – **Genie** appears and speak about Parents Info menu.*
2. When G&T3 clicked, the Homepage menu appears.
3. When G&T4 clicked, Learning Center menu appears.
4. When G&T5 clicked, Course menu appears.
5. When G&T6 clicked, Games menu appears.
6. When G&T7 clicked, Parents Info menu refreshed.
7. When G&T8 clicked, Educational Link menu appears.

Figure 5.6 (e): Parents Info Menu



Narration: Genie

The Educational Links menu guide the user to any other educational website.

Object:
G1: Background
*G2: MASH - **Genie***
G3: System Logo

G&T1: Banner – Explore Science and Maths
G&T2: Education Corner
G&T3: Home Button
G&T4: Learning Center Button
G&T5: Course Button
G&T6: Games Button
G&T7: Parents Info Button
G&T8: Educational Link Button

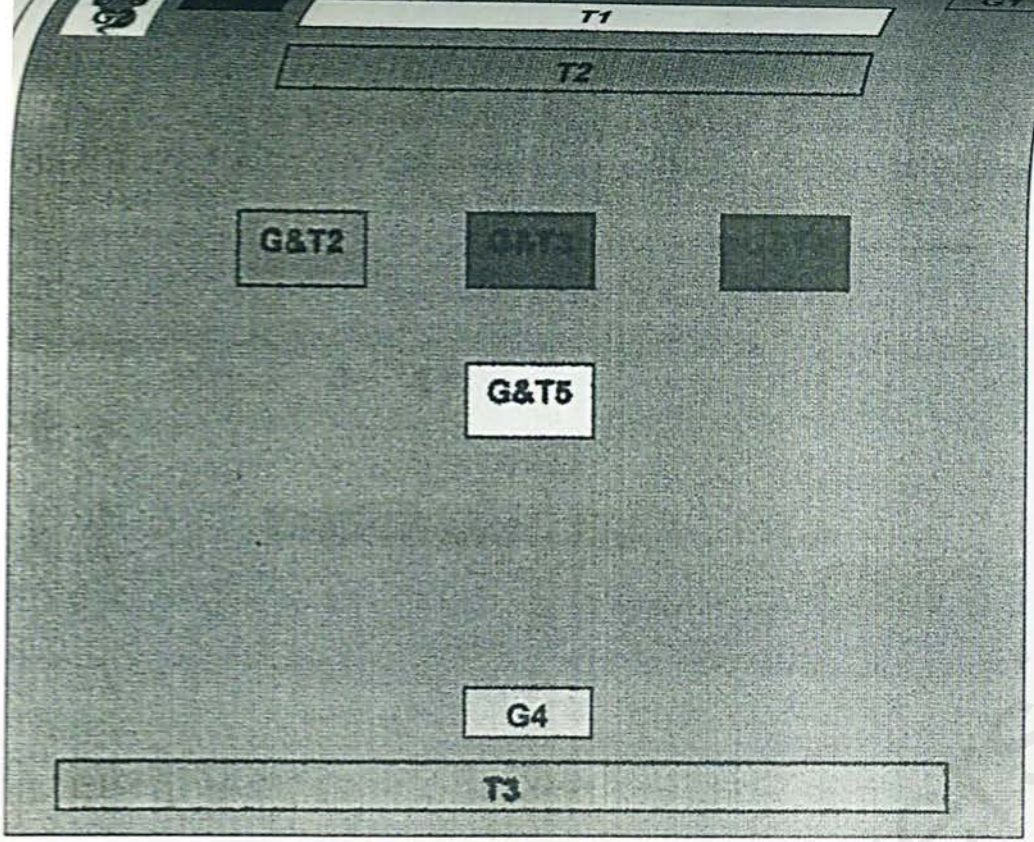
T1: Marquee – Online education website
T2: Heading: Explore Science and Maths
T3: Educational links websites text
T4: Privacy policy copyright

Animation:

- G2
- G&T3, G&T4, G&T5, G&T6, G&T7, G&T8
- T1, T3

*1. G2 – **Genie** appears and speaks about Educational Link menu.*
2. When G&T3 clicked, the Homepage menu appears.
3. When G&T4 clicked, Learning Center menu appears.
4. When G&T5 clicked, Course menu appears.
5. When G&T6 clicked, Games menu appears.
6. When G&T7 clicked, Parents Info menu appears.
7. When G&T8 clicked, Educational Link menu refreshed.
8. When T3 links individually clicked, the educational link website menu appears.

Figure 5.6 (f): Educational Link Menu



Narration: Genie

Science Year 1 consists of three lessons, that is Lesson 1 - Ourselves, Lesson 2 - Animals and Lesson 3 - Plants. A fun and interactive revision drag and drop activities which conclude all the lessons. Click any lesson to start your fun lessons!

Object:
G1: Background
*G2: MASH - **Genie***
G3: System Logo
G4: Home Button

G&T1: Banner – Explore Science and Maths
G&T2: Lesson 1 Button
G&T3: Lesson 2 Button
G&T4: Lesson 3 Button
G&T5: Revision: Drag and Drop Activities Button

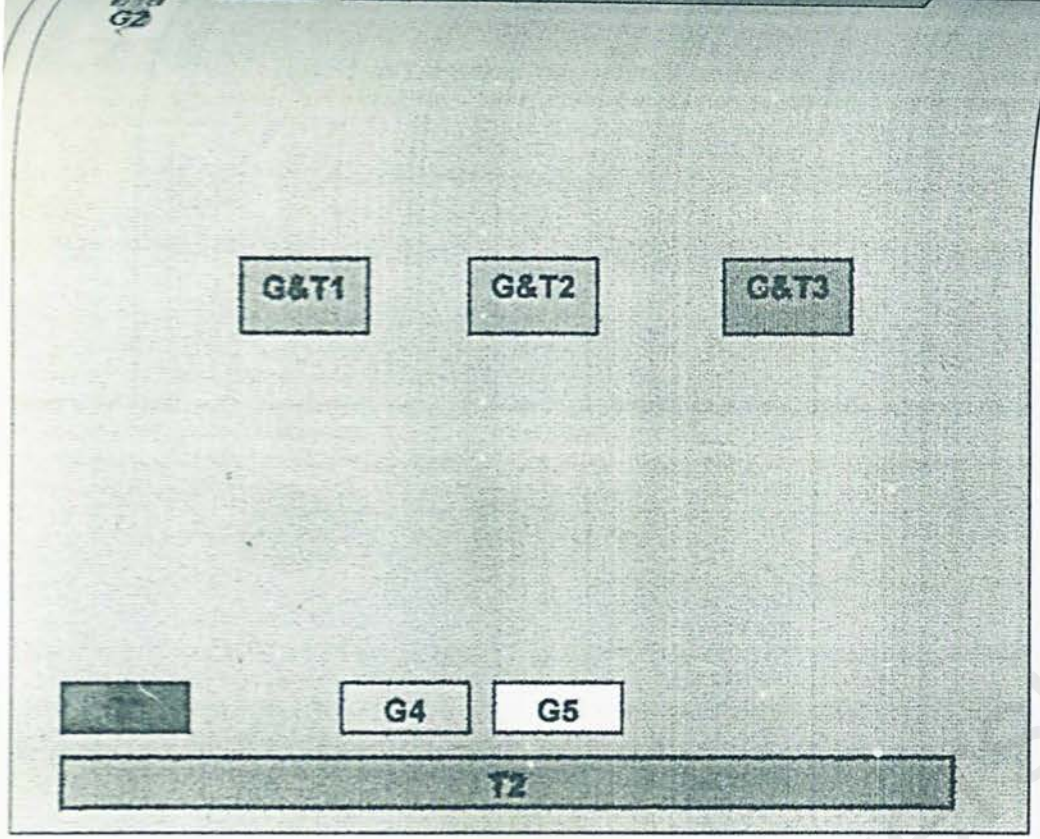
T1: Marquee – Online education website
T2: Heading: Explore Science and Maths
T3: Privacy policy copyright

Animation:

- G2,G4
- G&T2, G&T3, G&T4, G&T5
- T1

*1. G2 – **Genie** appears and speaks about three lessons of Science Year 1.*
2. When G&T2 clicked, the Lesson 1 menu appears.
3. When G&T3 clicked, Lesson 2 menu appears.
4. When G&T4 clicked, Lesson 3 menu appears.
5. When G&T5 clicked, Revision drag and drop activities menu appears.
6. When G4 clicked, Homepage menu appears.

Figure 5.6 (g): Science Year 1 Menu



Narration: Genie

Lesson 1 consists of three topics, that is 'Different Body Parts', 'Good Habits' and 'Healthy Food'. Click any topic to begin!"

Object:

G1: Background
G2: MASH - Genie
G3: System Logo
G4: Home Button
G5: Course Button
G6: Back Button

G&T1: Topic 1 Button
G&T2: Topic 2 Button
G&T3: Topic 3 Button

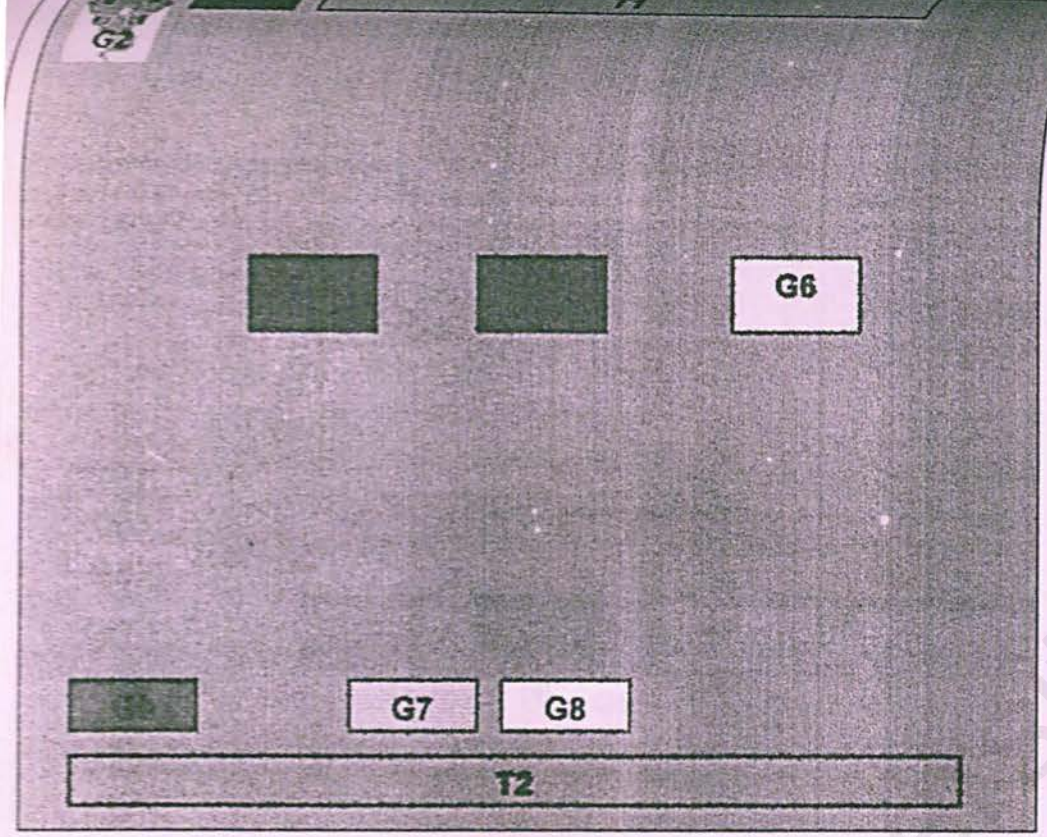
T1: Heading: Explore Science and Maths
T2: Privacy policy copyright

Animation:

- G2, G4, G5, G6
- G&T1, G&T2, G&T3

1. G2 – Genie appears and speaks about three topics of Lesson 1.
2. When G&T1 clicked, Topic 1 menu appears.
3. When G&T2 clicked, Topic 2 menu appears.
4. When G&T3 clicked, Topic 3 menu appears.
5. When G4 clicked, Homepage menu appears.
6. When G5 clicked, Course menu appears.
7. When G6 clicked, Science Year 1 menu appears.

Figure 5.6 (h): Lesson 1 Menu



Narration: Genie

Topic 1 of Lesson 1 consists of notes, an exercise and a quiz. It is important to understand the contents of the notes before attempting the exercise and quiz.

Object:

G1: Background
G2: MASH - Genie
G3: System Logo
G4: Notes Button
G5: Exercise Button
G6: Quiz Button
G7: Home Button
G8: Course Button
G9: Back Button

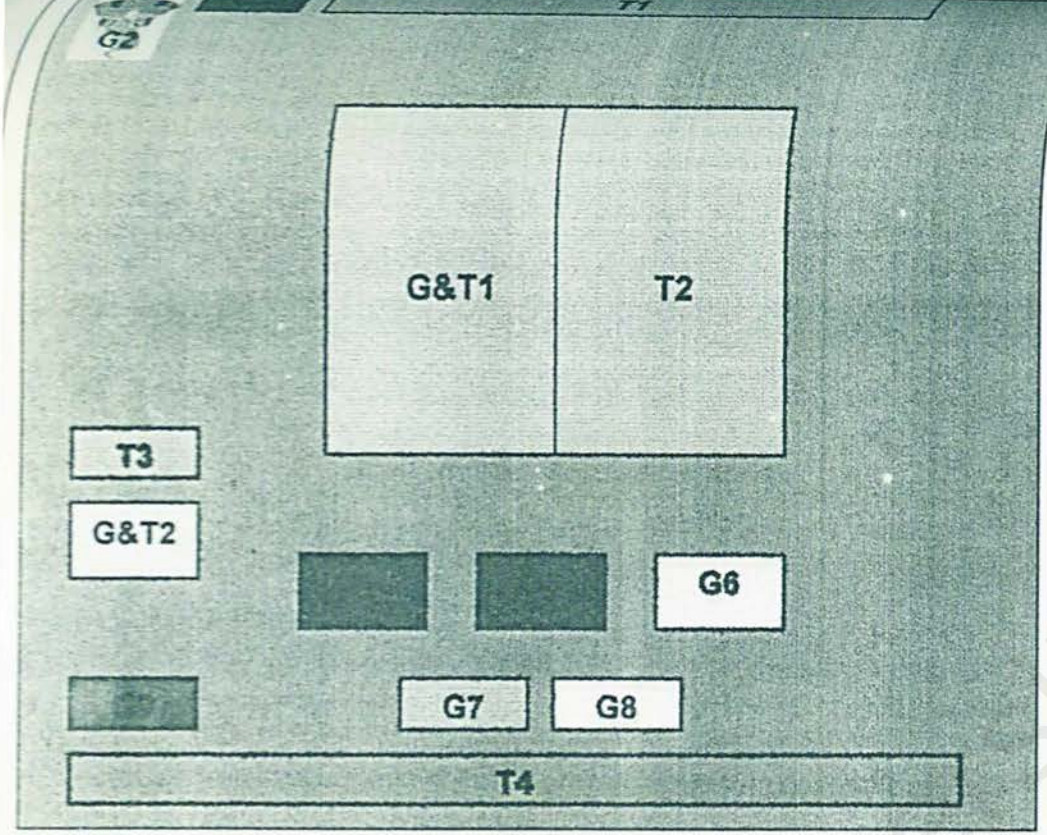
T1: Heading: Explore Science and Maths
T2: Privacy policy copyright

Animation:

- G2, G4, G5, G6, G7, G8, G9

1. G2 – Genie appears and speaks about Topic 1 of Lesson 1.
2. When G4 clicked, notes of Topic 1 screen appears.
3. When G5 clicked, exercise of Topic 1 screen appears.
4. When G6 clicked, quiz of Topic 1 screen appears.
5. When G7 clicked, Homepage menu appears.
6. When G8 clicked, Course menu appears.
7. When G9 clicked, Science Year 1 menu appears.

Figure 5.6 (i): Topic 1 of Lesson 1 Menu



Narration: Genie

Topic 1 of Lesson 1 is about different body parts. For example, the head, hair, eyes, nose, ear, and mouth are the most important parts of the body. Next, the upper part of the body includes the neck, shoulder, hand and fingers. Finally, the knee, leg and foot are the different lower parts of the body.

Object:
G1: Background
G2: MASH - Genie
G3: System Logo
G4: Notes Button
G5: Exercise Button
G6: Quiz Button
G7: Home Button
G8: Course Button
G9: Back Button

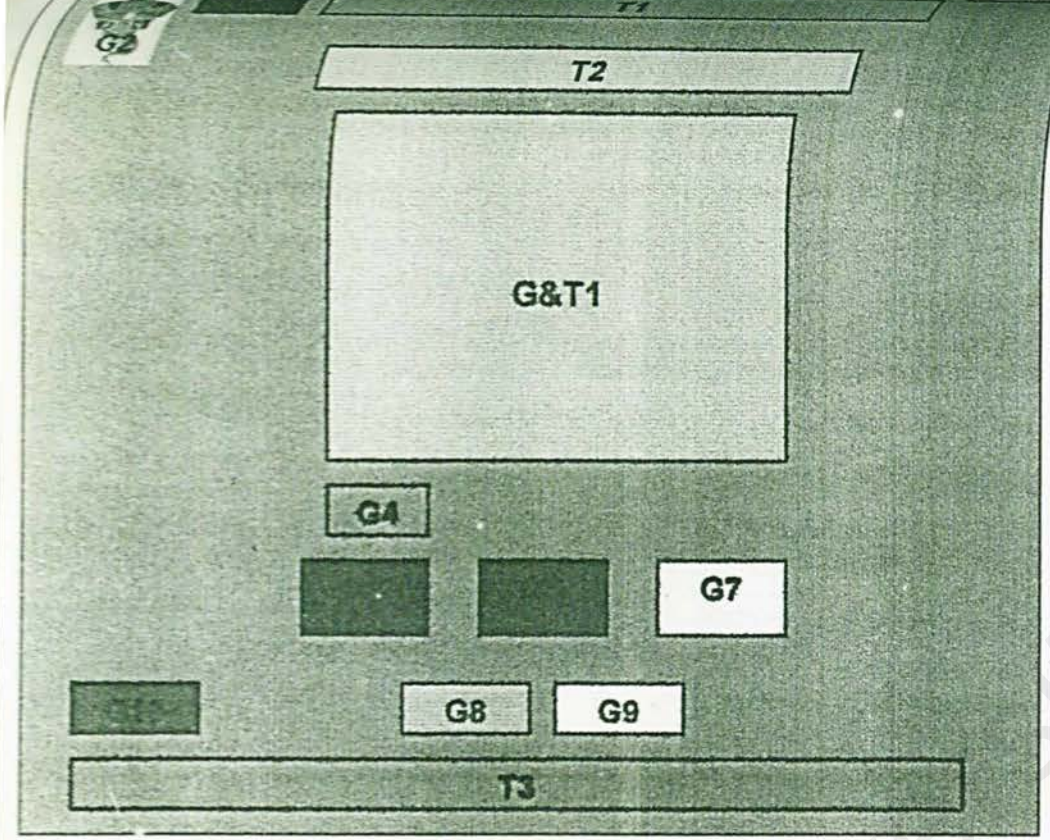
G&T1: Flash animation text
G&T2: Refresh Button

T1: Heading: Explore Science and Maths
T2: Notes text
T3: Bahasa Malaysia user drag mouse instruction
T4: Privacy policy copyright

Animation:
- G2, G4, G5, G6, G7, G8, G9
- G&T1, G&T2

1. G2 – Genie appears and speaks about the contents of the notes menu.
2. When G5 clicked, exercise of Topic 1 screen appears.
3. When G6 clicked, quiz of Topic 1 screen appears.
4. When G7 clicked, Homepage menu appears.
5. When G8 clicked, Course menu appears.
6. When G9 clicked, Topic 1 of Lesson 1 menu appears.
7. When user drag the mouse over G&T1, flash animation text of Bahasa Malaysia version appears.
8. When G&T2 clicked, the notes menu is refreshed and the user can hear the contents of notes again from **Genie**.

Figure 5.6 (j): Notes Menu



Narration: Genie

Topic 1 of Lesson 1 exercise is about body parts. Click the correct picture for body parts only.

Object:

G1: Background
G2: MASH - Genie
G3: System Logo
G4: Submit Button
G5: Notes Button
G6: Exercise Button
G7: Quiz Button
G8: Home Button
G9: Course Button
G10: Back Button

G&T1: Flash animation exercise

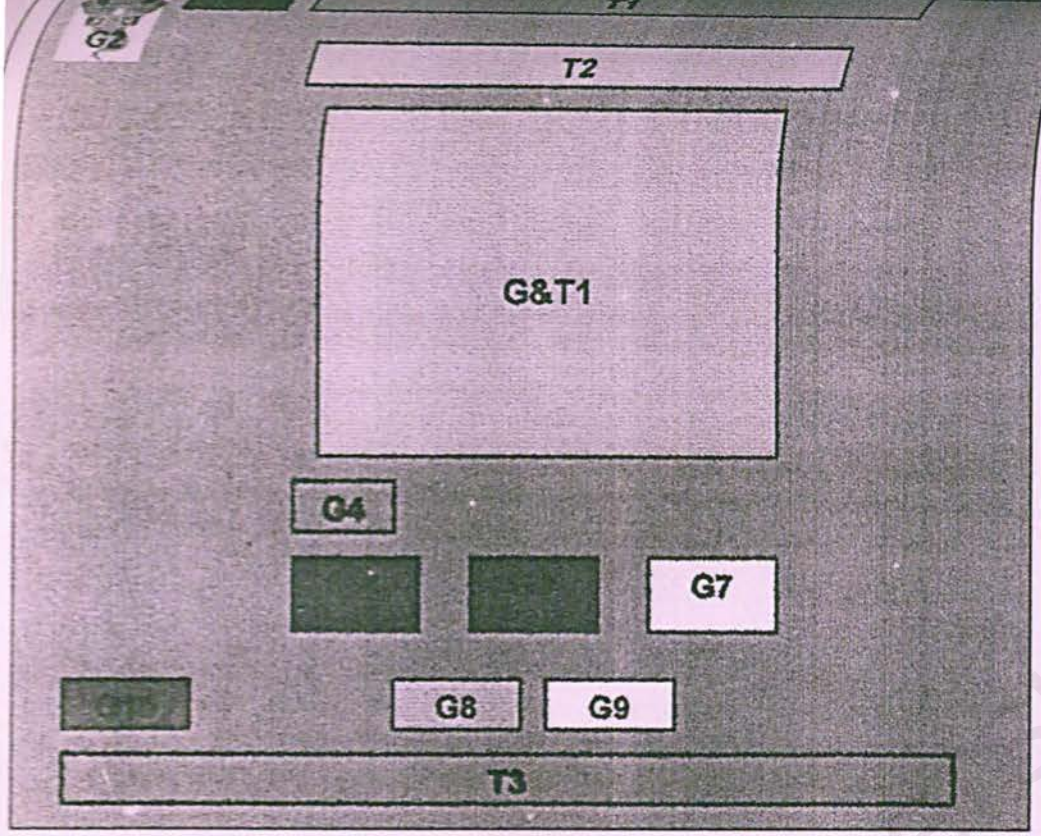
T1: Heading: Explore Science and Maths
T2: Instruction of the exercise
T3: Privacy policy copyright

Animation:

- G2, G4, G5, G6, G7, G8, G9, G10
- G&T1

*1. G2 – **Genie** appears and speaks the instructions of the exercise.*
2. When exercise completed, user click G4 to submit for evaluation (E-report) results.
3. When G5 clicked, notes of Topic 1 screen appears.
4. When G7 clicked, quiz of Topic 1 screen appears.
5. When G8 clicked, Homepage menu appears.
6. When G9 clicked, Course menu appears.
7. When G10 clicked, Topic 1 of Lesson 1 menu appears.

Figure 5.6 (k): Exercise Menu



Narration: Genie

Topic 1 of Lesson 1 quiz is about filling in the blanks with words given, that is ear, nose, leg, mouth, foot, eye, finger and knee.

Object:
G1: Background
G2: MASH - Genie
G3: System Logo
G4: Submit Button
G5: Notes Button
G6: Exercise Button
G7: Quiz Button
G8: Home Button
G9: Course Button
G10: Back Button

G&T1: Flash animation quiz

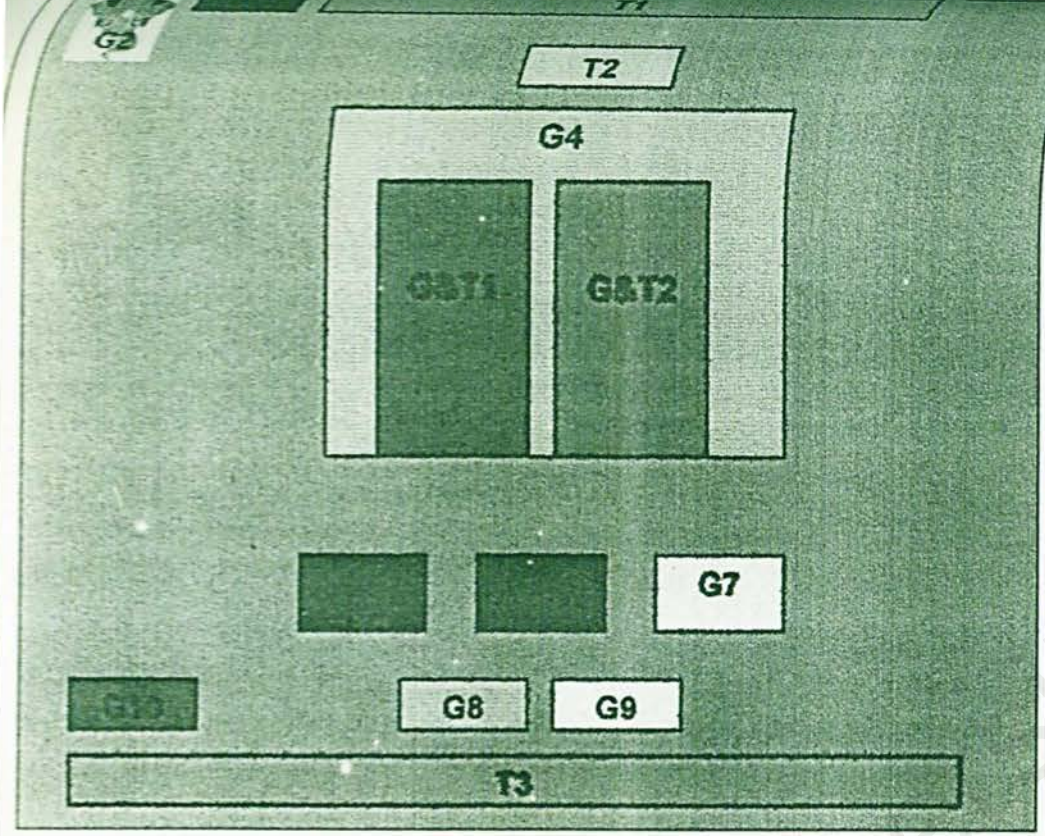
T1: Heading: Explore Science and Maths
T2: Instruction of the quiz
T3: Privacy policy copyright

Animation:

- G2, G4, G5, G6, G7, G8, G9, G10
- G&T1

1. G2 – Genie appears and speaks the instructions of the quiz.
2. When quiz completed, user click G4 to submit for evaluation (E-report) results.
3. When G5 clicked, notes of Topic 1 screen appears.
4. When G6 clicked, exercise of Topic 1 screen appears.
4. When G8 clicked, Homepage menu appears.
5. When G9 clicked, Course menu appears.
6. When G10 clicked, Topic 1 of Lesson 1 menu appears.

Figure 5.6 (l): Quiz Menu



Narration: Genie

Object:

G1: Background
G2: MASH - Genie
G3: System Logo
G4: Results display
G5: Notes Button
G6: Exercise Button
G7: Quiz Button
G8: Home Button
G9: Course Button
G10: Back Button

G&T1: Bar chart – correct answers
G&T2: Bar chart - wrong answers

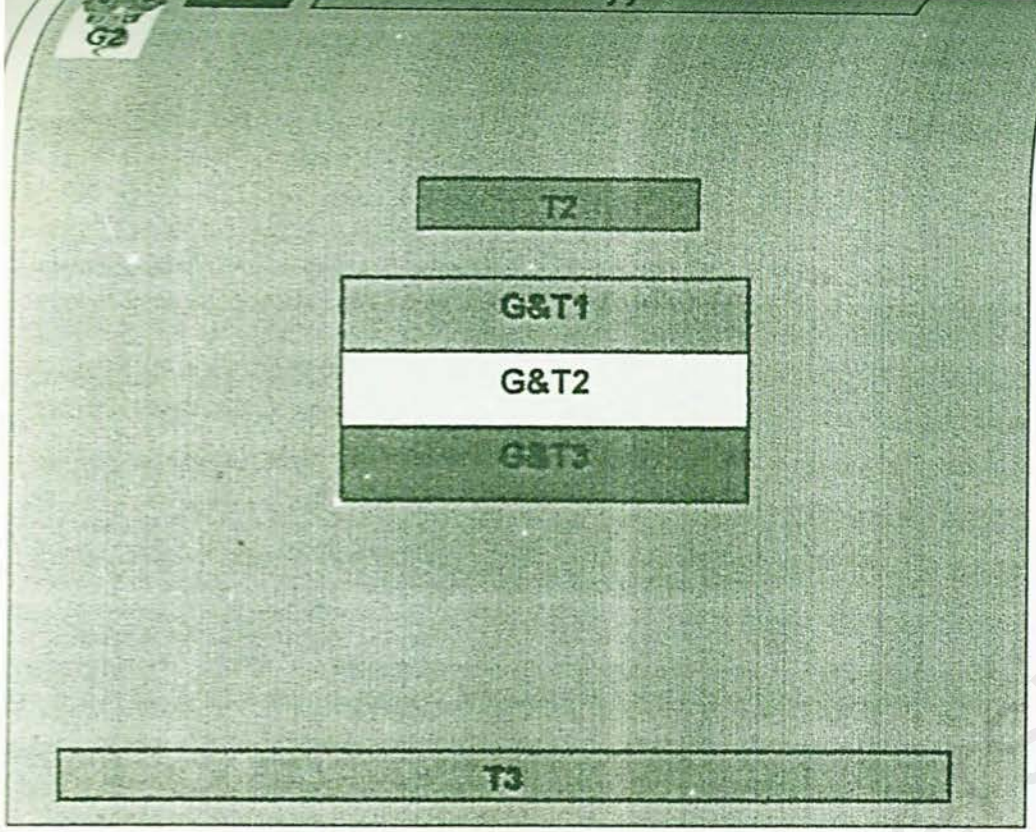
T1: Heading: Explore Science and Maths
T2: Exercise / Quiz text
T3: Privacy policy copyright

Animation:

- G2, G5, G6, G7, G8, G9, G10
- G&T, G&T2

1. When Exercise/ Quiz completed, the E-report menu shows the evaluation results at G4.
2. G&T1 bar chart displays correct answers.
3. G&T2 bar chart displays wrong answers
4. When G5 clicked, notes of Topic 1 screen appears.
5. When G6 clicked, exercise of Topic 1 screen appears.
When G7 clicked, quiz of Topic 1 screen appears.
6. When G8 clicked, Homepage menu appears.
7. When G9 clicked, Course menu appears.
8. When G10 clicked, Topic 1 of Lesson 1 menu appears.

Figure 5.6 (m): E-report Menu



Narration: Genie

Revision drag and drop are fun, colorful and interactive activities. There are three activities, that is Activity 1 from Lesson 1, Activity 2 from Lesson 2 and Activity 3 from Lesson 3. Click any activity to begin your fun lesson!

Object:
G1: Background
G2: MASH - Genie
G3: System Logo

G&T1: Activity 1 Button
G&T2: Activity 2 Button
G&T3: Activity 3 Button

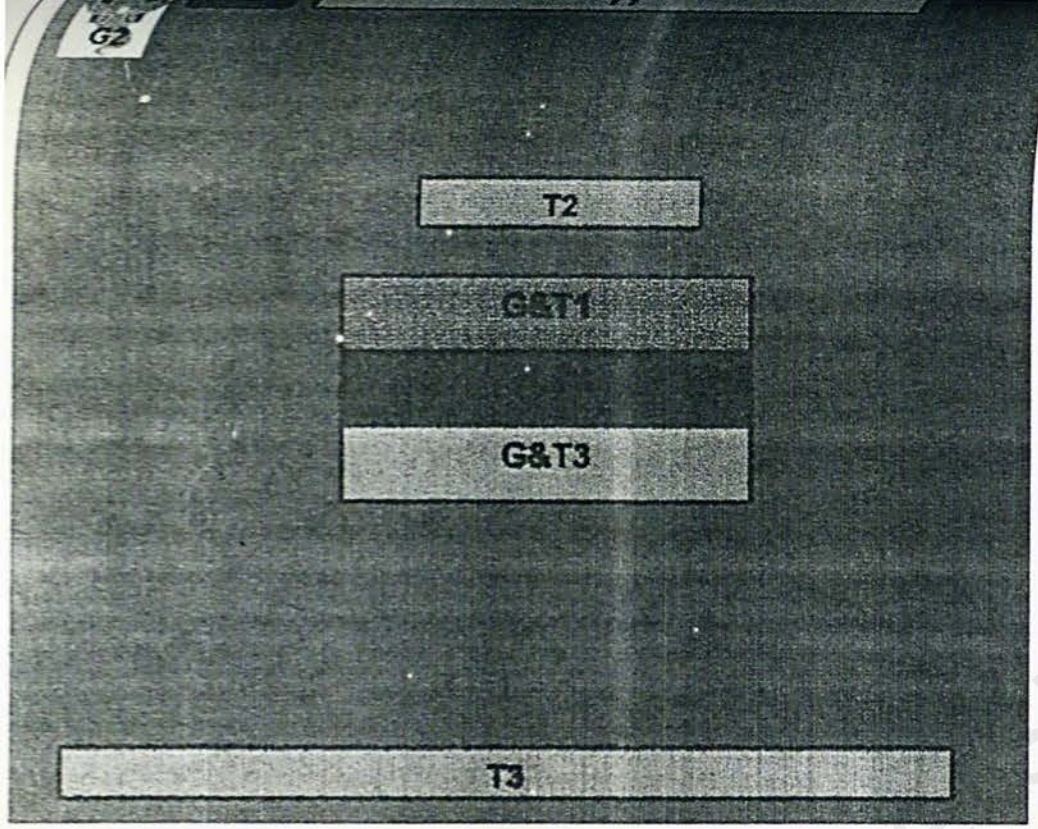
T1: Heading: Explore Science and Maths
T2: Revision text
T3: Privacy policy copyright

Animation:

- G2
- G&T1, G&T2, G&T3

1. G2 – Genie appears and speaks about Revision menu.
2. When G&T1 clicked, Activity 1 screen appears.
3. When G&T2 clicked, Activity 2 screen appears.
4. When G&T3 clicked, Activity 3 screen appears.

Figure 5.6 (n): Revision Menu



Narration: Genie

Revision drag and drop Activity 2 consists of three levels of animal homes. Click any level to begin your fun activity.

Object:
G1: Background
G2: MASH - Genie
G3: System Logo

G&T1: Level 1 Button
G&T2: Level 2 Button
G&T3: Level 3 Button

T1: Heading: Explore Science and Maths
T2: Activity 2 text
T3: Privacy policy copyright

Animation:

- G2
- G&T1, G&T2, G&T3

*1. G2 – **Genie** appears and speaks about Activity 2 menu.*
2. When G&T1 clicked, Level 1 screen appears.
3. When G&T2 clicked, Level 2 screen appears.
4. When G&T3 clicked, Level 3 screen appears.

Figure 5.6 (o): Activity 2 Menu

5.7 Conclusion

Designing the system efficiently is essential to ensure the Explore Science & Maths System is functional according to the system requirements. The flow chart gives an overview of the proposed system. The most important stage in designing phase is the storyboard. A detailed storyboard is a necessity for the Web-based E-learning System Science for Year One to ensure the implementation of the system is successful.

CHAPTER 6

System Development and Implementation

Objectives

- Software development tools
- System implementation
- Main screen – Homepage
- Course menu
- Science Year 1 menu
- Lesson menu
- Topic screen
- Notes screen
- Exercise screen
- Quiz screen
- Revision: Drag and drop activities menu

Chapter 6: System Development and Implementation

6.1 Introduction

The web pages of the system developed based on

- software development tools
- programming and scripting languages
- graphic software
- web authoring tools

6.1.1 Software development tools

Microsoft FrontPage with templates, themes and wizards is user friendly software to build websites. Its intelligent design assistance and support several programming languages that assembles the latest web technologies.

MASH is software used where interactive Genie to introduce, guide and enhance the Web pages or applications in addition to the conventional use of windows, menus, and controls.

6.1.2 Programming and scripting languages

The languages used to develop the system are HTML, VBScript, JavaScript and ASP. Basically, HTML is mostly used designing the web page. Next, VBScript is used which

supports the MASH software. The JavaScript language is used to display different images, give feedback on forms for example, display message box to the users. The ASP language connects the database, extract and displays results of correct and wrong answers input by the users.

6.1.3 Graphic software

The design and images of web pages for the system is sketched in Adobe Photoshop 7.0. The powerful graphic software is used to create pictures, buttons, resize and edit images.

6.1.4 Web authoring tools

The strength of Flash MX creates navigation controls, animated logos, and long-form animations with synchronized sound and even completes sensory-rich web sites. With Flash MX the system delivers rich, interactive and animation web pages to the users. Besides, the bilingual terms that are Bahasa Malaysia can be viewed as text tool tip in Flash gives an additional impression to the user for easier translation.

6.2 System Implementation

System interface and program is very important in the development of a system. Explore Science and Maths system concludes 71 interactive and colorful user interfaces.

Each interface represents a specific module of the program. Each web page was developed individually and integrated into a fully functional system. The main various interface function based on each module as show in Figure 6.2.

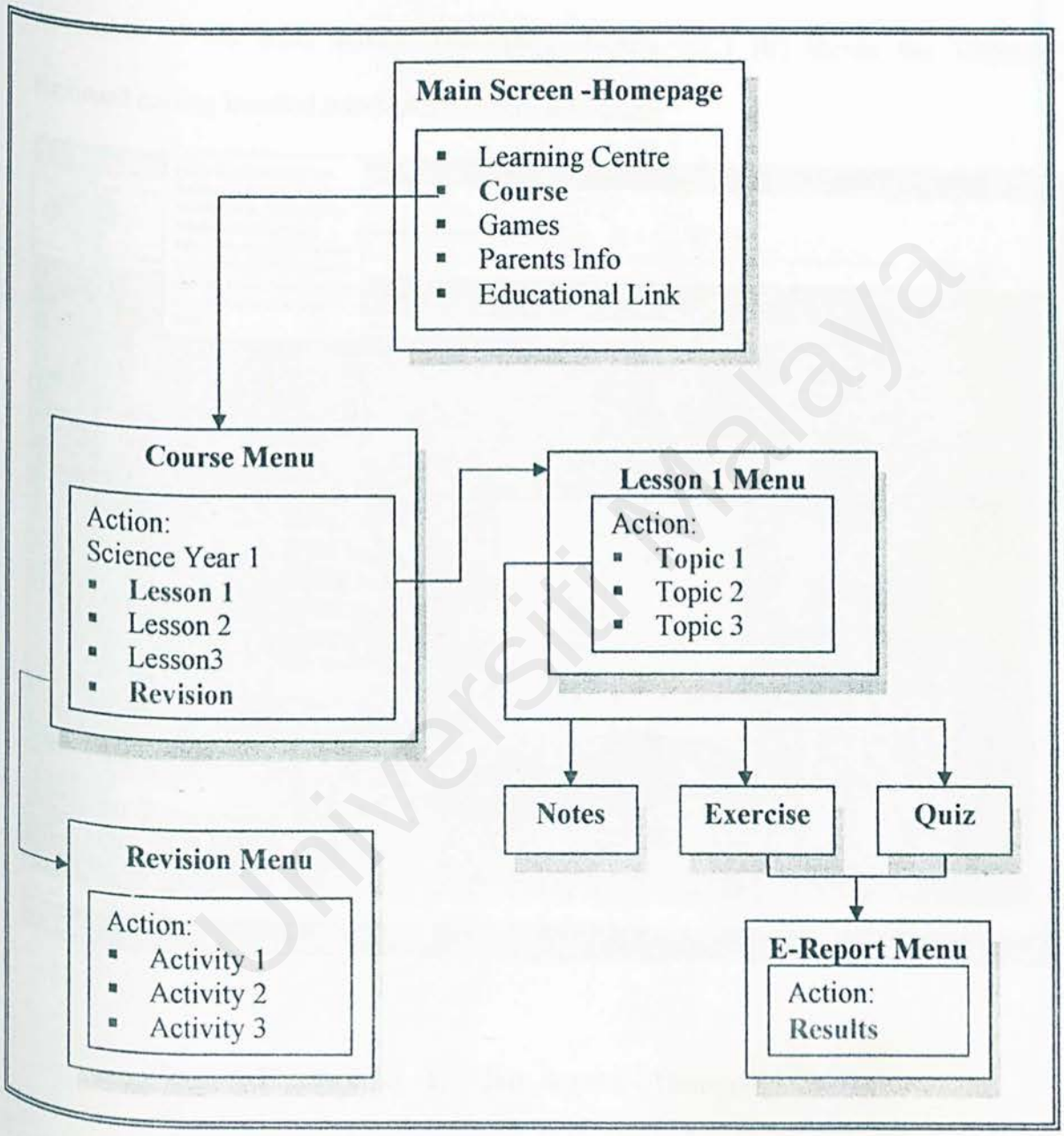


Figure 6.2: Main Screen Function

6.2.1 Main Screen - Homepage

The main screen of the system is the Homepage menu where users can select different menus to view the related information of the program. Figure 6.2.1 (a) shows the screenshot of the main screen, Homepage. Figure 6.2.1 (b) shows the VBScript clipboard coding inserted into MASH Genie web page.

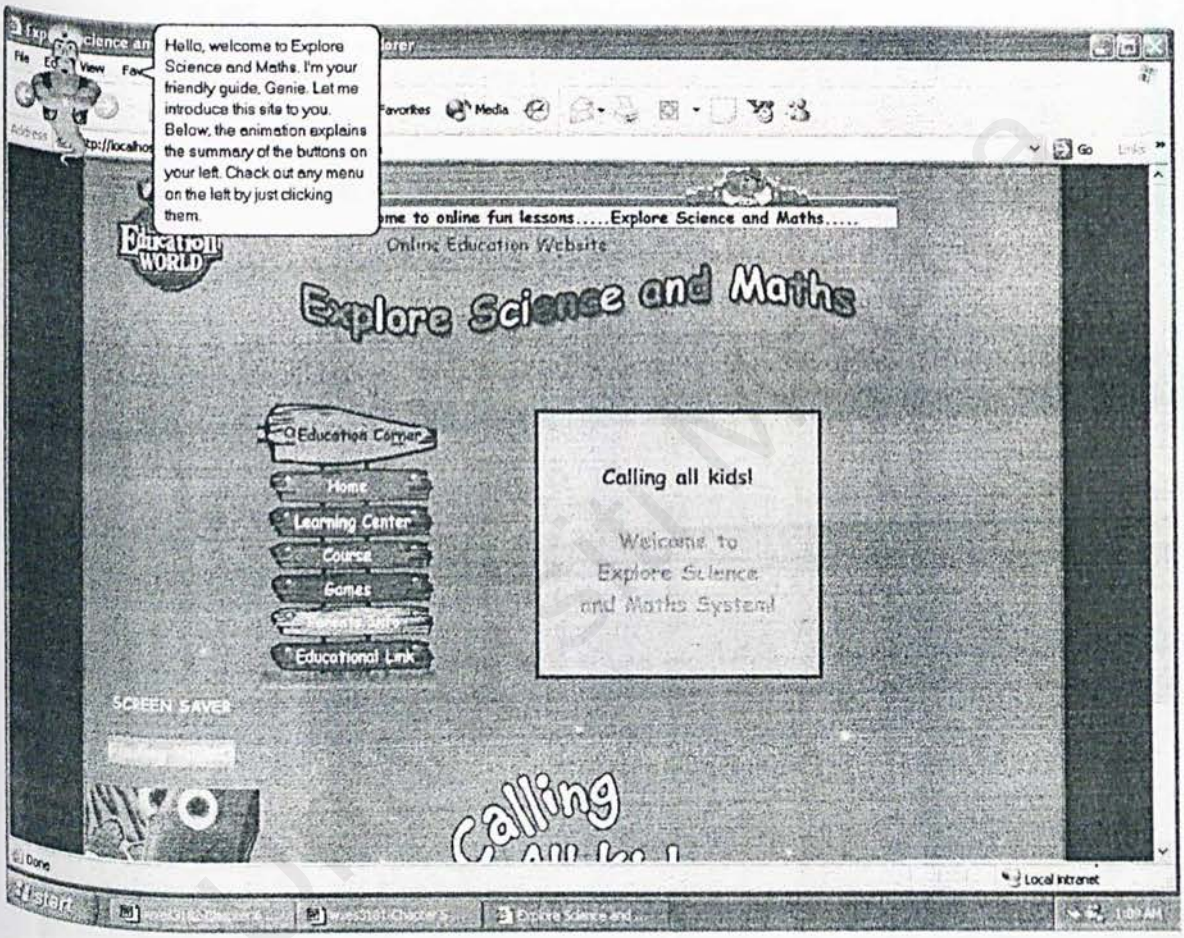


Figure 6.2.1 (a): Main Screen – Homepage

```
'*** BEGIN MASH USER SCRIPT ***

  Genie.Show
  Genie.Speak "Hello, welcome to Explore Science and Maths. I'm your friendly guide, Genie. Let me
  introduce this site to you. Below, the animation explains the summary of the buttons on your
  left.  Check out any menu on the left by just clicking them.

  '*** END MASH USER SCRIPT ***
End Sub
```

Figure 6.2.1 (b) – MASH Genie VBScript coding

6.2.2 Course Menu

The Course menu consists of six modules. Currently, only Science Year 1 is functional for the present system's requirement as shown in Figure 6.2.2.

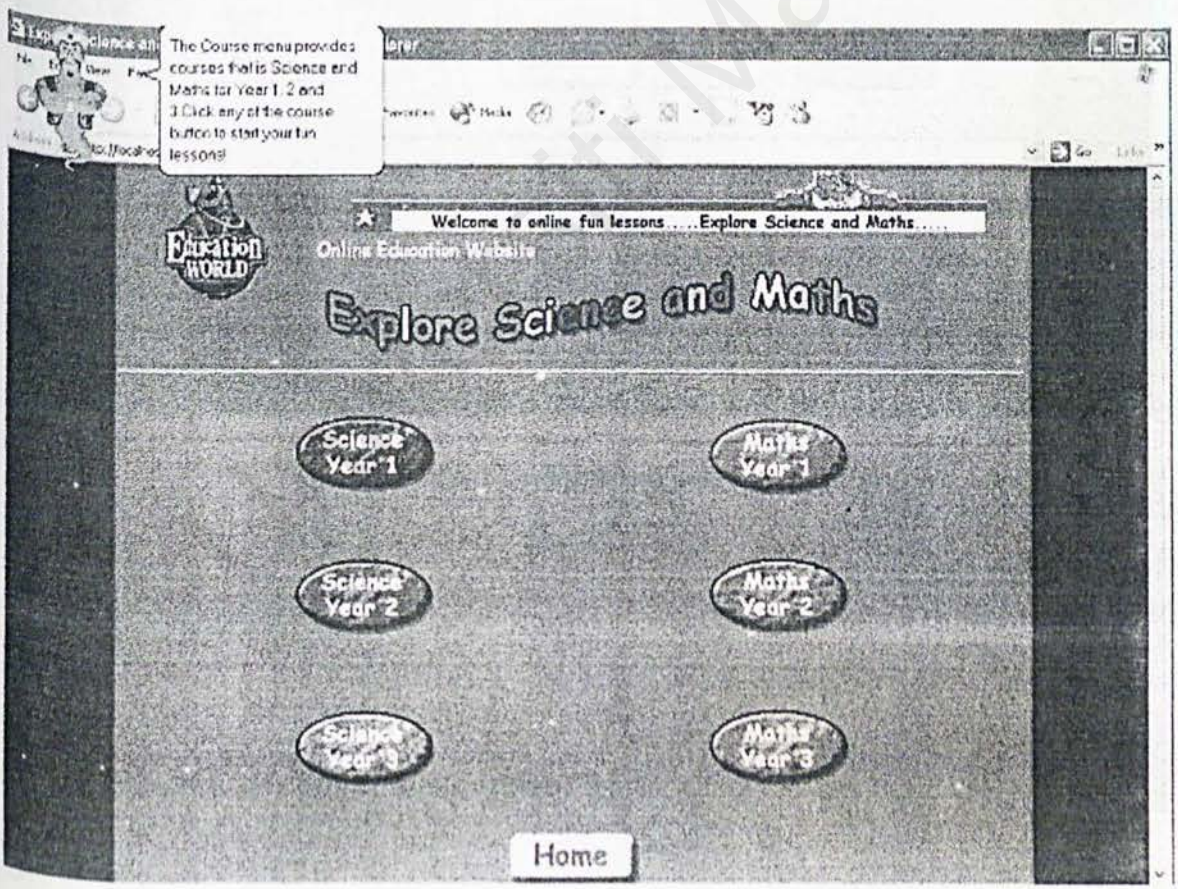


Figure 6.2.2: Course Menu

6.2.3 Science Year 1 Menu

This is the core of the system where the users can select any lesson and understand the topics of each lesson. Figure 6.2.3 displays three lessons and a revision activity.

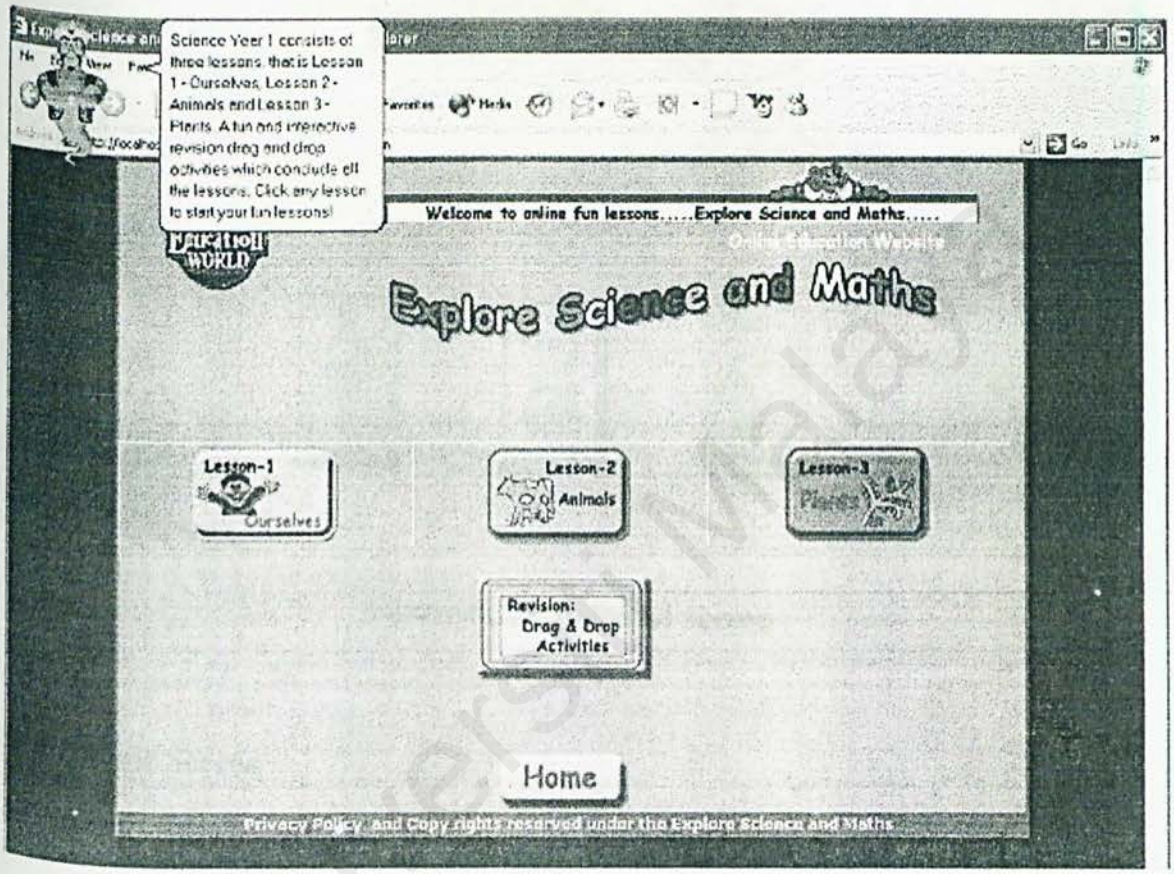


Figure 6.2.3: Science Year 1 menu

6.2.4 Lesson Menu

Each lesson consists of three topics where the user can select any topic as show in Figure 6.2.4.

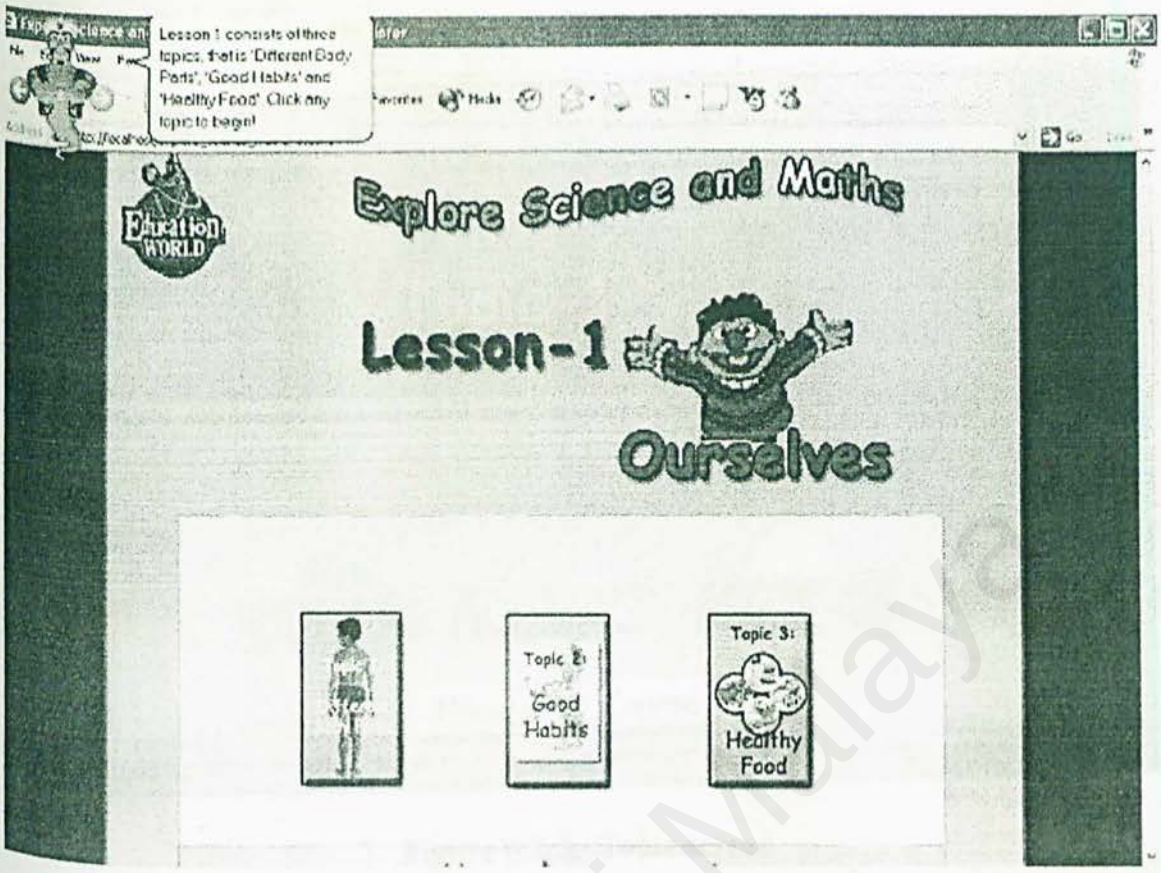


Figure 6.2.4: Lesson 1 screen

6.2.5 Topic Screen

Each topic of any lesson has three main buttons at the tool bar that is Notes button, Exercise button, and Quiz button. Besides, Home button, Course button and Back button are designed below the three main buttons as shown in Figure 6.2.5.

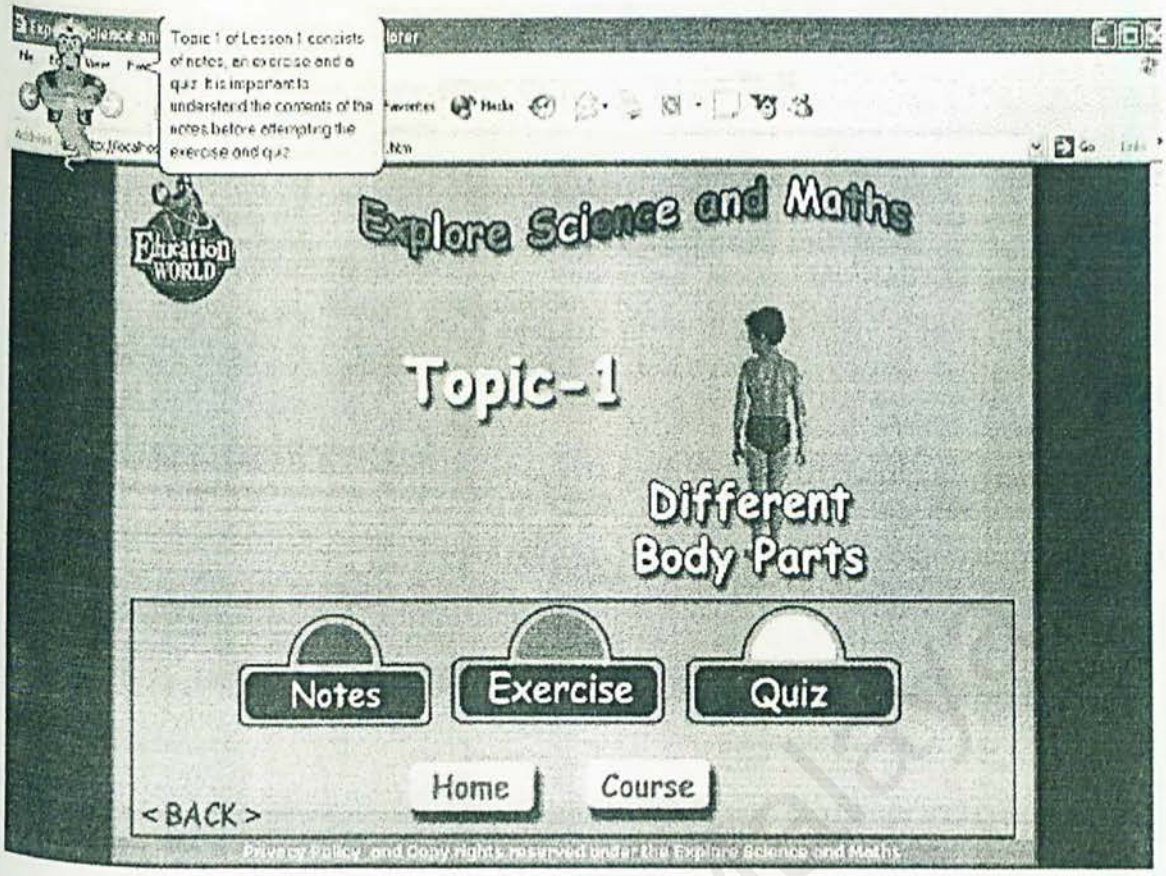


Figure 6.2.5: Topic screen

6.2.5.1 Notes Screen

Each notes screen of the system is designed with rich interactive, animated and colorful graphics and text. The Flash MX animations add the '*splash*' which attracts the user's attention. Figure 6.2.5.1 displays the Flash animation of different body parts in Bahasa Malaysia version.

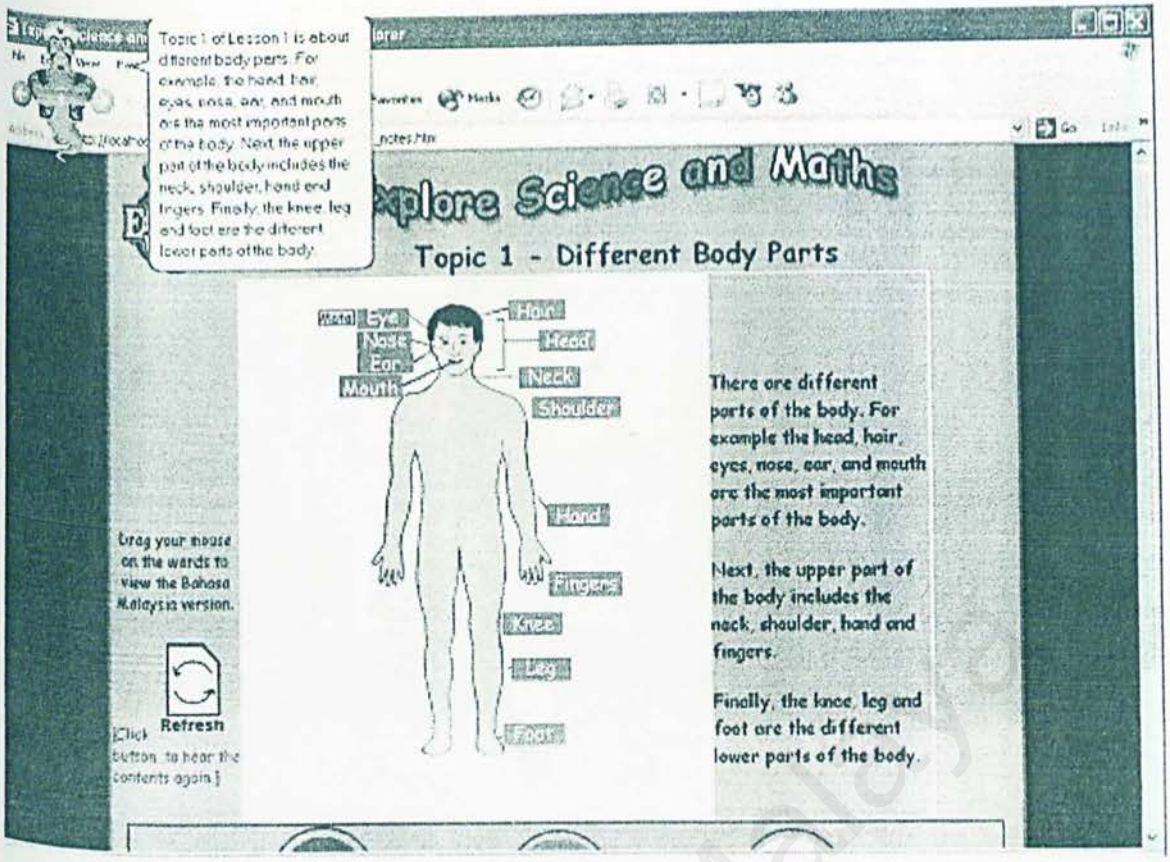


Figure 6.2.5.1: Notes screen

6.2.5.2 Exercise Screen

The exercise of the system developed comprises several ways to test the users for each certain topic as shown in 6.2.5.2 (a). Each exercise consists of a few questions and the user need to submit for evaluation results. A message box display the results after submitting the exercise as shown in 6.2.5.2 (b). Figure 6.2.5.2 (c) displays the coding of the message box in JavaScript. The E-report screen displays the correct and wrong answers in bar charts as shown in Figure 6.2.5.2 (d). The E-report exercise coding for evaluation as shown in Figure 6.2.5.2 (e).

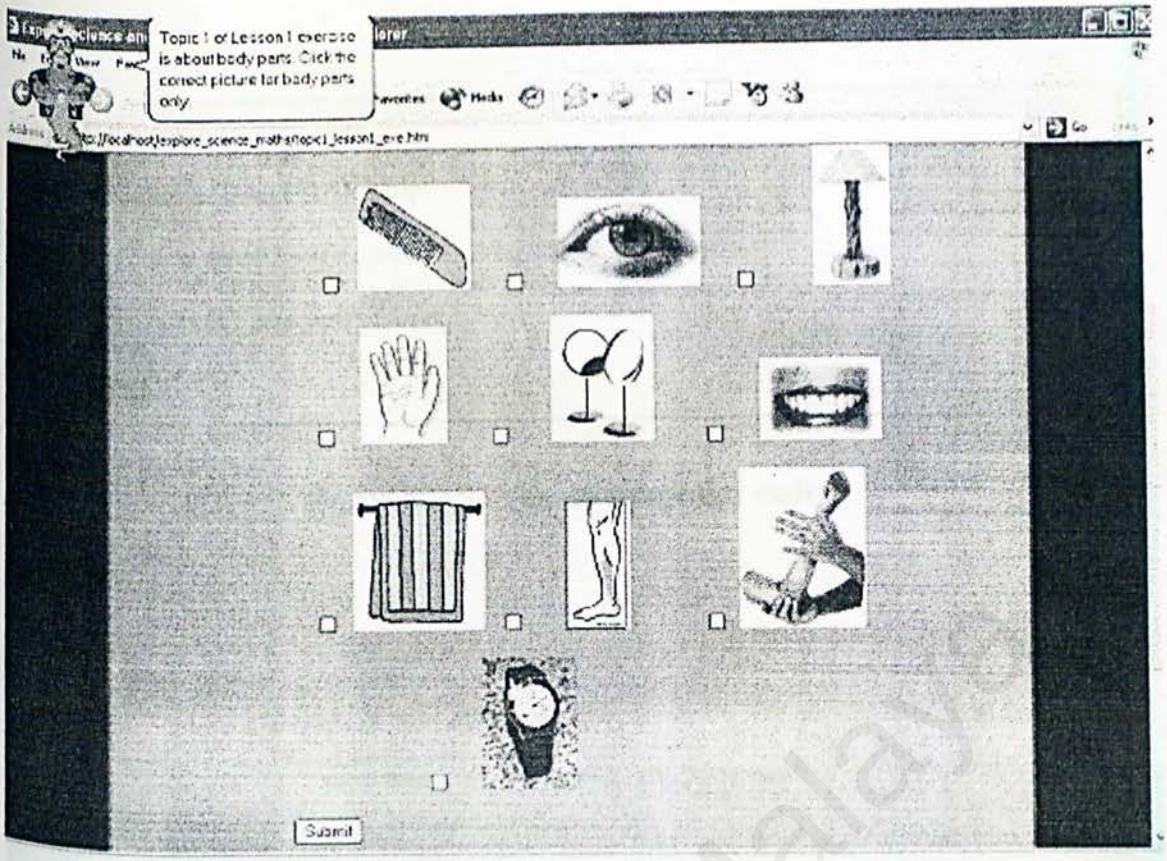


Figure 6.2.5.2 (a): Exercise screen

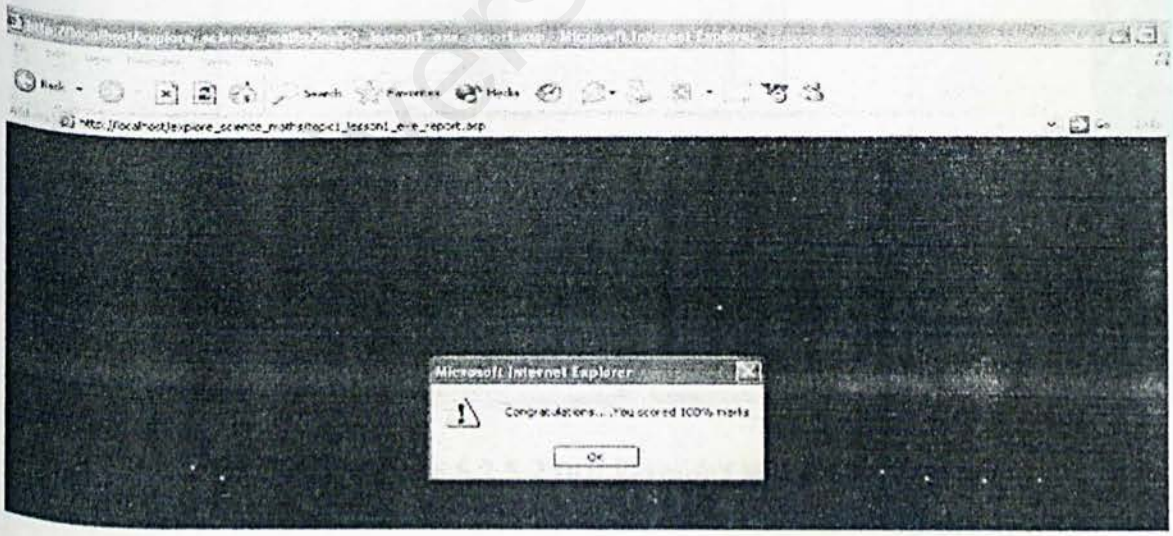


Figure 6.2.5.2 (b): Message box screen

```
if answeredcnt = 5 then
%>
<Script language="Javascript">

window.alert("Congratulations....You scored 100% marks ");

            </script>
<%
end if
```

Figure 6.2.5.2 (c): Message box coding

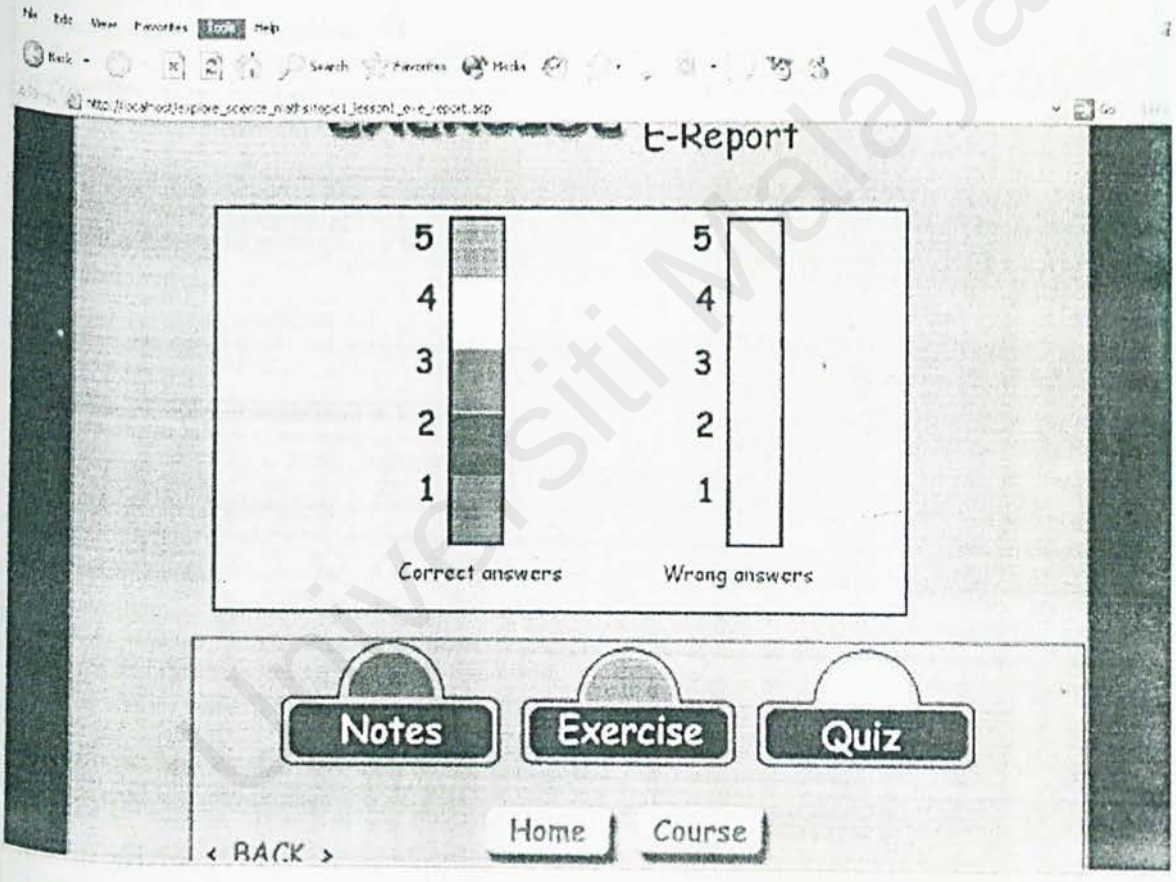


Figure 6.2.5.2 (d): E-report screen

```
<%
dim A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, Aname
dim answeredcnt, answeredcnt1
answeredcnt = 0
answeredcnt1 = 0

'Aname =  request.form("txtname")
A1 = request.form("C1")
A2 = request.form("C2")
A3 = request.form("C3")
A4 = request.form("C4")
A5 = request.form("C5")
A6 = request.form("C6")
A7 = request.form("C7")
A8 = request.form("C8")
A9 = request.form("C9")
A10 = request.form("C10")

if A1="ON" then
  answeredcnt1=answeredcnt1 + 1
end if
if A2="ON" then
  answeredcnt=answeredcnt + 1
end if
if A3="ON" then
  answeredcnt1=answeredcnt1 + 1
end if
if A4="ON" then
  answeredcnt=answeredcnt + 1
end if
if A5="ON" then
  answeredcnt1=answeredcnt1 + 1
end if
if A6="ON" then
  answeredcnt=answeredcnt + 1
end if
if A7="ON" then
  answeredcnt1=answeredcnt1 + 1
end if
if A8="ON" then
  answeredcnt=answeredcnt + 1
end if
if A9="ON" then
  answeredcnt=answeredcnt + 1
end if
if A10="ON" then
  answeredcnt1=answeredcnt1 + 1
end if

if answeredcnt >=5 then
%>
```

Figure 6.2.5.2 (e) E-report exercise coding for evaluation results

Some exercises require users to fill in the blanks with words provided matching to the correct pictures as shown in Figure 6.2.5.2 (f) in any order as shown in Figure 6.2.5.2 (g).

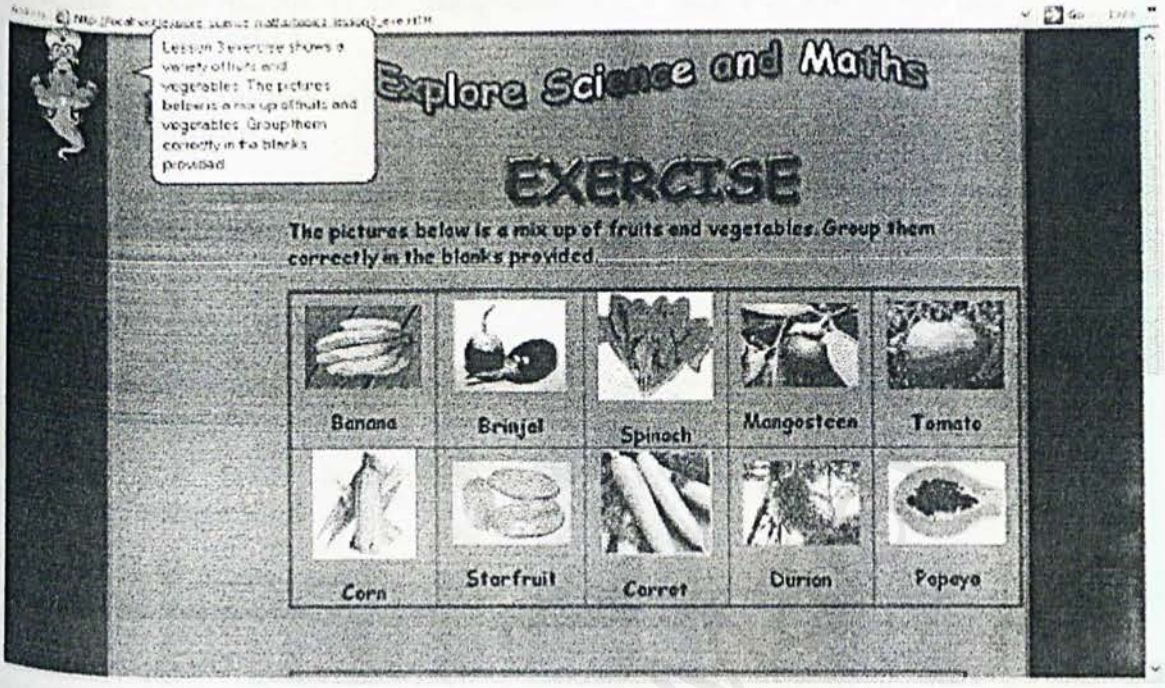
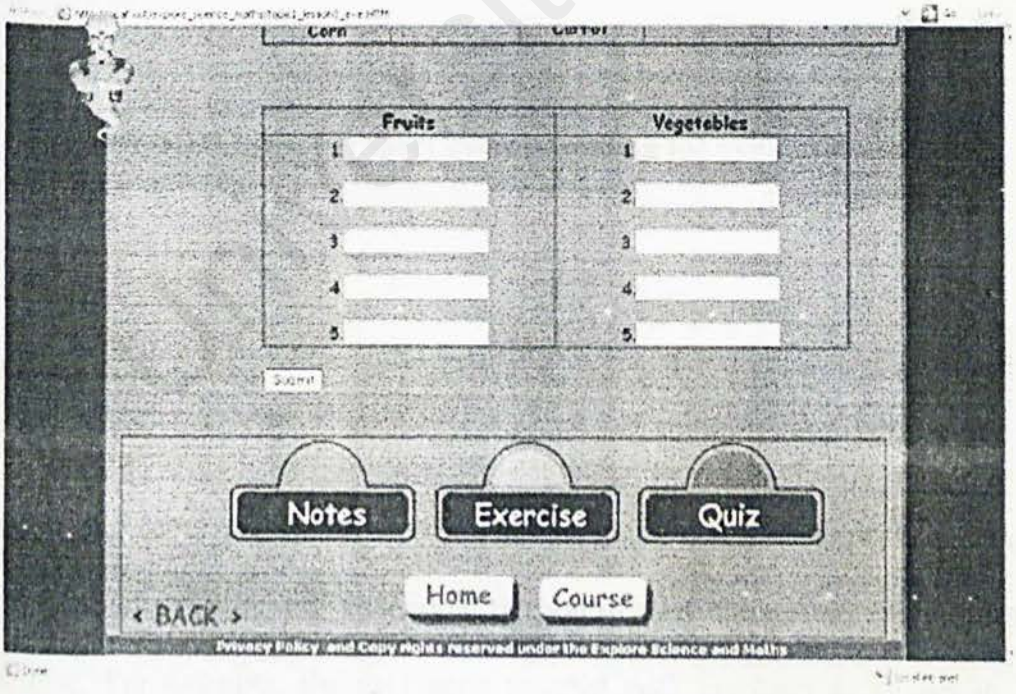


Figure 6.2.5.2 (f): Exercise screen – mix of fruits and vegetables



6.2.5.2 (g): Exercise screen – fill in the blanks in any order

```
if A1= "banana" or A1= "starfruit" or A1= "mangosteen" or A1= "papaya" or A1= "durian" then
  answeredcnt=answeredcnt + 1
end if
if A2= "banana" or A2= "starfruit" or A2= "mangosteen" or A2= "papaya" or A2= "durian" then
  answeredcnt=answeredcnt + 1
end if
if A3= "banana" or A3= "starfruit" or A3= "mangosteen" or A3= "papaya" or A3= "durian" then
  answeredcnt=answeredcnt + 1
end if
if A4= "banana" or A4= "starfruit" or A4= "mangosteen" or A4= "papaya" or A4= "durian" then
  answeredcnt=answeredcnt + 1
end if
if A5= "banana" or A5= "starfruit" or A5= "mangosteen" or A5= "papaya" or A5= "durian" then
  answeredcnt=answeredcnt + 1
end if
if A6= "brinjal" or A6= "spinach" or A6= "tomato" or A6= "corn" or A6= "carrot" then
  answeredcnt=answeredcnt + 1
end if
if A7= "brinjal" or A7= "spinach" or A7= "tomato" or A7= "corn" or A7= "carrot" then
  answeredcnt=answeredcnt + 1
end if
if A8= "brinjal" or A8= "spinach" or A8= "tomato" or A8= "corn" or A8= "carrot" then
  answeredcnt=answeredcnt + 1
end if
if A9= "brinjal" or A9= "spinach" or A9= "tomato" or A9= "corn" or A9= "carrot" then
  answeredcnt=answeredcnt + 1
end if
if A10= "brinjal" or A10= "spinach" or A10= "tomato" or A10= "corn" or A10= "carrot" then
  answeredcnt=answeredcnt + 1
end if
answeredcnt1 = 10 - answeredcnt
if answeredcnt >=5 then
%>
```

Figure 6.2.5.2 (h): E-report exercise coding for evaluation results

6.2.5.3 Quiz Screen

Each quiz of a topic presented several ways to analyze and test the knowledge and understanding of the user. The functional method of answering every quiz is similar to the exercise. For example, the user need to label with numbers as shown in Figure 6.2.5.3 (a) matching with description given as shown 6.2.5.3 (b).

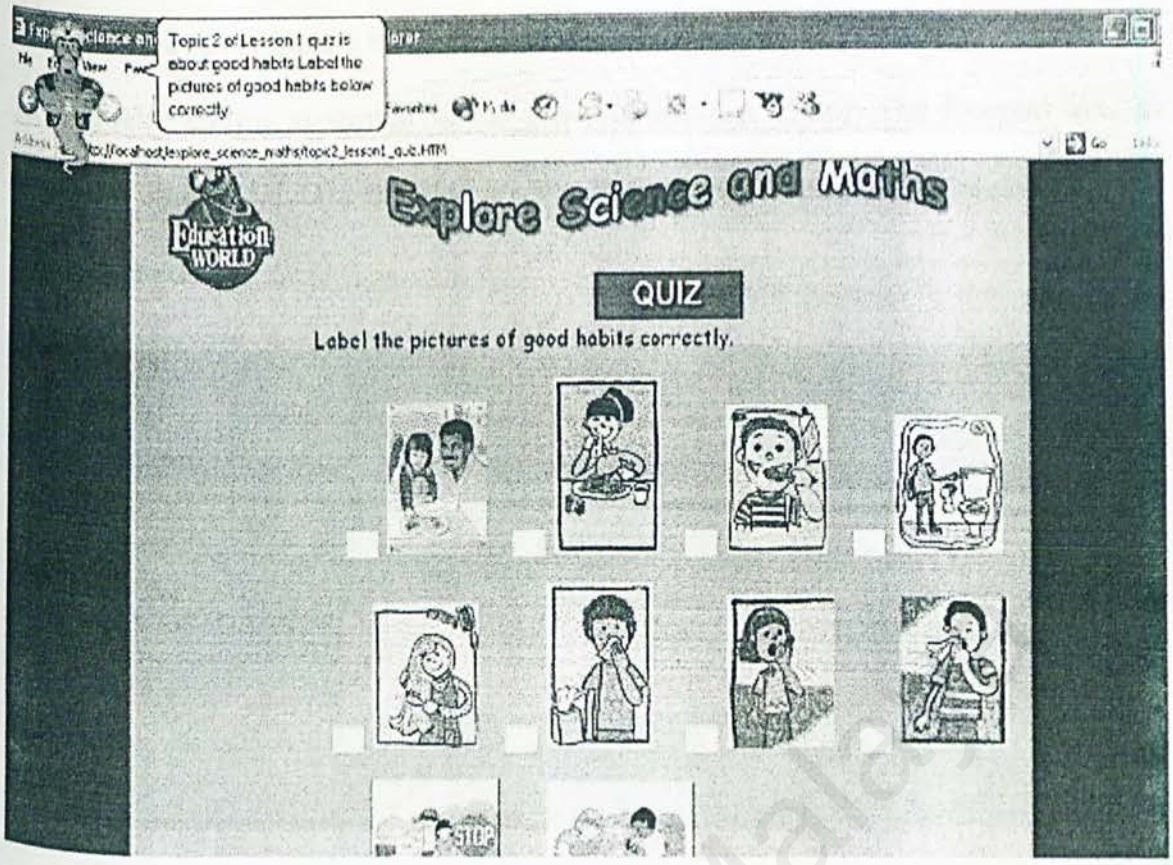


Figure 6.2.5.3 (a): Quiz screen – label the pictures

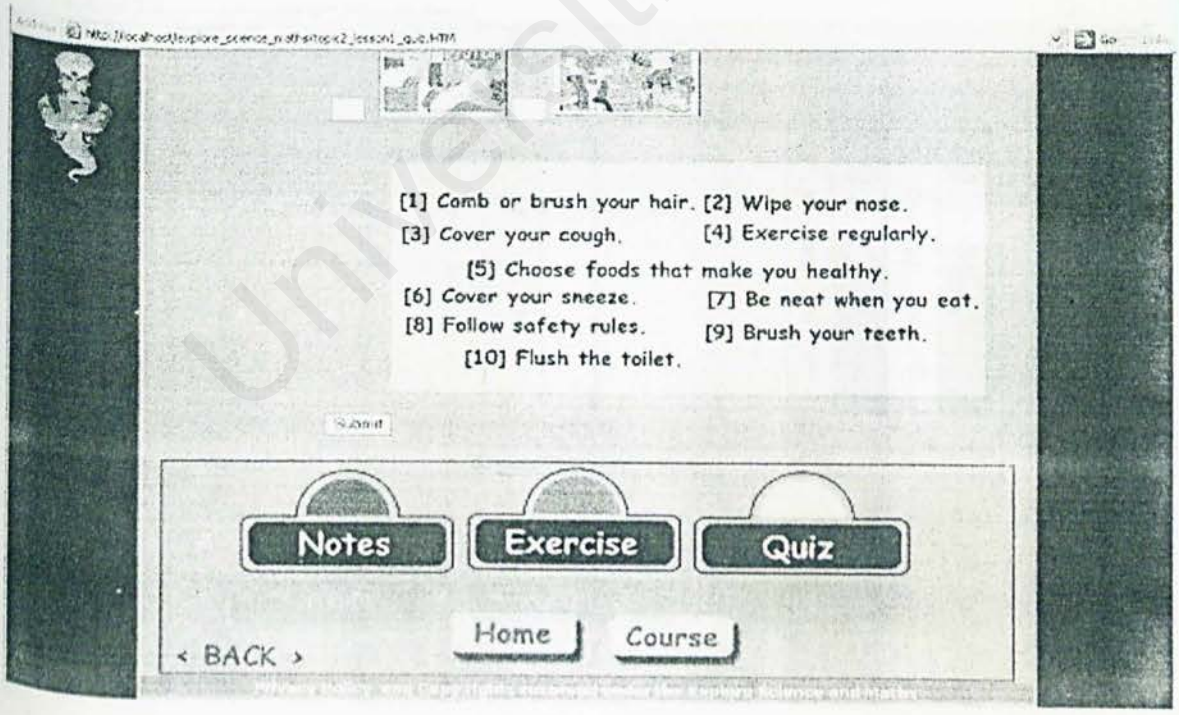


Figure 6.2.5.3 (b): Quiz screen – match the description given

If the user did not complete the quiz, a message box appears as shown in Figure 6.2.5.3 (c). The ASP coding is similar to the previous exercise above. The E-report quiz as shown in Figure 6.2.5.3 (d) displays all wrong answers when the user did not complete the quiz above.

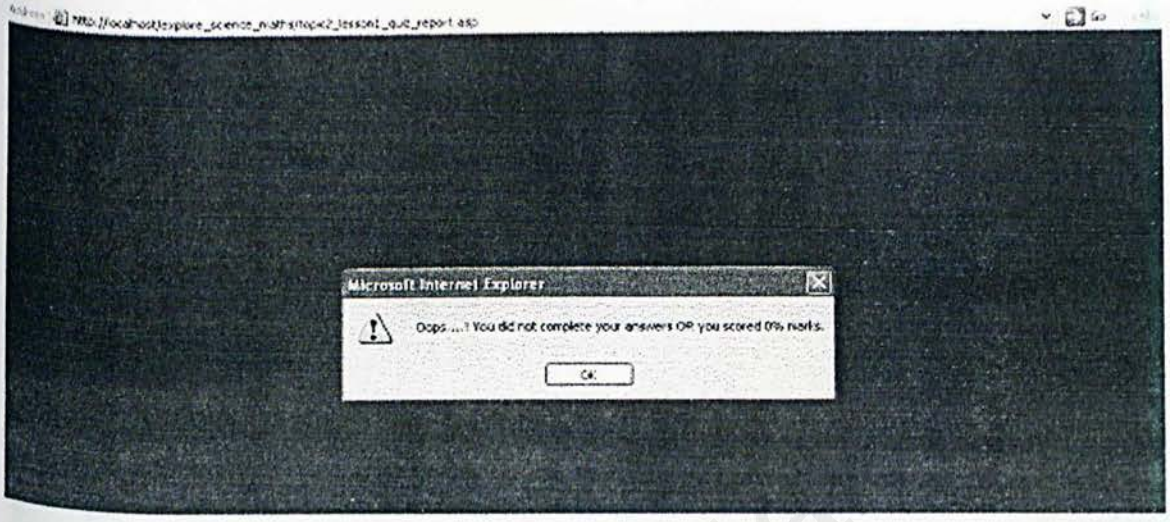


Figure 6.2.5.3 (c): Message Box Screen

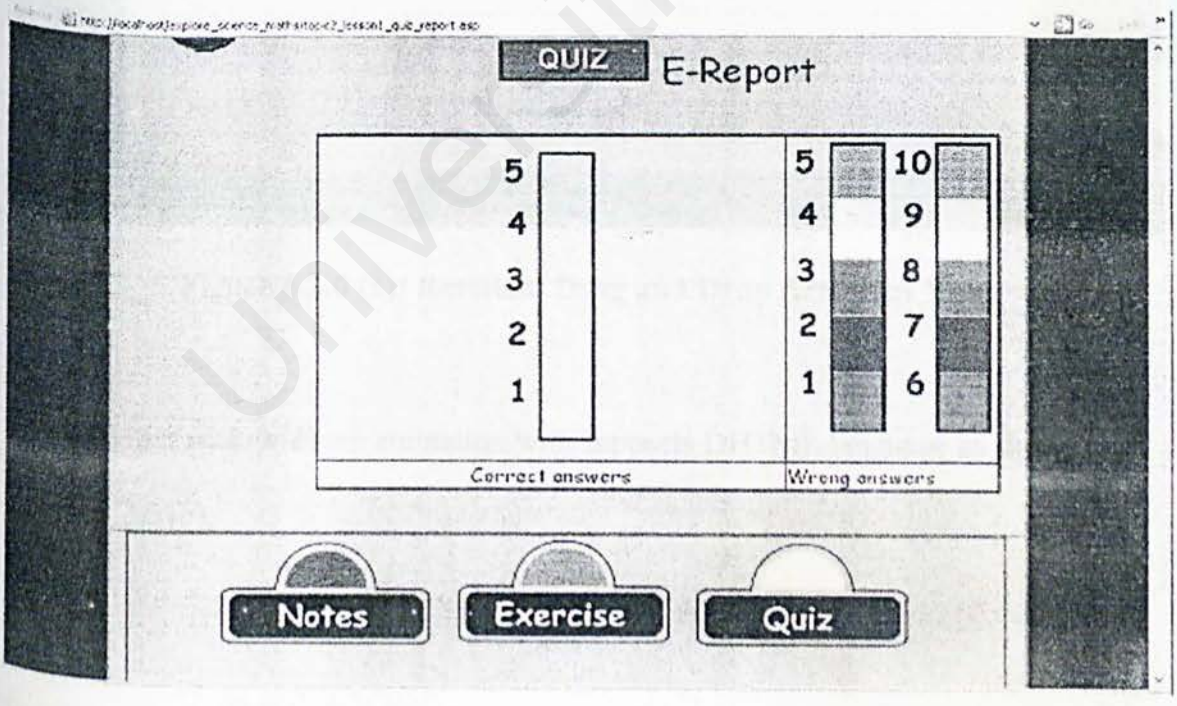


Figure 6.2.5.3 (d): E-report Quiz

6.2.6 Revision: Drag and Drop Activities Menu

The Revision menu concludes drag and drop activities from all three lessons as shown in Figure 6.2.6 (a).

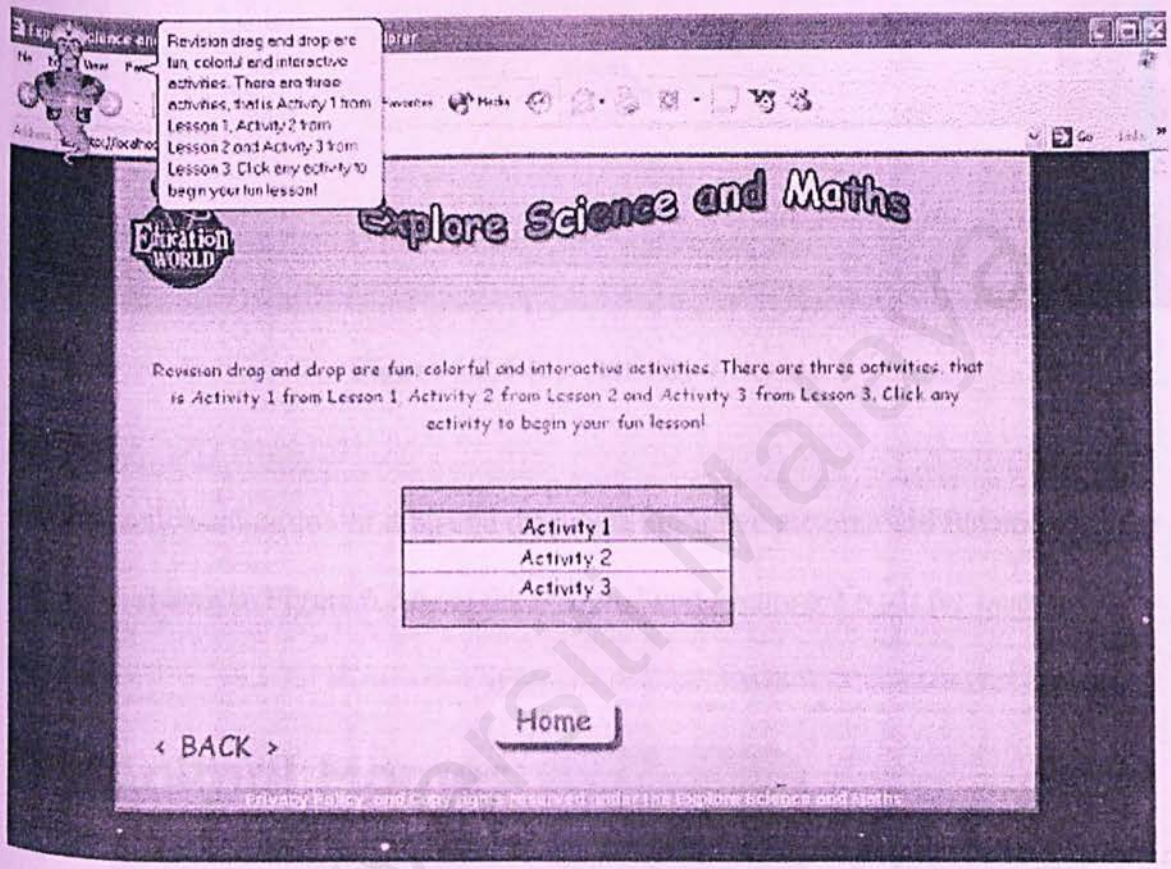


Figure 6.2.6 (a): Revision: Drag and Drop Activities Menu

The activities include Flash animation with supports DHTML language as shown in Figure 6.2.6 (b).

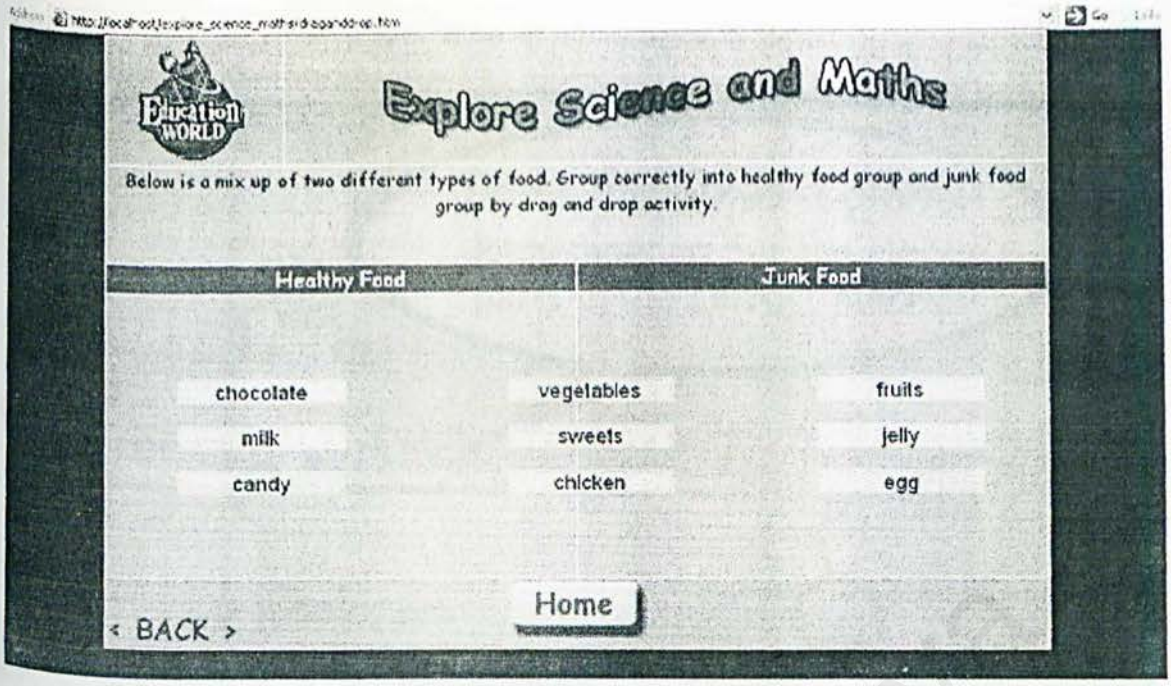


Figure 6.2.6 (b): Activity 1 Screen

The interactive animation of drag and drop with attractive pictures add fun and exciting lessons as shown in Figure 6.2.6 (c) for Lesson 2 and Figure 6.2.6 (d) for Lesson 3.

Figure 6.2.6 (c): Activity 2 Screen

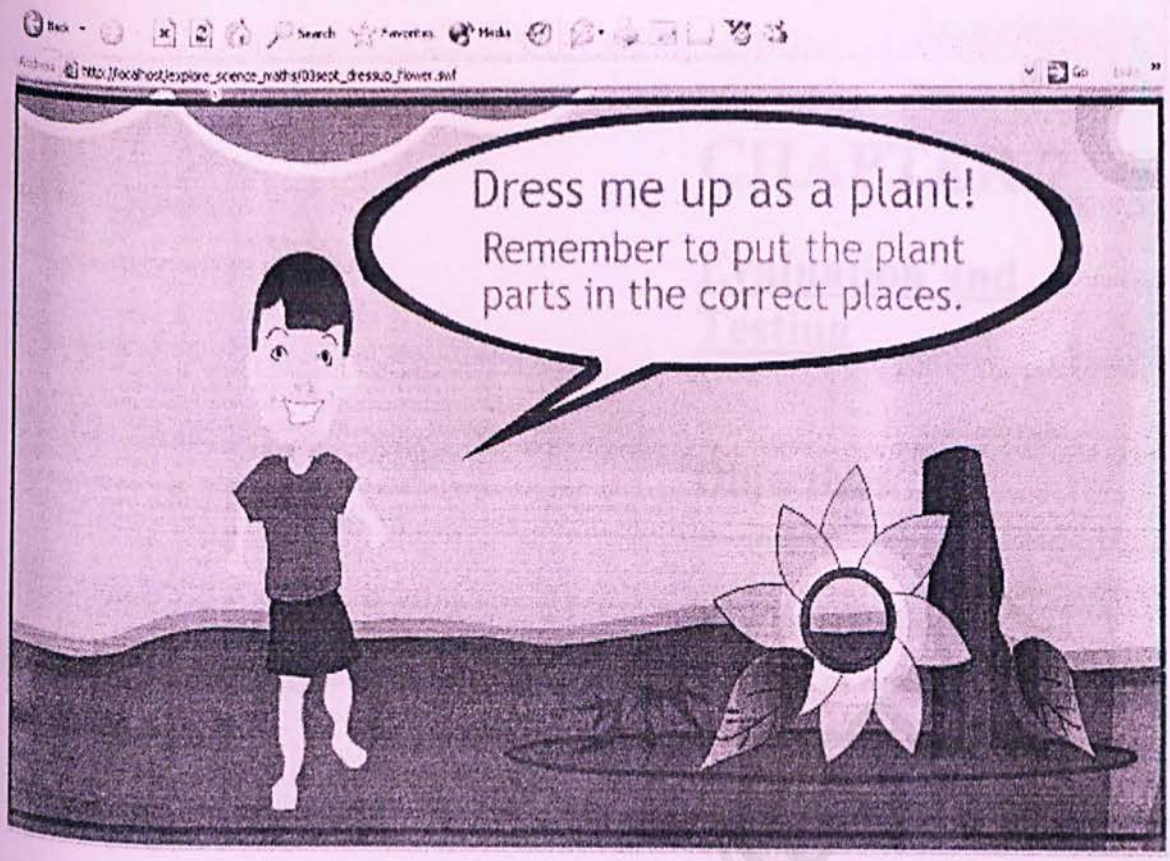


Figure 6.2.6 (d): Activity 3 Screen

6.3 Conclusion

Each module designed and developed as illustrated above. Detailed instructions by Genie, systematic modules and interactive interfaces enable users to navigate each screen easily.

CHAPTER 7

Evaluation and Testing

Objectives

- What is evaluation
- Goals of evaluation
- Functional requirement testing
- Non- functional requirement testing
- Evaluation methodology
  - Heuristic evaluation
  - Cognitive walkthrough
  - Usability testing
- Performance measurement
- When to apply the technique

Chapter 7: Evaluation and Testing

7.1 What is evaluation?

Evaluation is a technique employed to access designs and test system to ensure that they behave as expected and meets user requirements. Evaluation should occur throughout the life cycle of a product development. Considerations need to be taken when evaluating the system such as how easy to use, how easy the system is to learn and user's attitude towards it.

7.2 Goals of Evaluation

There are three golden goals of evaluation. Firstly, evaluation is used to access the context of the system functionality. Secondly, evaluation is seen as a tool to access the effect on the interface on the user. Finally, evaluate to identify any specific problems with the system. In terms of functionality capability, it is important to be able to measure the impact of the design on the user.

7.3 Functional Requirement Testing

The levels of tests and the types of test data are important aspects of the actual test process. Both unit testing and system testing is important to perform analysis.

7.3.1 Types of Testing

Testing software application can be done with or without executing the code and they may be manual or automated as shown in Table 7.3.1 (Valacich *et al*, 2001).

Table 7.3.1: A Categorization of Test Types

	MANUAL	AUTOMATED
Without Code Execution	Inspections	Syntax checking
With Code Execution	Walkthroughs Desk checking	Unit testing Integration testing System testing Stub testing

7.3.1.1 Inspections

Inspections is a testing technique in which participants manually examine program code for predictable language-specific errors such as syntax, grammar and come other routine errors can be checked by automated inspection software (Valacich *et al*, 2001).

7.3.1.2 Walkthroughs

Structured walkthrough is very effective method of detecting errors in code. Whereas specification walkthrough tend to be formal reviews, code walkthrough tend to be informal. Code walkthrough should be done frequently when the pieces of work reviewed are relatively small and before the work is formally tested (Valacich *et al*, 2001).

7.3.1.3 Desk Checking

What the code does is also important in desk checking, an informal process where the programmer understand the logic of the program works through the code with a paper and a pencil.

7.3.1.4 Syntax Checking

Syntax checking is typically done by a compiler. Errors in syntax are uncovered but the code is not executed (Valacich *et al*, 2001).

7.3.1.4 Unit testing

Unit testing is also known as module testing. Unit testing focuses first on modules, independently of one another to locate errors. This enables to detect errors in coding and logic that are contained within that module alone. The test case involve exercise of each condition and option (Hoffer *et al*, 1996).

7.3.1.5 Integration Testing

The process of bringing together all of the modules that a program comprises for testing purposes. Modules are typically integrated in a top-down, incremental fashion (Valacich *et al*, 2001).

7.3.1.6 System Testing

System testing will test on the integration of each module in the system. It also tests to find discrepancies between the system and its original objective, current specifications and system documentation. Under system testing, not only do individual modules get tested, so do the interfaces between modules and programs (Hoffer *et al*, 1996). System testing is also intended to demonstrate whether a system meets its objective (Hoffer *et al*, 1996).

7.3.1.7 Stub Testing

Stub testing is a technique used in testing modules, especially where modules are written and tested in a top-down fashion, where a few lines of code are used to substitute for subordinate modules.

7.4 Non Functional Requirement Testing

The types of tests are determined by the type of non-functional requirements specified:

- Stress Test

  Stress test evaluates the system when stressed to its limits over a short period of time.

- Environmental Tests

  Environmental tests look at the system's ability to perform in the installation site.

- Compatibility Tests

Compatibility tests are needed when a system interacts with other systems.

7.5 Evaluation Methodology

Mostly evaluation methodology is available in unit testing and system testing. Three main approaches taken into consideration for evaluation are Cognitive Walkthrough, Heuristic Walkthrough and Usability Testing. Each approach has its own advantages and disadvantages. However, to select an approach depends on the following factors:

- The style in the cycle at which the evaluation is carried out
- The style of evaluation
- The level of subjectivity of objectivity of the technique
- The type of measures provided by the approach
- The importance of quick response
- The level of interference implied
- The information provided
- The resources required for performing the evaluation

7.5.1 Heuristic Evaluation

Heuristic evaluation is a modification of usability inspection where usability specialists judge whether each element of a user interface follows established usability principles (Nielsen *et al*, 1994). This method is the part of the so-called '*discount usability engineering*' method. Basically, heuristic evaluation is a method for structuring the

critique of a system using a set of relatively simple and general heuristics (Nielsen *et al*, 1994).

7.5.2 Cognitive Walkthrough

A cognitive walkthrough evaluate the degree of difficulty for a user to work out what to do next (Lewis, 1988). It also test how easy is it to do what is required and having to perform a step, how much the system let the user know that he is closer to his '*goal*'. The process of forming a cognitive walkthrough as shown as in Figure 7.5.2 answers a series of questions about each procedure.

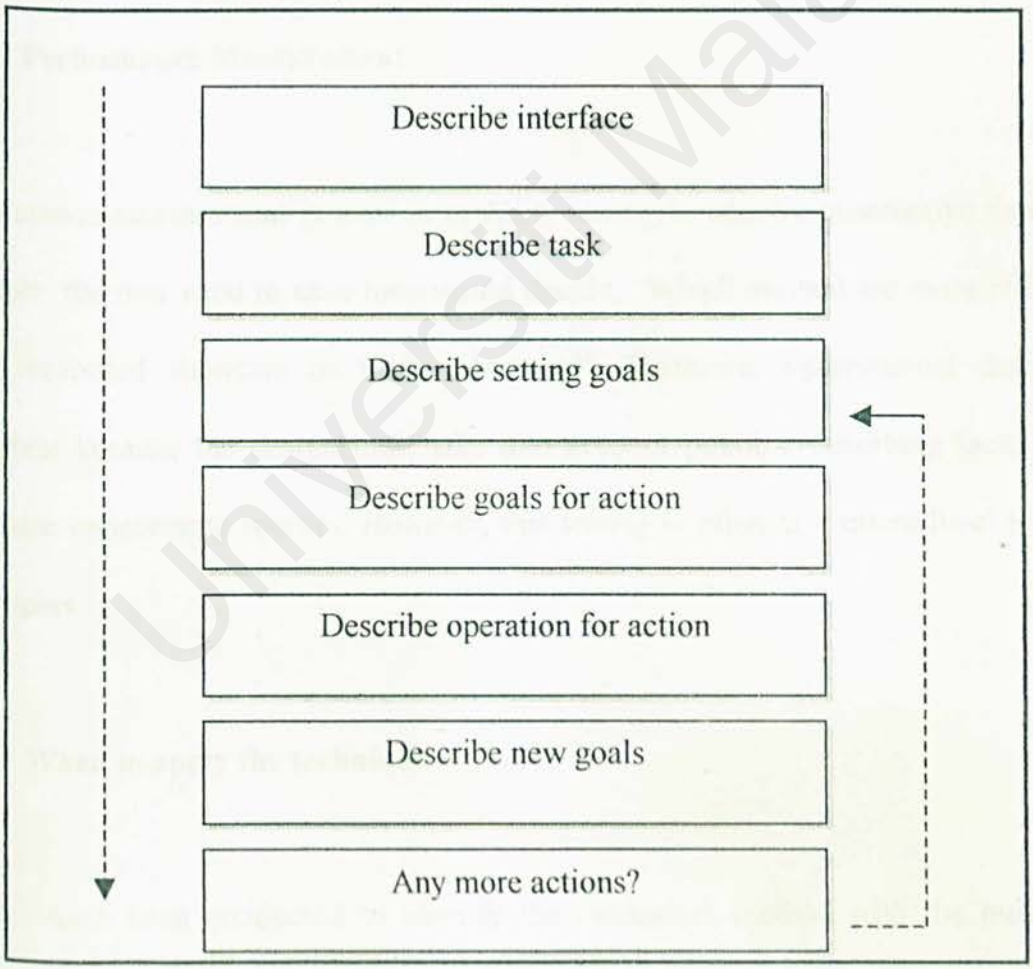


Figure 7.5.2: Process of Forming a Cognitive Walkthrough

7.5.3 Usability Testing

Usability testing carrying out experiments to find out specific information about a system (Nielsen *et al*, 1994). Current trend is emphasizing more on the interpretation of the results rather than the actual data-driven figures. For example, the testing on exercises and quizzes did for the system make use performance measurement. To perform the usability testing, users need to find out how to *work* the product, for example exercise and quiz. The duration to perform a task or attempt an exercise thru number of errors is made throughout the process.

7.6 Performance Measurement

Performance measurement is used in usability testing to acquire quantitative data. For example, the user need to save time would decide, "Which method are more efficient, using keyboard shortcuts or toolbar buttons?" Therefore, experimental design is important because the design must take into account possible disturbing factors and eliminate unnecessary sources. However, this testing is often at a micro level to most developers.

7.7 When to apply the technique

Studies have been conducted to identify the evaluation method with the most cost effective and reliable technique as shown in Table 7.7.

Table 7.7: When to apply this technique

Techniques	Implementation
Heuristic Evaluation	- best suited in the early stage when the system can run or perform.
Usability Testing	- testing can be done throughout the entire development lifecycle.
Cognitive Walkthrough	- early stages of development due to fact that they can be performed using just system specification as a basis. - suitable for program code testing

7.8 Conclusion

It is important to select a suitable evaluation method for the system. First, it is important to collect data that is reliable to the requirements of the system. This is significant because different methods evaluate might produce different results. Hence, planning is another issue to be considered for an evaluation. Planning must be done with the fact the evaluation is reliable and valid.

CHAPTER 8

Discussion

Objectives

- Additional knowledge gained
- Problems encountered
- System strength
- System limitation
- Future enhancement
- Purpose of documentation

Chapter 8: Discussion

8.1 Introduction

The final phase in the life cycle of the project, many experiences and events took place when developing the system. The additional knowledge gained concludes that '*nothing can replace the experience of a person who has been to a place compared to a person who has heard about it*'.

8.2 Additional knowledge gained

During the duration of the project, new concepts and methodologies have been additional knowledge and experience in developing the system. For example, the research process though the Internet has provided extra tutorial, best images and latest information to assist the development of the system which is rather difficult to search from hard copies or books.

Next, the material, for example books and CD-ROMs for Science Year One in English has been a good guide to develop the system. The education system has created interest and enlightened to many aspects in the syllabus of the school curriculum why the Malaysian government has introduced ICT in today's education. The research about why e-learning is important has created ideas, knowledge and additional experience to develop interactive online education.

The graphic software, authoring tools and development tools have granted a wide range of techniques in web-based e-learning development system. The features of each product tool have been analyzed in different ways to select the best tools for the system development.

Another important factor is good and understanding communication with my supervisor. Mrs. Sri Devi has assisted and support throughout the project by providing ideas, techniques to improve and checking the progress of the development system time to time.

Lastly, the additional valid experience gained throughout the project duration is being a good and analytical thinking skill. Being able to evaluate the strength and limitations of a given methodology and concept, knowing the way to apply the techniques, and dealing with surveys (questionnaires) the project has provided good experience in handling requirements of the system.

8.3 Problems Encountered

The feasibility studies and research analysis were conducted as discussed earlier in the project to develop the Web-based Science System for Year One. There were many problems encountered during these stages. However, with the proper guidance and support from Mrs. Sri Devi who explained in detail how to investigate and conduct research in proper manner was very helpful and successful.

The initial stage of research was difficult due to the teaching-learning of Science in English for Year One students was only implemented this year, thus limited resources available in the market to help and guide in the research analysis.

The research analysis especially the questionnaires and interviews were time consuming due to effort, and time taken to survey the Ministry of Education (MOE) staff and school teachers. For example, it was difficult to contact making appointments and meet the 'correct' staff at MOE. Another case was a school headmaster refused to allow the survey thru questionnaire with his staff teachers.

Since the project is web-based, thus storyboard is essential for the project in designing the proposed system. It was difficult to draft the storyboard because the system

requirement must be well-understood. Fortunately, Mrs. Sri Devi provided ideas to improve the presentation of the storyboard.

Searching the images according school curriculum syllabus from the Internet incurred too much time and stress. Besides, downloading the tutorial and MASH software as a trial version delayed a few days during the project development.

Many of the tools used have different functionalities and capabilities. Research and detail analysis was made to ensure the best tools to fit the development framework accurately.

Finally, a detail research involved coding MASH software, programming languages and animations to develop an interactive, simple GUI with the presence of genie and user friendly system.

8.4 System Strength

1. The Web-based Science System for Year One is developed based on school curriculum by MOE. Therefore, the target users for example the teachers and students have more resources to teach, learn and understand effectively.
2. Since the proposed system is web-based, thus the users can access the Explore Science and Maths System at anytime and anywhere at their pace.

3. The Explore Science & Maths System does not require the new user to login in detail for example, e-mail address or password.
4. The user interface is simple and interactive. Users especially the Year One students just need to drag the mouse to select the operation they need in the application window. The colorful and graphical buttons enable the users to navigate the interface application easily.
5. The presences of animated and talking genie explain and guide the user throughout the application of the system. For example, the genie with the Refresh button enables the user to hear again the contents of a topic.
6. The user can view the Bahasa Malaysia version when he or she drags the mouse over the animated words or pictures.
7. The user gets the opportunity to hear different animal sounds by clicking the pictures of the animals as in Lesson 2.
8. The E-report is helpful to the user, as it will evaluate the answers when the users attempt in the exercise and quiz. A colorful bar chart displays the correct and wrong answers input by the user.

8.5 System Limitation

1. The Explore Science & Maths System is limited to Science Year 1 only.

2. The system does not include security features because it is inconvenient for the target users' example students of Year One to register the e-mail particulars as 'forgetful' kind of behavior.
3. A limited exercise and quiz due to limited resources of school curriculum syllabus.
4. The system requires the user to download Flash Player to enable to interactive graphical sites.
5. The user has no option to select the language of the course due to the requirement of the MOE.
6. Rather than developing the system and distribute it on the web, the system can be publish in CD-ROM format for the purpose or those users who do not have Internet access or obsolete operating system.
7. The development of the system is crucial only for targeted Science Year One users. Therefore, the standard and presentation of the syllabus is essential to this level only. Mostly the syllabus is based on pictures or images rather than detail text words.

8.6 Future Enhancement

There is always room to improve or enhance the system after detecting the constraints of the system as discussed below:

1. The system should provide a variety of more exercises and quizzes to enable the user to acquire better knowledge and understanding Science in English.
2. Due to time and resources constraints, the remaining modules for example Science Year 2 and Year 3 and Mathematic Year 1 to Year 3 should be developed in future.

8.7 Purpose of Documentation

1. Communication

Documentation provides in-depth information about a system, which referred by anyone to understand the system.

2. Instructions

System design especially storyboard presents graphical and colorful buttons and links. Therefore, the task requires complete understanding the requirements of the systems.

3. Establishing Performance Criteria

   - Expected results are part of documentation

4. Historical Reference

Parts of the documentation acquired during the various phases of a system study referenced in future:

- A study left unconcluded only to be resume. Documentation of previous works will save needless repetition of effort.
- An existing system can be modified or altered if complete documentation is available.

8.8 Conclusion

The chapter discusses about the results of the project for the proposed system. Despite of the difficulty faced during the research analysis, the literature review and development of methodology have emphasis clearly the requirements of the system.

It is necessity to understand the problems encountered the system strength and limitations, thus new concepts to improve the system in the future. By understanding these capabilities, the development of every stage in the process of the system should take place efficiently.

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